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Alcohol Misuse Among Operation Enduring Freedom and Operation Iraqi Freedom Military Healthcare Professionals

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ALCOHOL MISUSE AMONG OPERATION EDURING FREEDOM AND OPERATION IRAQI FREEDOM MILITARY HEALTHCARE PROFESSIONALS

by

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DISSERTATION APPROVAL SHEET

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Statement of Original Work

I declare the following:

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ABSTRACT

Over 2.1 million United States military service members have deployed to support Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF). Nearly 40% of OEF/OIF service members meet criteria for an alcohol use disorder post-deployment. Minimal research has addressed alcohol misuse among military healthcare professionals despite the prevalence of alcohol abuse among civilian providers. This study explored whether military healthcare professionals involved with OIF/OEF operations have increased risk for alcohol misuse (i.e., problem drinking, heavy weekly drinking, heavy episodic drinking). Three evidence-based hypotheses were evaluated: (a) among OEF/OIF military personnel, healthcare professionals would have an increased likelihood of alcohol misuse compared to service members in other occupations; (b) personnel who screen positive for PTSD would be more likely to screen positive for alcohol misuse outcomes versus personnel who screen negative for PTSD; and (c) personnel with enlisted status would be more likely to endorse alcohol misuse compared to personnel with officer status. Participants were drawn from 81,247 military personnel enrolled in the Millennium Cohort Study, a prospective, longitudinal cohort study investigating health consequences of military service. Chi-square tests of independence identified significantly different demographic characteristics between participants in the first and second enrollment panels and resulted in participants being divided into subgroups based upon their enrollment panel and baseline alcohol use. Participants who had complete data at baseline and all follow-up waves were included in the primary multinomial logistic regression analyses used to identify variables associated with each alcohol use outcome over time. Results suggested that being a healthcare professional did not influence alcohol misuse outcomes. A positive screening for PTSD was associated with greater endorsement of alcohol misuse outcomes across most participant subgroups, and holding enlisted status was associated with problem drinking and heavy episodic drinking in some participant subgroups. Additional variables associated with alcohol misuse outcomes included being younger, male, using tobacco, and belonging to the National Guard/Reserve. The results of this study suggest that, while alcohol-related interventions may not need to be tailored to specific occupations, alcohol use screening and treatment should continue to be focused on at-risk groups to enhance troop health and functioning.

Keywords: military, alcohol use disorder, deployment, Iraq, Afghanistan, healthcare

CHAPTER I: STATEMENT OF THE PROBLEM

Operation Enduring Freedom/Operation Iraqi Freedom

Since 2001, the United States (US) military has been involved in conflicts in the Middle East. Over 2.1 million service members have deployed in support of Operation Enduring Freedom (OEF; Afghanistan) and Operation Iraqi Freedom (OIF; Iraq), with at least 56.2% of troops reporting exposure to combat in what has become the largest sustained ground operation by the US military since the Vietnam War (Barlas, Higgins, Pfieger, & Diecker, 2013; Burnett-Zeigler et al., 2011; Defense Manpower Data Center, 2015; Hoge, Auchterlonie, & Milliken, 2006). Deployments in support of OEF/OIF are unique from previous military conflicts in that the majority of service members endure multiple prolonged deployments, with 150,000 to 200,000 military service members being deployed to the Middle East at any given time (Barlas, Cambridge, Spera, Szoc, & Thomas, 2011; Castro, 2014).

The sheer number of troops deployed to combat zones comes with an enormous human cost. As of 2014, OEF/OIF operations have resulted in over 6,500 US service member deaths and over 50,000 service members wounded in combat (Fischer, 2014). In addition, military personnel returning from OEF/OIF deployments experience high rates of mental health and substance use problems (Barlas et al., 2013; Hoge et al., 2006; Jacobson et al., 2008; Seal et al., 2011). Over 118,000 service members have been diagnosed with posttraumatic stress disorder (PTSD), many of whom returned to active duty even after receiving the diagnosis (Fischer, 2014). Furthermore, it is estimated that between 12% and 40% of OEF/OIF veterans misuse alcohol, with the risk of alcohol misuse being greater among male service members under 30 years of age (Burnett-

Zeigler et al., 2011; Jacobson et al., 2008).

While the influence of involvement with OEF/OIF operations has been studied for military members as a whole, little is known about the mental health and substance use concerns specific to military healthcare professionals (Tvaryanas, Maupin, White, Schroeder, & Mahaney, 2017). Given that civilian healthcare professionals have relatively high rates of mental health concerns, it seems logical that military healthcare professionals who have served in support of OEF/OIF may also experience mental health (e.g., depression, anxiety, PTSD) and substance use issues (Bennett & O'Donovan, 2001; Brooks, Gerada, & Chalder, 2011; Center et al., 2003; Gibbons, Hickling, & Watts, 2012; Schernhammer, 2005; Tyssen & Vaglum, 2002). Studies suggest that up to 15% of civilian physicians misuse alcohol which supports the idea that these rates may be similar among military healthcare professionals (Bennett & O'Donovan, 2001; Brooks et al., 2011; Gibbons et al., 2012). Unfortunately, it is unknown how military healthcare providers cope with deployment stressors and whether these coping strategies differ from those used by other military personnel, which often includes alcohol use (Milliken, Auchterlonie, & Hoge, 2007; Schumm & Chard, 2012). What is known, however, is that military healthcare providers tend to have low rates of seeking mental health treatment which may stem from concerns about career repercussions from engaging in treatment (Center et al., 2003; Gross, Mead, Ford, & Klag, 2000; Schernhammer, 2005). Additional research is needed to understand the occurrence of alcohol misuse among military healthcare professionals involved with OEF/OIF operations in order to help inform appropriate and effective prevention and intervention efforts.

Review of the Literature

Military Mental Health

The military is a unique environment in which to understand and treat mental health concerns. Life as a military service member is inherently stressful and can be dangerous regardless of rank or occupation (Armed Forces Health Surveillance Center, 2014). The military occupational mental health model was developed to provide a conceptual framework to assist in understanding the relationship between military occupational demands and mental health (Castro, 2014). The model emphasizes the background characteristics of individuals and organizations that occur prior to military-specific stressors, and also accounts for the importance of military culture and available health prevention and treatment strategies. The model highlights the role that various micro-transitions (e.g., changing duty stations, combat missions, promotions) and macro-transitions (e.g., deployment, injury) play on the mental health of service members. It is vital that non-military mental health practitioners consider the nuances of military service when conceptualizing service members' concerns and develop appropriate strategies for awareness, prevention, and treatment.

A major issue in addressing mental health concerns among military service members is that, for a variety of reasons, many service members and veterans simply avoid seeking and participating in mental health treatment. At an institutional level, many service members may not be screened for mental health problems and, if they are screened, may not be referred to treatment for issues such as alcohol abuse despite research supporting the effectiveness of brief alcohol interventions (e.g., education about recommended levels of alcohol consumption; Calhoun et al., 2015; Golub, Vazan, Bennett, & Liberty, 2013). In addition, factors such as insufficient assessment measures,

lack of referrals, poor access to a variety of treatment approaches, and other barriers to treatment (e.g., poor dissemination of information, time off, transportation issues) may prevent service members from obtaining treatment (Burnett-Zeigler et al., 2011; Institute of Medicine, 2013).

Another major deterrent to seeking mental health or substance use treatment is the prevalence of stigma associated with treatment which may lead to service members attempting to treat their perceived problems on their own (Department of Veterans Affairs & Department of Defense, 2015; Golub et al., 2013; Institute of Medicine, 2013). There is a common belief among service members that endorsing mental health concerns may negatively affect their career progressions. Specific to alcohol misuse, it is quite possible that service members, regardless of rank or occupation, will not acknowledge risky alcohol use during screening procedures out of concern that doing so would result in the involvement of the service members' command and will have negative employment consequences up to and including separation from military service (Clinton-Sherrod, Barrick, & Gibbs, 2011; Department of Veterans Affairs & Department of Defense, 2015; Institute of Medicine, 2013; Jacobson et al., 2008; Tvaryanas et al., 2017).

Despite these concerns, there is evidence that service members are beginning to engage in mental health services post-deployment. Among all US Armed Forces personnel, annual rates of service members who received a mental health diagnosis increased between the years 2000 and 2012 such that 76% more service members received a mental health diagnosis in 2012 than in 2000 (Armed Forces Health Surveillance Center, 2014). In fact, by 2012 approximately 1 out of every 29 active duty

service members were receiving treatment for mental health concerns (Armed Forces Health Surveillance Center, 2014). Part of this increase can be explained by the military's involvement in the Middle East beginning in 2001. However, as the conflicts in the Middle East prolonged and the number of deployed troops decreased, it was found that the numbers of service members seeking mental health treatment continued to increase (Armed Forces Health Surveillance Center, 2014). This occurrence suggests that an increase in awareness of mental health services, a decrease in the stigma of seeking such services, and reductions in barriers and improved access to services may enhance the likelihood that service members will continue to seek and receive mental health treatment.

OEF/OIF and Alcohol Use

One of the major mental health concerns for military personnel who deploy in support of OEF/OIF is alcohol abuse (Department of Veterans Affairs & Department of Defense, 2015). Despite the Department of Defense's official policies strongly discouraging alcohol abuse it remains prevalent among service members both while on active duty and once they leave the service (Institute of Medicine, 2013). A 2008 estimate revealed that nearly 20% of active duty service members engaged in heavy weekly drinking (i.e., for men, consuming >14 drinks per week; for women, consuming >7 drinks per week; National Institute on Alcohol Abuse and Alcoholism, 2007), while a 2011 survey suggested that nearly 40% of active duty personnel reported heavy episodic (i.e., binge) drinking (i.e., for men, drinking ≥5 drinks on one occasion; for women, drinking ≥4 drinks on one occasion; Barlas et al., 2013; Dawson, 2000; Jelinek, 2012; National Institute on Alcohol Abuse and Alcoholism, 2007; Tan, Denny, Cheal, Sniezek,

& Kanny, 2015). Annually, it is estimated that alcohol abuse costs the US military around $1.12 billion, leads to 320,000 lost work days, and renders 10,400 service members unable to deploy with another 2,200 being discharged from duty (Schumm & Chard, 2012). As might be expected, alcohol misuse is also associated with a number of negative consequences, including increased risk of injury-related mortality, domestic violence, work difficulties, and legal issues (Bell, Harford, McCarroll, & Senier, 2004; Fudalej et al., 2010; Jakupcak et al., 2010; Stahre, Brewer, Fonseca, & Naimi, 2009). While it is evident that risky alcohol use is prevalent in the military, it is still unclear which specific aspects of military service influence the initiation and continuation of alcohol misuse (Barlas et al., 2011).

It has been suggested that between 22% and 40% of OEF/OIF veterans seeking treatment within the VA healthcare system meet criteria for risky drinking (i.e., heavy weekly drinking, heavy episodic drinking) yet tend to be referred to alcohol treatment at lower rates than veterans from other service eras (Burnett-Zeigler et al., 2011; Seal et al., 2011). Understanding the rate of alcohol misuse among OEF/OIF veterans is particularly important given the likelihood that these service members have comorbid mental health diagnoses. It has been suggested that the high rates of risky alcohol use among OEF/OIF service members is at least due in part to demographic characteristics and inherent factors of military service, including the fact that regular alcohol use may be the norm among most military members (Ames, Cunradi, Moore, & Stern, 2007; Barlas et al., 2013; Jakupcak et al., 2010). The majority of OEF/OIF service members are men under the age of 25 years, and higher rates of alcohol misuse have been noted in service members who are unmarried, of enlisted rank, and who identify as Hispanic or Caucasian (Bray &

Hourani, 2007; Golub et al., 2013; Schumm & Chard, 2012). Given the number of service members associated with OEF/OIF, it is quite likely that a large portion of OEF/OIF veterans seeking VA healthcare services will have an alcohol use disorder whether or not it is their primary reason for treatment. Healthcare professionals should be aware of these rates and be prepared to screen for risky alcohol use and refer service members to appropriate interventions (e.g., cognitive behavioral therapy, motivational enhancement therapy, behavioral couples therapy; Department of Veterans Affairs & Department of Defense, 2015).

Heavy episodic drinking has been observed among OEF/OIF service members. A study by Calhoun et al. (2015) of 1,161 OEF/OIF veterans found that 51% of the sample reported heavy episodic drinking, with 17% reporting frequent episodes of heavy episodic drinking. Similar to overall levels of alcohol misuse, certain demographic indicators influenced heavy episodic drinking within the sample. Age was found to be negatively associated with heavy episodic drinking such that younger OEF/OIF veterans reported higher rates of heavy episodic drinking, and veterans who were male, Caucasian, unmarried, served in active duty units, and were of enlisted rank were more likely to report heavy episodic drinking. The authors found that 75% of the OEF/OIF veterans who reported frequent heavy episodic drinking reported using healthcare services within the previous year and 32.1% of these veterans reported that their healthcare provider advised them to change their alcohol use. This suggests that increasing the availability of primary healthcare services may enhance the likelihood that service members at risk for alcohol misuse will receive advice to change their drinking, and may reduce some negative alcohol-related consequences. It is possible that service members are unaware of

the potential hazards associated with their alcohol use, and thus may not seek out specific substance use services. In line with the Patient Protection and Affordable Care Act of 2010's promotion of the integration of mental health and substance use treatment within primary care settings, primary care physicians will play an increasingly vital role in identifying and assisting service members with alcohol misuse and have the opportunity to implement successful brief alcohol interventions (Department of Veterans Affairs & Department of Defense, 2015; Institute of Medicine, 2013).

Exposure to combat while deployed, including witnessing atrocities and experiencing personal threats, has been linked to an increased likelihood of risky alcohol use (Jacobson et al., 2008; Milliken et al., 2007; Schumm & Chard, 2012; Wilk et al., 2010). A study of 88,235 OIF veterans who had experienced combat situations suggested that 12% to 15% of the returning service members demonstrated risky alcohol use within 6 months of returning from combat (Milliken et al., 2007). While OEF/OIF service members who report experiencing combat situations tend to have an increased likelihood of misusing alcohol, it is still unclear which specific factors of combat have the strongest influence on alcohol misuse (Schumm & Chard, 2012). It is important to consider whether it is the process of being deployed itself that leads to risky alcohol use or if experiencing combat is an important causal variable. Jacobson et al. (2008) explored rates of alcohol use and their outcomes among a sample of 48,481 OEF/OIF service members. The authors found that the baseline, follow-up, and new onset rates of meeting criteria for heavy weekly drinking and heavy episodic drinking among active duty service members were highest among OEF/OIF service members who had been deployed and experienced combat as compared to service members who had been deployed but did not experience

combat and service members who had not been deployed. Specifically, service members who had experienced combat had a higher likelihood of endorsing new onset heavy episodic drinking (i.e., heavy episodic drinking that was not endorsed during the baseline period) during the follow-up period. Interestingly, it was found that women were 1.21 times more likely than men to endorse heavy weekly drinking at baseline and new onset, while proportionally more men reported heavy episodic drinking across baseline and follow-ups. In addition, service members who had diagnoses of PTSD, major depressive disorder, or who smoked cigarettes were at an increased risk for new-onset alcohol problems as well as negative outcomes from alcohol use. These results suggest that, while combat appears to have a role in the onset of risky alcohol use, the act of deployment itself also may have played a role in later onset of alcohol problems.

While evidence from OEF/OIF service members tends to suggest that combat may directly influence risky alcohol use, data from previous military conflicts provide helpful contrasting insights. A study with veterans from the earlier Persian Gulf War revealed that veterans who had been deployed to the conflict had significantly higher rates of alcohol misuse than troops who had not deployed; however, it was revealed that these increased rates of alcohol misuse were associated with an increase in other health conditions and could not be directly linked to combat exposure (Iowa Persian Gulf Study Group, 1997). These mixed results suggest that, while combat may play a role in service members' alcohol use, additional research is needed to determine the specific factors of combat that may be important in determining subsequent alcohol use.

Military Healthcare Professional Mental Health

While many studies have focused on the effects of OEF/OIF deployments on military

service members in general, little research has focused on the mental health effects of deployments specific to military healthcare professionals. It has been found that civilian healthcare professionals may have relatively high rates of mental health concerns (e.g., depression, anxiety, interpersonal problems), and that suicide comprises a disproportionately high cause of mortality among physicians, especially females (Bennett & O'Donovan, 2001; Brooks et al., 2011; Center et al., 2003; Gibbons et al., 2012; Schernhammer, 2005; Tyssen & Vaglum, 2002). It is estimated that between 1% and 15% of civilian physicians in the United States will meet criteria for a substance use disorder annually; however, it is possible that healthcare professionals underreport their substance use and misuse rates due to the potential for professional sanctions and/or stigma (Bennett & O'Donovan, 2001; Brooks et al., 2011; Gibbons et al., 2012; Kenna & Wood, 2004). While the limited available literature suggests that rates of substance abuse among healthcare professionals is similar to rates among the general population, it is of particular concern to military healthcare professionals given their specific risk factors for substance abuse and lack of research attention (Brooks et al., 2011).

Research has found that military healthcare professionals tend to be diagnosed with PTSD and depression at rates similar to non-healthcare military personnel; however, among enlisted healthcare professionals, there appears to be an increase in mental health concerns as compared to officers with healthcare professions (Gibbons et al., 2012; Jacobson et al., 2012; Jones et al., 2008; Kolkow, Spira, Morse, & Grieger, 2007). In addition, military healthcare professionals who have been exposed to combat appear to be at greater risk for developing PTSD as compared with healthcare professionals who do not experience combat (Jacobson et al., 2012; Kolkow et al., 2007). Given that there

appears to be a very well-documented association between PTSD and alcohol and substance abuse (Bohnert et al., 2013; Creamer, Burgess, & McFarlane, 2001; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995), it is important to examine alcohol abuse among combat-exposed military healthcare professionals in order better understand the scope of the issue and to assist in the development and implementation of prevention and intervention efforts.

The primary risk factor for alcohol abuse among both civilian and military healthcare professionals is the high stress level inherent in the healthcare professions (Bennett & O'Donovan, 2001; Gibbons et al., 2012; Kenna & Wood, 2004; Stewart, 2009). Military healthcare professionals also have risk factors specific to military service including frequently working in dangerous situations with high patient workloads, long and unpredictable hours, exposure to mass casualties, poor sleep, emotional demands of working with patients, and a frequent lack of control over patient outcomes (Brooks et al., 2011; Carson et al., 2000; Gibbons et al., 2012; Kenna & Wood, 2004; Richman & Flaherty, 1996; Stewart, 2009). Furthermore, stressors that are common to most deployed personnel (e.g., separation from family, difficult living conditions, physical job demands, exposure to danger, multiple deployments) apply to healthcare professionals (Gibbons et al., 2012; Stewart, 2009). It has been noted by Kenna and Wood (2004) that these common deployment stressors have been associated with alcohol misuse among military service members who do not work in the healthcare field which raises the possibility that healthcare professionals may also misuse alcohol as a coping mechanism. In addition, it has been noted that first-line healthcare providers in deployed settings (i.e., enlisted medical technicians) are typically between the ages of 18 and 30 years which has been

considered an age range at higher risk of alcohol abuse among general military members (Burnett-Zeigler et al., 2011; Jacobson et al., 2008). Having these younger people working in such stressful roles could enhance the likelihood that these providers identify with their patients (which has been associated with compassion fatigue and other mental health concerns), and they also may have fewer life experiences and skills to adaptively cope with their stressors (Carson et al., 2000; Richman & Flaherty, 1996; Stewart, 2009).

Given the enormous pressure under which military healthcare professionals function as well as frequent exposures to combat-related casualties it would not be surprising to discover that military healthcare professionals may be at increased risk for misusing alcohol and other substances. Unfortunately, it is unknown how military healthcare professionals cope with exposure to traumatic events and whether these coping strategies differ from those used by other military personnel. Civilian medical students tend to have low rates of seeking mental health treatment, with roughly 22% of medical students screening positive for depression and 42% of medical students with depression and suicidal ideation seeking mental health services (Givens & Tjia, 2002). These low rates of help-seeking may not be surprising when considering that physicians with mental health disorders are frequently overtly or covertly discriminated against with regards to medical licensing, hospital privileges, health insurance, and/or malpractice insurance, and that physicians tend to have low rates of personal healthcare utilization and believe that there is a stigma against acknowledging physical or mental health concerns within the medical community (Center et al., 2003; Gross et al., 2000; Schernhammer, 2005).

OEF/OIF, PTSD, and Alcohol Use

As expected with most military wartime involvements, PTSD is a major mental

health concern for OEF/OIF service members and veterans. Among OEF/OIF veterans treated in the VA healthcare system, between 14% and 22% meet diagnostic criteria for PTSD and it is estimated that upwards of 30% of all OEF/OIF veterans will meet lifetime criteria for PTSD (Marmar et al., 2015; Schumm & Chard, 2012). Rates of PTSD among OEF/OIF service members are concerning because there appears to be a well-documented association between PTSD and alcohol and other substance abuse (Bohnert et al., 2013; Creamer et al., 2001; Kessler et al., 1995). Clinical samples of male veterans find that an alcohol use disorder is the most common co-occurring disorder with a PTSD diagnosis (Hawkins, Lapham, Kivlahan, & Bradley, 2010; Jacobsen, Southwick, & Kosten, 2001). In fact, 73% of a large national cohort sample of male Vietnam veterans met criteria for comorbid PTSD and a lifetime diagnosis alcohol use disorder (Kulka et al., 1990; Seal et al., 2011). These rates among Vietnam-era veterans make it clear that alcohol use and PTSD are prevalent among military populations, and it could be implied that a large proportion of OEF/OIF veterans may also have comorbid PTSD and alcohol use disorder.

It is unclear why alcohol use co-occurs so highly with PTSD. It is possible that there is some individual variability with the order of onset of the diagnoses (Schumm & Chard, 2012). There is some evidence that PTSD may increase the risk for the onset of an alcohol use disorder related to self-medication of PTSD symptoms (Bohnert et al., 2013). Conversely, there is little evidence that alcohol misuse increases the risk for PTSD as service members who misuse alcohol prior to experiencing traumatic events may remain likely to misuse alcohol after the trauma even if they do not experience an onset of PTSD (Bohnert et al., 2013; Schumm & Chard, 2012). Interestingly, a longitudinal study of

PTSD symptom recovery of soldiers deployed to Kosovo found that, while 84% had a resilient recovery following return from deployment, those with higher levels of alcohol use prior to deployment tended to be more likely to display PTSD symptoms during follow-up than soldiers with lower levels of prior alcohol use (Dickstein, Suvak, Litz, & Adler, 2010; Schumm & Chard, 2012). Collectively, it is possible that prevention measures that educate about and assist with service members' risky alcohol use prior to deployments may help potentially mitigate the onset of PTSD symptoms following deployment.

While it has been noted that the misuse of alcohol tends to be associated with and impede recovery from PTSD, it is clear that there is no single best explanation for the relationship between PTSD and alcohol abuse (Barlas et al., 2013; Jacobsen et al., 2001; Schumm & Chard, 2012). OEF/OIF service members who abuse alcohol and have PTSD typically experience more difficulties with the treatment of each disorder (e.g., exacerbated symptoms, requiring specialized treatment, poorer treatment outcomes) as compared with service members with only a single diagnosis (Seal et al., 2011). It has been found that service members with comorbid diagnoses of substance use disorder and PTSD are more likely to struggle maintaining abstinence from alcohol and other substances as compared with service members with a single diagnosis of PTSD, and it has been suggested that service members with comorbid alcohol use disorder and PTSD may experience more barriers to recovery from both diagnoses (Brown, Stout, & Mueller, 1999; Schumm & Chard, 2012). It is possible that increasing the understanding of the relationship between alcohol misuse and PTSD may enable service members to better recognize their alcohol abuse which may enhance their ability to obtain successful

treatment for both PTSD and alcohol issues.

Considerations for National Guard and Reserve Troops

While many of the same issues are prevalent among OEF/OIF service members who have deployed as members of active duty troops as those who are members of National Guard/Reserve (NG/R) units, risk factors for risky alcohol use specific to NG/R service members have been identified. This is especially salient given the heavy reliance on NG/R troops during operations supporting OEF/OIF. Between 26% and 40% of OEF/OIF troops have been from NG/R units that are remote from military installations and may lack many of the support systems found among active duty members (Castro, 2014). It has been estimated that roughly 42% of NG/R service members require mental health services, including services for alcohol abuse, as compared to 20% of active duty members (Burnett-Zeigler et al., 2011; Castro, 2014). Studies have found that between 12% and 15% of NG/R service members screen positive for alcohol problems within 6 months of returning from deployment and that returning from deployment has been linked with an increased likelihood of heavy episodic drinking (Kline et al., 2010; Milliken et al., 2007; Shen, Arkes, & Williams, 2012; Wilk et al., 2010). In addition, deployments during which NG/R service members experienced combat have been associated with new developments of heavy weekly drinking, heavy episodic drinking, and negative consequences of drinking, particularly among younger Marine Corps personnel with comorbid diagnoses of PTSD and/or depression (Burnett-Zeigler et al., 2011; Jacobson et al., 2008). It has been suggested that this increased likelihood of mental health concerns may be related to the fact that NG/R troops often hold civilian occupations, are less likely to have access to military support networks, and may have

had less preparation for a combat deployment which could increase difficulties transitioning back to civilian life (Jacobson et al., 2008; Seal et al., 2011).

Burnett-Zeigler et al. (2011) explored the relationship between alcohol misuse, demographic variables, deployment, and receiving mental health services among a sample of 585 Michigan Army National Guard members attending a mandatory reintegration workshop within 60 days from deployment demobilization. It was found that 36% of the sample met criteria for alcohol misuse based on scores from the Alcohol Use Disorder Identification Test (AUDIT) with higher likelihoods for risky alcohol use found among members who had lower income, were unmarried, had fewer than 4 years of military service, and reported co-occurring thoughts of suicide and symptoms of depression, anxiety, and/or PTSD. Of the members who screened positive for alcohol misuse, 31% reported that they had received mental health treatment within the preceding year and 2.5% endorsed receiving specific substance abuse treatment primarily from a general physician at a military facility. It was also found that members were concerned about mental health treatment appearing in their records, feared that they would be viewed as weak by other personnel and treated differently by leadership, and felt embarrassed. Given these concerns, it remained unclear whether the low rates of alcohol treatment were due to poor alcohol use assessment, availability of services, barriers to treatment, or other reasons (e.g., perceived need for treatment, stigma). These results suggest that alcohol misuse is prevalent among returning NG/R troops and it is highly likely that civilian practitioners will need to play a role in providing treatment.

Millennium Cohort Study

The Department of Defense established a prospective cohort study (i.e.,

Millennium Cohort Study) in order to help determine whether military service increases service members' risk for developing chronic illness. Comprised of all military service branches and including National Guard and Reserve troops, the aim of the Millennium Cohort Study (MCS) is to determine if certain aspects of military service (e.g., occupation, deployment, type of service, miscellaneous exposures) are associated with the onset of chronic disease (Chesbrough et al., 2002). Participant enrollment for the initial recruitment panel began in late 2000, and follow-up surveys are administered to participants every three years (Ryan et al., 2007). Additionally, new panels of participants were added in 2004 and 2007 and follow-up data is expected to be collected until at least 2068 (Chesbrough et al., 2002; Jacobson et al., 2012). Interestingly, many of the baseline assessments for the first participant enrollment panel were completed prior to the terrorist attacks of September 11, 2001, which enables prospective data to be gathered investigating factors associated with deployments in support of OEF/OIF.

The first participant enrollment panel is comprised of a random selection of military personnel who were on military rosters as of October 1, 2000 (Jacobson et al., 2008). The first recruitment panel contained 77,047 randomly-selected participants enrolled between 2001 and 2003, and a second participant panel of 31,110 randomly-selected participants was enrolled between 2004 and 2006 (Jacobson et al., 2012). Participants included an oversampling of women, National Guard/Reserve personnel, and service members who had deployed prior to September 11, 2001 (Ryan et al., 2007). It has been found that the MCS participants in the first panel are more likely to be female, older, have greater levels of education, married, have officer status, members of the US Air Force, and work in a health care occupation as compared to the overall military in

2000 (Ryan et al., 2007). Furthermore, 46% of the first panel of MCS participants met criteria for heavy episodic drinking, 8% met criteria for heavy weekly drinking, and 2% had a positive screening for PTSD (Ryan et al., 2007).

The MCS survey instrument contains 67 items assessing a variety of domains (e.g., medical diagnoses, psychosocial characteristics, substance use, occupation, sleep patterns) and is available on paper and electronically (Chesbrough et al., 2002; Ryan et al., 2007). In addition, the survey contains embedded standardized instruments, including the Patient Health Questionnaire (PHQ), Medical Outcomes Study Short Form-36 for Veterans (SF-36V), a Department of Veterans Affairs Gulf War survey to assess war-related exposures, the CAGE questionnaire, and the Posttraumatic Stress Disorder Checklist-Civilian Version (PCL-C; Ryan et al., 2007). For the PCL-C, participants were considered to screen positive for a possible PTSD diagnosis if they reported at least one intrusion symptom, three avoidance symptoms, two hyperarousal symptoms, and had a PCL-C score of 50 or greater (Ryan et al., 2007). The survey instrument also has space for participants to list any other concerns not otherwise assessed (Chesbrough et al., 2002). It is expected that the survey will capture a multitude of variables, including health habits, health care utilization, deployment information, chronic diseases (e.g., diabetes, heart disease, cancer), and changes in functional status (Chesbrough et al., 2002).

Summary of Findings and Future Directions

It is clear that certain factors associated with military service during OEF/OIF seem to enhance the likelihood for problematic alcohol use. Research has repeatedly suggested that service members who are male, under age 25 years, unmarried, Caucasian, and enlisted active duty members who have experienced combat while deployed tend to

have a greater likelihood for risky alcohol use and for experiencing negative consequences as a result of this alcohol use as compared with older, married service members holding higher ranks across the service branches. Research has begun to suggest that comorbid diagnoses of PTSD and/or major depressive disorder may strengthen the relationship between OEF/OIF service members and risky alcohol use. While these factors may help mental health professionals identify service members who may be at risk for experiencing alcohol misuse, a number of issues related to alcohol misuse and deployment still remain unclear.

Despite the strong evidence for an association between OEF/OIF deployments and increased rates of alcohol misuse, there is still a dearth of research that clearly identifies causal pathways between deployment and alcohol abuse. Additional research focusing on the role of combat in the development and maintenance of risky alcohol use could lead to improved training and debriefing programs for troops (Shen et al., 2012). This is especially true among military healthcare providers, who may be exposed to combat situations and yet are woefully understudied. Having a better understanding of how deployments and combat exposure may influence alcohol use among healthcare providers may help with the development of targeted interventions for military personnel based upon their specific occupations.

As troops continue to return from OEF/OIF operations, it is likely that rates of PTSD diagnoses will increase. It is vital for mental health practitioners to have a thorough understanding of the relationship between PTSD and alcohol misuse in order to better provide effective treatment and prevention measures where available. Given that research has already suggested a relationship between PTSD and alcohol misuse, it is

important to continue exploring this relationship among military subpopulations, in particular among military healthcare providers. It is likely that military healthcare providers will be exposed to potentially traumatic events during a combat deployment (e.g., frequent exposure to mass casualties, emotional demands of working with large numbers of critically-wounded patients, lack of control over patient outcomes) and may use alcohol as a coping mechanism. Having a better understanding of the relationship between potential PTSD and alcohol misuse among healthcare providers could lead to an increased awareness of the issue and help military leadership and other healthcare providers screen for possible PTSD and/or alcohol misuse among healthcare providers.

Purpose of the Study

Military healthcare professionals experience many of the same deployment stressors as non-healthcare personnel, yet are frequently overlooked during research into mental health and substance abuse consequences of deployment. Given that military healthcare professionals experience high levels of stress inherent to their profession and that the literature has documented substance abuse by civilian healthcare providers, it is important to explore this issue within the military. Alcohol abuse among healthcare professionals can lead to diminished quality of patient care, professional sanctions, and a loss of identity as a role model for healthy behaviors.

Unfortunately, the available research into this issue tends to use retrospective data which may be at risk for recall bias and underreporting. Using the MCS database provides an opportunity for prospective evaluation of alcohol use among a vulnerable population. This improved understanding could lead to the enhancement of prevention and intervention methods specific to military healthcare personnel which in turn may lead

to an increase in overall quality of patient care.

This study addressed the lack of research regarding risky alcohol use among military healthcare professionals involved with operations supporting OEF/OIF. The primary research question was whether military healthcare professionals involved in OEF/OEF operations are at increased risk for alcohol misuse, including problem drinking (i.e., the presence of negative consequences from alcohol use), heavy weekly drinking (i.e., for men, greater than 14 drinks per week; for women, greater than 7 drinks per week), and/or heavy episodic drinking (i.e., binge drinking; for men, 5 or more drinks per occasion; for women, 4 or more drinks per occasion) as compared with service members who do not have a healthcare occupation. Based on the research just reviewed, three hypotheses were formulated: (a) among military personnel involved with OEF/OIF operations, healthcare professionals will have an increased likelihood of alcohol misuse (i.e., problem drinking, heavy weekly drinking, heavy episodic drinking) compared with service members in other occupations; (b) military personnel who screen positive for PTSD will be more likely to screen positive for alcohol misuse outcomes (i.e., problem drinking, heavy weekly drinking, heavy episodic drinking) when compared with personnel who do not screen positive for PTSD; and (c) military personnel with enlisted status will be more likely to screen positive for alcohol misuse outcomes compared with personnel with officer status. Additional aims of this study were to: (a) identify the influence of combat deployment experience on alcohol use; (b) identify the association between separation from military service and alcohol use; and (c) identify the association of service component (i.e., active duty, National Guard/Reserve) with alcohol use.

CHAPTER II: METHOD

Participants

Participants were selected from the first and second enrollment panels (i.e., Panel 1, Panel 2) of the MCS database. Enrollment for Panel 1 began in late 2000, and enrollment for Panel 2 began in 2004 (Jacobson et al., 2012). These participants had completed the MCS survey at baseline, and follow-up surveys were administered every three years. Due to the timing of follow-up administration, participants in Panel 1 had completed three follow-up surveys (i.e., at 3, 6, and 9 years after the baseline survey), and participants in Panel 2 had completed two follow-up surveys (i.e., at 3 and 6 years after the baseline survey). Participants comprised a representative cross-section of the military at the time of enrollment. Not all participants in the MCS database had completed surveys at every follow-up period; however, participants were included in the primary analyses only if they completed surveys for their baseline entrance into the study and completed surveys at all follow-up periods. Healthcare occupations were identified for enlisted personnel (i.e., medical care, ancillary medical support, biomedical sciences or allied health, dental care) and for officers (i.e., physician, nurse, dentist, veterinarian, biomedical sciences or allied health, psychologist). Due to the manner in which occupations were coded, participants were not divided into their specific healthcare occupations, nor were they divided into groups based on whether or not they provided direct patient care. Participants who did not identify as healthcare professionals were included as a comparison group to identify differences in alcohol use between healthcare and non-healthcare professionals. Any participants who were in the Marine Corps were excluded as Navy personnel provide healthcare services for Marine Corps personnel, and

participants who were in the Coast Guard were excluded as personnel from the United States Public Health Service provide healthcare services for the Coast Guard.

Measures

Participants completed instruments obtaining demographic, military service, alcohol use, combat exposure, and PTSD symptom data as part of the MCS survey. The primary exposure of interest (i.e., independent variable) was occupation as a military healthcare professional, and the primary outcome variables of interest were problem drinking, heavy weekly drinking, and heavy episodic drinking. Other predictor variables explored in the analyses included positive screening for PTSD, enlisted or officer status, combat exposure, military-related variables, and demographic information.

Demographic Data

Participants' demographic data were obtained through questions on the MCS survey. Demographic data relevant to this study included gender, birth year, race/ethnicity, education level, service branch (i.e., Army, Navy, Air Force), service component (i.e., active duty, National Guard/Reserve), marital status, smoking status, occupation, and whether or not the participant separated from military service during the follow-up period.

Alcohol Use

Health Risk Appraisal (HRA) survey.

Recent alcohol use was assessed using questions from the MCS survey asking about participants' alcohol use over the seven days prior to completing the survey. These questions were based upon the US Army's Health Risk Appraisal (HRA) survey (Jacobson et al., 2008). The HRA was originally intended to be used to create a

workforce wellness plan, but has also been found useful for assessing soldiers' alcohol use (Bell, Williams, Senier, Strowman, & Amoroso, 2003). While it has been identified as a useful instrument for research and for identifying trends, the HRA was never used, nor was it intended for use, as a screening instrument to identify military personnel appropriate for any psychological or medical intervention based upon their survey responses (Bell, Williams, Senier, Amoroso, & Strowman, 2002). The HRA includes eight alcohol items, including items assessing the amount of alcohol consumed weekly (i.e., drinks per week; range from 0 to 99), whether other people are concerned about the respondent's alcohol use (i.e., yes or no), a self-report of having a perceived drinking problem (i.e., yes or no), past-month incidence of drinking and driving (i.e., as a driver or passenger; range from 0 to 59), and the CAGE questionnaire (Bell et al., 2002; Bell et al., 2003). Reliability studies have found that the alcohol items on the HRA demonstrate a reasonable degree of reliability (Cronbach's $\alpha = 0.69$) and good criterion-related validity in that respondents consuming over 21 drinks per week had a risk for alcohol-related hospitalizations that was six times higher than non-drinkers (hazard ratio = 6.36; 95% confidence interval = 5.79, 6.99; Bell et al., 2003). Collectively, the results suggest that the alcohol questions on the HRA (and subsequently those on the MCS survey instrument) are able to obtain valid and reliable responses.

Primary Care Evaluation of Mental Disorders – Patient Health Questionnaire (PHQ).

The PHQ was derived from the original Primary Care Evaluation of Mental Disorders (PRIME-MD) screening instrument as a three-page, self-administered questionnaire designed to aid clinicians in the diagnoses of eight mental disorders

including depressive disorders, anxiety disorders, and alcohol abuse (Spitzer, Kroenke, Williams, & and the Patient Health Questionnaire Primary Care Study, 1999). The PHQ asks whether or not five situations related to alcohol use have occurred at least once in the last six months (i.e., drinking alcohol against a doctor's advice; drinking alcohol, high from alcohol, or hungover while working, going to school, caring for children, or having other responsibilities; missing or being late for work, school, or other activities due to drinking or being hungover; having problems getting along with other people while drinking; driving a car after having several drinks) with a "yes" response to at least one question being indicative of probable alcohol use or dependence (Grucza, Przybeck, & Cloninger, 2008; Spitzer et al., 1999). When compared with diagnoses made by independent practitioners, the PHQ has been found to have an overall accuracy rate of 85% with a sensitivity of 75% and a specificity of 90% (Spitzer et al., 1999). In addition, the PHQ has been found to take considerable less time to administer and review when compared to the PRIME-MD (Spitzer et al., 1999; Spitzer, Williams, Kroenke, & et al., 1994). The five alcohol-related questions on the PHQ were used in this study to create the problem drinking variable and assess alcohol-related problems in the past year (Jacobson et al., 2008).

PTSD

PTSD Checklist – Civilian Version (PCL-C).

The PCL-C is designed to detect PTSD symptoms among civilian populations, and was chosen over other versions of the PCL (i.e., PCL-military, PCL-specific) for inclusion in the MCS survey as it was expected that most MCS participants would have discharged from military service prior to the final follow-up (Jacobson et al., 2008). The

PCL-C contains 17 Likert-style items corresponding with PTSD criteria found in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; Wilkins, Lang, & Norman, 2011). Participants are asked to self-report the severity of intrusion, avoidance, and hyperarousal symptoms in the 30 days prior to completing the measure using a 5-point (1 = not at all, 5 = extremely) Likert scale (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996). Total scores range from 17 to 85, with a cut-off score of 50 being indicative of a probable diagnosis of PTSD (Blanchard et al., 1996; Weathers, Litz, Herman, Huska, & Keane, 1993). The PCL-C is unique in that it asks respondents to rate their symptoms related to a stressful experience as compared with other versions of the PCL that ask respondents to rate symptoms related to a stressful military experience or a specific traumatic event (Wilkins et al., 2011). Among combat veterans, studies have suggested that the PCL-C has a high specificity (0.99), a moderate sensitivity (0.60), a positive predictive value of 0.75, and a negative predictive value of 0.97 for identifying the presence of PTSD (Smith, Smith, Jacobson, Corbeil, & Ryan, 2007).

Procedure

All data were obtained from a de-identified MCS database. The primary outcome variable of interest was alcohol misuse as defined by three unique alcohol use outcome variables (i.e., problem drinking, heavy weekly drinking, heavy episodic drinking) which included both initiation and persistence of alcohol misuse. Participants were separated into two groups based on their enrollment panel (i.e., Panel 1, Panel 2). They were further separated into subgroups based on alcohol misuse initiation or persistence. Initiation or persistence for each of the three alcohol use outcome variables was identified

independently for each outcome variable. Participants were placed in an initiation group if they reported no problem drinking, heavy weekly drinking, and/or heavy episodic drinking at baseline. Participants were placed in a persistence group if they endorsed problem drinking, heavy weekly drinking, and/or heavy episodic drinking at baseline. Participants' heavy weekly drinking (i.e., for men, consuming >14 standard drinks in a week; for women, consuming >7 standard drinks in a week) and heavy episodic drinking (i.e., for men, consuming ≥5 standard drinks on one occasion; for women, consuming ≥4 standard drinks on one occasion) at baseline and at each follow-up assessment were assessed using the MCS survey questions asking about alcohol use over the seven days prior to completing the survey. Identifying participants' problem drinking at baseline and each follow-up assessment was completed using questions from the PHQ given as part of the MCS survey. Participants were considered to have experienced problem drinking if they endorsed a positive response to one or more of the following PHQ questions in the previous 12 months: (a) drank alcohol against the advice of a physician due to a health problem; (b) drank alcohol, were under the influence of alcohol, or were hungover from alcohol while working, going to school, or taking care of children or other responsibilities; (c) were late for or missed work, school, or other responsibilities due to drinking or being hungover; (d) interpersonal difficulties while drinking; or (e) driving a car after having several drinks or after drinking too much (Jacobson et al., 2008).

Primary predictor variables for endorsing the three alcohol use outcome variables included occupation as a healthcare professional, positive PTSD screening, and enlisted rank. Additional predictor variables included self-report of OEF/OIF-related combat exposure (i.e., through survey questions asking whether participants had witnessed a

person's death because of war, disaster, or tragic event; witnessed instances of physical abuse; and seen dead or decomposing bodies, maimed soldiers or civilians, or prisoners of war or refugees) and demographic (i.e., gender, birth year, race/ethnicity, education level, marital status, tobacco use) and military (e.g., service branch, service component, separation from military service during the follow-up period) data.

Data Analyses

Analyses were performed using IBM SPSS Statistics 20 (IBM Corporation, 2011). Given the complexity of the database, multiple analyses were completed in order to achieve the final outcomes.

Demographic Characteristics

Previous research has reported that participants in the MCS have distinct demographic characteristics depending upon their enrollment panel (Jacobson, 2013). As such, it was decided that the participants in this study would be divided and analyzed separately by their enrollment panel. Participants were separated into two groups based upon their enrollment panel, and chi-square (X^2) tests of independence were completed to identify differences among nominal demographic and alcohol use characteristics between participants in the two enrollment panels at baseline. Participants were included if they had any baseline data regardless of whether they had complete information at baseline for all demographic and alcohol use variables, and regardless of the number of follow-up surveys they had completed. These tests of independence suggested statistically significant ($p < .05$) differences between the two enrollment panels for all demographic (i.e., enlisted status, occupation, service branch, sex, PTSD screening, tobacco use, active duty status, education level, marital status, race/ethnicity, birth year category, separation

from military service, combat deployment experience) and alcohol use variables (i.e., problem drinking, heavy weekly drinking, heavy episodic drinking; see Table 1). Although the presence of significant differences might in some cases have reflected the large sample size, this finding was consistent with previous research. Thus, it was decided to continue separating participants by enrollment panel for the subsequent analyses.

Preliminary Analyses

Univariate logistic regression models were completed to gain a preliminary understanding of the relationship between the predictor variables (e.g., occupation, PTSD screening, enlisted status) and alcohol use outcome variables. Participants from both enrollment panels were pooled to assess the initial odds ratios of interaction effects between enrollment panel and predictor variables on alcohol use outcome variables. The presence of interaction effects would capture if the association between predictor variables and alcohol use outcomes varied by enrollment panel, and general differences between the two enrollment panels would be captured as a main effect of enrollment panel. Identifying these interaction and main effects would further justify the decision to split participants by enrollment panel for the primary analyses. These models were completed separately for all three alcohol use outcomes at baseline and at each of the first two follow-up waves. Analyses for the third follow-up wave could not be completed as no data were available for Panel 2 participants for this follow-up period.

Additional univariate logistic regression models were completed with participants divided by enrollment panel to explore the effects of predictor variables on alcohol outcome variables and help refine which predictors would be included in the primary

Table 1: Demographic data for available participants at baseline split by enrollment panel

	N (%)		X^2 (df)	*p*	Cramer's V
	Panel 1	Panel 2			
Variable					
Enlisted status			496.98 (1)	<.001	.08
Enlisted	41,257 (76.5)	14,871 (84.4)			
Officer	12,695 (23.5)	2,743 (15.6)			
Occupation			579.61 (1)	<.001	.09
Healthcare occupation	3,769 (7.0)	2,252 (12.8)			
Other occupation	50,183 (93.0)	15,362 (87.2)			
Service Branch			25.40 (2)	<.001	.02
Army	31,204 (49.9)	9,698 (52.0)			
Navy	11,604 (18.5)	3,299 (17.7)			
Air Force	19,774 (31.6)	5,668 (30.4)			
Sex			1443.29 (1)	<.001	.13
Male	45,424 (72.6)	10,818 (58.0)			
Female	17,158 (27.4)	7,847 (42.0)			
PTSD screening[a]			62.26 (1)	<.001	.03
Negative for PTSD	60,766 (98.3)	17,134 (97.4)			
Positive for PTSD	1,039 (1.7)	457 (2.6)			
Tobacco use			869.87 (1)	<.001	.14
Non-smoker	20,642 (72.8)	10,828 (59.7)			
Smoker	7,709 (27.2)	7,311 (40.3)			
Active duty status			4.64 (1)	.031	.01
National Guard/Reserve	27,972 (44.7)	8,176 (43.8)			
Active Duty	34,610 (55.3)	10,489 (56.2)			
Education			970.38 (1)	<.001	.11
Associate's degree or less	40,732 (65.1)	14,409 (77.2)			
Bachelor's degree or higher	21,842 (34.9)	4,249 (22.8)			
Marital status			7629.00 (2)	<.001	.31
Single, never married	11,947 (19.1)	9,561 (51.2)			
Married	42,034 (67.2)	7,506 (40.2)			
Separated/Divorced/Widowed	8,596 (13.7)	1,596 (8.6)			
Race/ethnicity			57.86 (2)	<.001	.03
White, non-Hispanic	43,623 (69.8)	13,388 (71.8)			
Black, non-Hispanic	8,307 (13.3)	2,086 (11.2)			
Other	10,599 (17.0)	3,162 (17.0)			
Birth year			33176.22 (3)	<.001	.64
Pre-1960	14,843 (23.7)	199 (1.1)			
1960-1969	24,942 (39.9)	1,368 (7.3)			
1970-1979	19,981 (31.9)	6,281 (33.7)			
1980+	2,816 (4.5)	10,817 (58.0)			
Separated from military			32.10 (1)	<.001	.02
Not separated	59,091 (94.4)	17,822 (95.5)			
Separated	3,491 (5.6)	843 (4.5)			
Deployment prior to baseline			14087.51 (2)	<.001	.42
Not deployed	59,082 (94.4)	11,415 (61.2)			
Deployed without combat	1,776 (2.8)	2,652 (14.2)			
Deployed with combat	1,724 (2.8)	4,598 (24.6)			
Problem drinking[b]			230.18 (1)	<.001	.06
No	51,153 (88.2)	13,487 (83.7)			
Yes	6,851 (11.8)	2,631 (16.3)			
Heavy weekly drinking[c]			302.22 (1)	<.001	.06
No	52,289 (91.3)	14,240 (86.8)			
Yes	54,970 (8.7)	2,172 (13.2)			
Heavy episodic drinking[d]			950.83 (1)	<.001	.11
No	28,888 (50.6)	5,858 (36.8)			
Yes	28,173 (49.4)	10,052 (63.2)			

Note. Panel 1 enrolled 62,582 participants and Panel 2 enrolled 18,665 participants; however, not all participants had complete data for every variable.
[a]Based on PTSD Checklist – Civilian Verstion (PCL-C) score $\geq$50. [b]Problem drinking assessed via endorsing alcohol-related consequences on the PHQ. [c]Heavy weekly drinking is defined as >14 standard drinks per week for men and >7 standard drinks per week for women. [d]Heavy episodic drinking (i.e., binge drinking) is defined as $\geq$5 standard drinks on any one occasion for men and $\geq$4 standard drinks on any one occasion for women.

analyses. These analyses were completed separately for each alcohol use outcome variable at each time point (including at the third follow-up wave for participants in Panel 1).

Primary Analyses

In order to assess for alcohol use over time, participants were divided into separate groups based on their baseline alcohol use for each alcohol use outcome. This resulted in participants being divided into four subgroups based on their enrollment panel and their baseline alcohol use for the primary analyses (i.e., Panel 1 initiation, Panel 1 persistence, Panel 2 initiation, Panel 2 persistence).

It was initially decided that generalized linear mixed models (GLMMs) would be used to explore the effects of the primary predictor variables of interest (i.e., occupation, PTSD, enlisted status) on the three alcohol use outcome variables. GLMMs were deemed appropriate as they extended beyond a generalized linear model by accounting for both the random effect of time and the fixed effects of the predictor variables on the alcohol use outcome variables for the longitudinal data and could include participants with incomplete follow-up data (Hedeker, 2005; McCulloch & Neuhaus, 2006). The initial GLMMs separated participants into the four subgroups and included all of the demographic and military-related predictor variables. Separate GLMMs were run for each of the alcohol use outcomes. However, significant model fit errors occurred such that none of the GLMMs would converge. Attempts to address the issues with model convergence included incorporating fewer predictor variables into the model; however, convergence issues remained. It was determined that, based upon the manner in which the participants were divided, the data were distributed too sparsely to fit the GLMM.

Due to the preliminary analyses which demonstrated the importance of dividing participants into subgroups based on their enrollment panel and baseline alcohol use, another statistical approach was implemented.

It was decided that the statistical model for the primary analyses would need to incorporate information from the longitudinal data, but would need to do so in a manner that would result in a simpler statistical model. The preliminary univariate analyses explored the endorsement of the alcohol use outcomes at each time point individually, and the GLMMs attempted to incorporate the random time effect into the models – neither of which provided a sufficient explanation of the effects of the predictor variables of interest over time. One possible approach that was considered was to graphically plot the probability of endorsing each alcohol use outcome for the predictor variables of interest across time points. Using this approach would have enabled participants to be included if they had complete predictor and alcohol use data at any given time point rather than needing complete data at all time points. It was decided, however, that this approach would not provide the best understanding of which predictors influenced alcohol use outcomes over time.

In order to accomplish the task of incorporating the effect of time on alcohol use outcomes, assumptions were made to simplify the models while accounting for the passage of time in the data. This approach resulted in recoding participants into alcohol misuse risk categories based upon their patterns of endorsing each alcohol use outcome variable (i.e., problem drinking, heavy weekly drinking, heavy episodic drinking) across follow-up waves. This resulted in three possible risk categories: (a) sustained lower risk (i.e., no endorsement of an alcohol use outcome at any follow-up); (b) sustained higher

risk (i.e., endorsement of an alcohol use outcome at each follow-up); and (c) variable risk (i.e., a mix of endorsement and no endorsement of an alcohol use outcome at each follow-up). Baseline endorsement of an alcohol use outcome determined whether participants were placed in the initiation or persistence group, and did not influence whether participants were categorized as being in the lower risk, higher risk, or variable risk group.

In order to identify participants' risk categories, analyses were restricted to participants with complete data at baseline and each follow-up period to avoid imputing values for the alcohol use outcomes. Panel 1 participants were included if they had completed assessments at baseline and three follow-ups, while Panel 2 participants were included if they had assessments at baseline and two follow-ups. Risk categories for each alcohol use outcome variable were recoded separately such that some participants could have had complete data for the problem drinking variable (and thus were included in the primary analyses for problem drinking) as this information was gathered via the PHQ, and have had incomplete data for the heavy weekly drinking and heavy episodic drinking variables (and thus were excluded from those primary analyses) as heavy weekly drinking and heavy episodic drinking were determined from participants' self-reported alcohol use on the seven days prior to completing the survey at each time point, and vice-versa. This restriction led to the exclusion of many participants and led to selection analyses, both of which will be discussed in detail later.

Following from these decisions, multinomial logistic regression models were completed to determine the odds ratios of the effects of all predictor variables on the three alcohol use outcomes. Participants were again divided into four subgroups and

separate analyses were completed for each of the three alcohol use outcomes. This statistical approach allowed for the examination of the effect of time on alcohol use outcomes without encountering the model convergence issues present in GLMM analyses treating time as a random effect.

Sample Selection Analyses

The use of multinomial logistic regression models resulted in list-wise deletion of participants in the primary analyses. Predictive probabilities analyses were completed to determine if any predictor variables could predict inclusion in or exclusion from the primary analyses. Predictor variables from the primary analyses were retained in the selection analyses if they were associated with alcohol use outcomes using a $p < .25$. Once these predictor variables were identified for each participant subgroup, binary logistic regression models were run using an outcome variable of being included in or excluded from the primary analyses for each alcohol use outcome variable. Cox and Snell R^2 approximations and odds ratios for the various predictors were used to identify predictor variables that may have predicted inclusion in or exclusion from the primary analyses. In addition, univariate logistic regression analyses were completed to assess whether the predictor variables included in the primary analyses interacted with occupation as a healthcare professional, PTSD screening status, and/or enlisted or officer status when determining inclusion in the primary analyses as these three variables were deemed our primary predictor variables of interest. Finally, chi-squared analyses compared participants who were included in the primary analyses with those who were excluded from the primary analyses on all predictor variables. Chi-squared analyses were completed separately for each alcohol use outcome variable.

CHAPTER III: RESULTS

Demographic Characteristics

The total study database included 81,247 participants. As previously mentioned, participants were included in the baseline demographic analysis regardless of whether they had provided information for each demographic variable. Panel 1 included 62,582 enrolled participants, with 7.0% holding a healthcare occupation, 76.5% having enlisted rank, 72.6% male, 1.7% screening positive for PTSD, and 2.8% reporting combat exposure prior to baseline. Panel 2 included 18,665 enrolled participants, with 12.8% holding a healthcare occupation, 84.4% having enlisted rank, 58.0% male, 2.6% screening positive for PTSD, and 24.6% reporting combat exposure prior to baseline. As previously mentioned, results from chi-square tests of independence suggested statistically significant ($p < .05$) differences between the two enrollment panels for all demographic and alcohol use variables (see Table 1). However, due to the very large sample sizes of the two groups, the effect sizes for most variables would be considered small (Cramer's $V \leq 0.1$) and would suggest that differences would not be considered clinically significant (Cohen, 1992). Nevertheless, there were some medium to large effect sizes present such that the participants in Panel 1 were more likely than participants in Panel 2 to: (a) be married (67.2% vs. 40.2%) or separated, divorced, or widowed (13.7% vs. 8.6%) and less likely to be single (19.1% vs. 51.2%; Cramer's V = .31); (b) be older and belong to the pre-1960 (23.7% vs. 1.1%) or 1960-1969 (39.9% vs. 7.3%) birth year categories and less likely to belong to the 1980+ (4.5% vs. 58.0%) birth year category (Cramer's V = .64); and (c) have not been deployed (94.4% vs. 61.2%) and less likely to have been deployed without combat exposure (2.8% vs. 14.2%) or been

deployed with combat exposure (2.8% vs. 24.6%) prior to baseline (Cramer's V = .42) (Cohen, 1992).

Preliminary Analyses

Preliminary univariate logistic regression models pooled participants from both enrollment panels to determine whether interaction effects between predictor variables and alcohol use outcomes varied by enrollment panel across baseline and the first two follow-up waves. These models suggested statistically significant ($p < .05$) interaction effects of enrollment panel for multiple predictors on all three alcohol use outcomes at baseline and the first and second follow-up waves as well as significant main effects of enrollment panel. Statistically significant interaction effects varied by alcohol use outcome and time point. Odds ratios for significant interaction effects ranged from 0.61 (interaction between enrollment panel and being a member of the Air Force on problem drinking in the first follow-up wave) to 5.13 (interaction between enrollment panel and having a bachelor's degree on heavy episodic drinking in the first follow-up wave). These results suggested that predictor variables may vary for each enrollment panel and suggested that the primary analyses should separate participants by enrollment panel to get a more accurate understanding of significant predictors of the alcohol use outcomes.

Primary Analyses

Multinomial logistic regression analyses were completed to identify the influence of predictor variables on each alcohol outcome over the course of all assessment waves. As previously mentioned, only participants who had complete MCS survey data at baseline and every follow-up wave for each of the three alcohol outcome variables were included in the multinomial logistic analyses. Of the 81,247 participants in the overall MCS

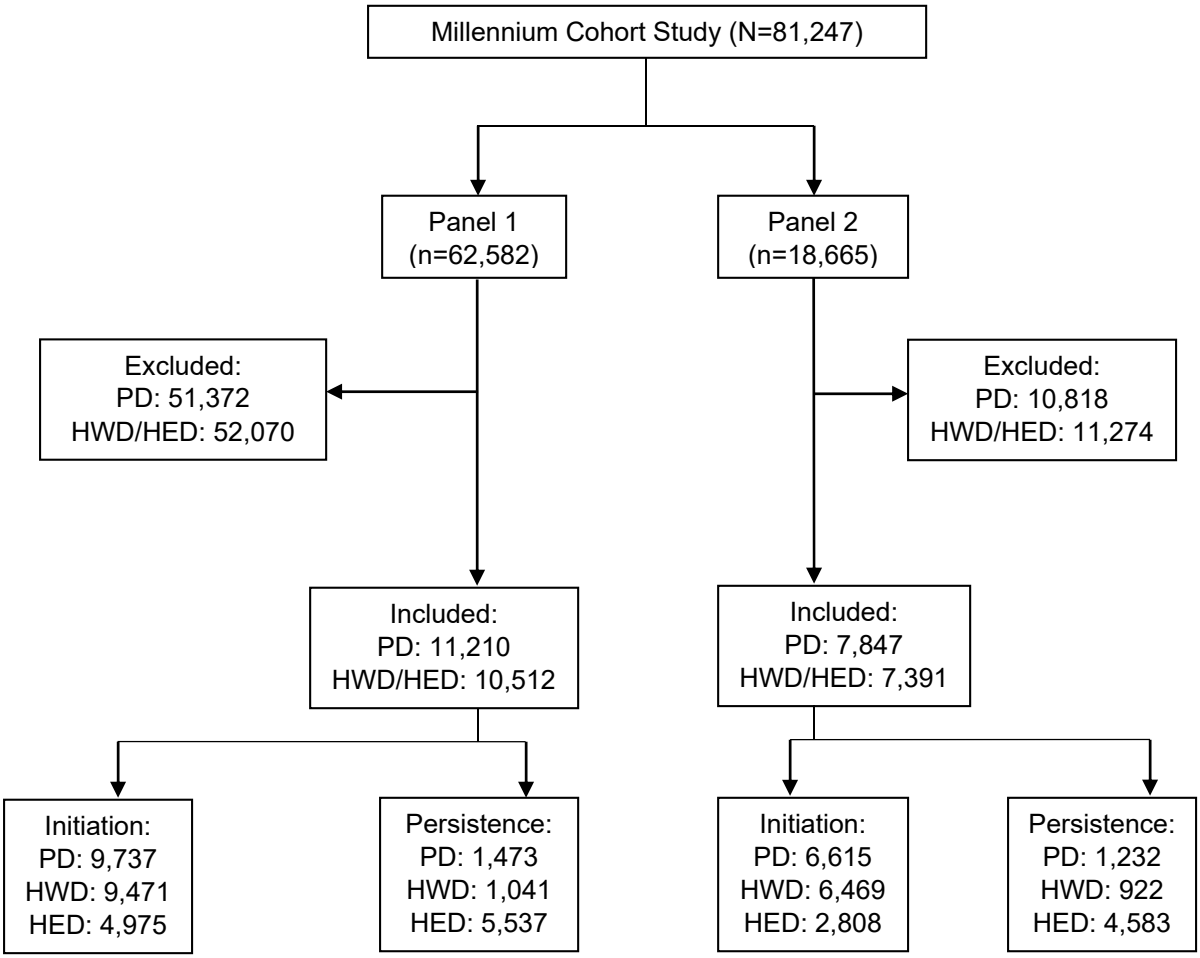
sample, 19,057 participants were included for the problem drinking variable (i.e., 11,210 participants in Panel 1; 7,847 participants in Panel 2) and 17,903 participants were included for the heavy weekly drinking and heavy episodic drinking variables (i.e., 10,512 participants in Panel 1; 7,391 participants in Panel 2; see Figure for the participant flow diagram). Participants were further subdivided by initiation and persistence based upon their baseline alcohol use for all three alcohol use outcomes. In addition, the multinomial logistic regression analyses used the recoded alcohol use risk categories and classified participants as being in the lowest risk, highest risk, or variable risk categories (see Tables 2, 3, and 4 for percentages of cases in each subgroup and risk category).

Statistically significant (p <.05) predictors changed depending on the subset of participants, the alcohol outcome variable, and the alcohol use risk category. Throughout the analyses, participants in the lowest risk category served as the reference group. Statistically significant predictor variables varied for differentiating the lowest risk versus highest risk categories and the lowest risk versus variable risk categories for all participant subgroups and alcohol use outcomes. However, there were many common significant predictor variables found for differentiating both the lowest risk versus highest risk categories and the lowest risk versus variable risk categories. Of particular note, occupation status as a healthcare professional was not a statistically significant predictor for any alcohol outcome in any participant subgroup.

Problem Drinking

Initiation subgroup.

The Panel 1 initiation subgroup contained 9,737 participants (see Table 5 for full list of significant predictors). Common predictors of problem drinking between participants



Note. PD = Problem drinking; HWD = Heavy weekly drinking; HED = Heavy episodic drinking

Figure: Participant flow diagram

Table 2: Number and percentages of participants in the lowest risk, highest risk, and variable risk categories for problem drinking

	Panel 1				Panel 2			
	Initiation		Persistence		Initiation		Persistence	
Alcohol risk level	n[a]	%	n[b]	%	n[c]	%	n[d]	%
Lowest risk	8,578	88.10	638	43.31	5,571	84.22	577	46.83
Highest risk	58	0.60	166	11.27	259	3.92	255	20.70
Variable risk	1,101	11.31	669	45.42	785	11.87	400	32.47

[a]Panel 1 initiation n=9,737. [b]Panel 1 persistence n=1,473. [c]Panel 2 initiation n=6,615. [d]Panel 2 persistence n=1,232

Table 3: Number and percentages of participants in the lowest risk, highest risk, and variable risk categories for heavy weekly drinking

	Panel 1				Panel 2			
	Initiation		Persistence		Initiation		Persistence	
Alcohol risk level	n[a]	%	n[b]	%	n[c]	%	n[d]	%
Lowest risk	8,201	86.59	385	36.98	5,599	86.55	531	57.78
Highest risk	114	1.20	219	21.04	162	2.50	140	15.03
Variable risk	1,156	12.21	437	42.98	708	10.94	251	27.22

[a]Panel 1 initiation n=9,471. [b]Panel 1 persistence n=1,041. [c]Panel 2 initiation n=6,469. [d]Panel 2 persistence n=922

Table 4: Number and percentages of participants in the lowest risk, highest risk, and variable risk categories for heavy episodic drinking

	Panel 1				Panel 2			
	Initiation		Persistence		Initiation		Persistence	
Alcohol risk level	n[a]	%	n[b]	%	n[c]	%	n[d]	%
Lowest risk	3,176	63.84	676	12.21	1,631	58.08	749	16.34
Highest risk	280	5.63	2,405	43.44	424	15.10	2,405	52.48
Variable risk	1,519	30.53	2,456	44.36	753	26.82	1,429	31.18

[a]Panel 1 initiation n=4,975. [b]Panel 1 persistence n=5,537. [c]Panel 2 initiation n=2,808. [d]Panel 2 persistence n=4,583

Table 5: Significant multinomial logistic regression outcomes for problem drinking among the 9,737 Panel 1 initiation subgroup participants

	Highest risk category					Variable risk category				
Variables	B	SE	OR	95% C.I.	*p*	B	SE	OR	95% C.I.	*p*
Male	.71	.34	2.04	1.05 – 3.96	.036	.42	.08	1.52	1.30 – 1.79	<.001
Negative PTSD	-1.27	.33	.28	.15 - .53	<.001	-0.77	.09	.47	.39 - .56	<.001
No tobacco use	-1.27	.28	.28	.16 - .49	<.001	-0.47	.07	.63	.54 - .72	<.001
Guard/Reserve	.83	.35	2.30	1.16 – 4.55	.017	.31	.09	1.36	1.15 – 1.61	<.001
Married						-0.22	.10	.80	.66 - .97	.024
Birth year: Pre-1960						-0.97	.19	.38	.26 - .55	<.001
Birth year: 1960-1969						-0.80	.18	.45	.32 - .64	<.001
Army						.43	.09	1.56	1.31 – 1.82	<.001
Navy						.40	.10	1.49	1.23 – 1.81	<.001
Separated from service						-0.43	.08	.65	.55 - .76	<.001

Note: Reference group is the lowest risk participant category.

in the highest risk and variable risk categories included PTSD screening status, gender, active duty status, and tobacco use. Participants were more likely to endorse problem drinking throughout follow-up waves if they screened positive for PTSD, were male, belonged to the National Guard/Reserve, and used tobacco.

The Panel 2 initiation subgroup contained 6,615 participants (see Table 6 for full list of significant predictors). Common predictors of problem drinking between participants in the highest risk and variable risk categories included PTSD screening status, separation from military service, birth year, gender, active duty status, being in the Army, being in the Navy, and tobacco use. Participants were more likely to endorse problem drinking throughout follow-up waves if they screened positive for PTSD, had separated from military service during follow-up, were younger (i.e., born in or after 1980), were male, belonged to the National Guard/Reserve, were in the Army or Navy, and used tobacco.

Collectively, these results suggest that, for participants who did not endorse problem drinking at baseline, screening positive for PTSD, being male, belonging to the National Guard/Reserve, and using tobacco influenced subsequent endorsement of problem drinking during follow periods regardless of enrollment panel.

Persistence subgroup.

The Panel 1 persistence subgroup contained 1,473 participants (see Table 7 for full list of significant predictors). Common predictors for problem drinking between participants in the highest risk and variable risk categories included separation from military service, gender, and active duty status. Participants were more likely to endorse problem drinking throughout follow-up waves if they had separated from military service during follow-up, were male, and belonged to the National Guard/Reserve.

Table 6: Significant multinomial logistic regression outcomes for problem drinking among the 6,615 Panel 2 initiation subgroup participants

	Highest risk category					Variable risk category				
Variables	B	SE	OR	95% C.I.	*p*	B	SE	OR	95% C.I.	*p*
Male	.84	.16	2.32	1.71 – 3.14	<.001	.33	.09	1.39	1.17 – 1.65	<.001
Negative PTSD	-0.75	.15	.47	.35 - .64	<.001	-0.43	.10	.65	.53 - .79	<.001
No tobacco use	-0.64	.14	.53	.40 - .69	<.001	-0.54	.08	.58	.50 - .69	<.001
Guard/Reserve	.67	.16	1.96	1.44 – 2.67	<.001	.22	.10	1.25	1.03 – 1.52	.022
Birth year: Pre-1960						-2.07	.73	.13	.03 - .52	.004
Birth year: 1960-1969	-1.00	.32	.37	.20 - .68	.002	-0.55	.17	.58	.41 - .81	.001
Birth year: 1970-1979	-0.60	.17	.55	.40 - .76	<.001	-0.34	.10	.71	.59 - .86	<.001
Deployed without combat						-0.29	.11	.75	.60 - .92	.007
Army	.92	.20	2.52	1.71 – 3.70	<.001	.78	.11	2.19	1.77 – 2.70	<.001
Navy	.65	.24	1.91	1.19 – 3.07	.007	.63	.13	1.87	1.45 – 2.41	<.001
Separated from service	-0.80	.14	.45	.34 - .60	<.001	-0.31	.09	.73	.62 - .87	<.001
Enlisted status	.76	.32	2.14	1.15 – 3.96	.016					

Note: Reference group is the lowest risk participant category.

Table 7: Significant multinomial logistic regression outcomes for problem drinking among the 1,473 Panel 1 persistence subgroup participants

	Highest risk category					Variable risk category				
Variables	B	SE	OR	95% C.I.	*p*	B	SE	OR	95% C.I.	*p*
Male	.84	.25	2.31	1.41 – 3.7	.001	.54	.15	1.71	1.29 – 2.28	<.001
Guard/Reserve	.82	.24	2.27	1.42 – 3.63	.001	.51	.15	1.66	1.24 – 2.21	.001
Never married	.61	.29	1.85	1.04 – 3.29	.037					
Separated from service	-0.72	.22	.49	.32 - .76	.001	-0.32	.15	.73	.55 - .97	.029

Note: Reference group is the lowest risk participant category

The Panel 2 persistence subgroup contained 1,232 participants (see Table 8 for full list of significant predictors). Common predictors of problem drinking between participants in the highest risk and variable risk categories included active duty status, being in the Navy, and tobacco use. Participants were more likely to endorse problem drinking throughout follow-ups if they belonged to the National Guard/Reserve, were in the Navy, and used tobacco. Taken together, these results suggest that, for participants who endorsed problem drinking at baseline, belonging to the National Guard/Reserve influenced subsequent endorsement of problem drinking during follow-up periods regardless of enrollment panel.

Heavy Weekly Drinking

Initiation subgroup.

The Panel 1 initiation subgroup contained 9,471 participants (see Table 9 for full list of significant predictors). Common predictors of heavy weekly drinking between participants in the highest risk and variable risk categories included separation from military service, being in the Army, and tobacco use. Participants were more likely to endorse heavy weekly drinking throughout follow-up waves if they had separated from military service during follow-up, were in the Army, and used tobacco.

The Panel 2 initiation subgroup contained 6,469 participants (see Table 10 for full list of significant predictors). Common predictors of heavy weekly drinking between participants in the highest risk and variable risk categories included birth year, deployment status, being in the Army and tobacco use. Participants were more likely to endorse heavy weekly drinking throughout follow-up waves if they were younger (i.e., born in or after 1980), had been deployed with combat exposure, in the Army and used

Table 8: Significant multinomial logistic regression outcomes for problem drinking among the 1,232 Panel 2 persistence subgroup participants

	Highest risk category					Variable risk category				
Variables	B	SE	OR	95% C.I.	*p*	B	SE	OR	95% C.I.	*p*
Male	.46	.18	1.59	1.11 – 2.27	.012					
Negative PTSD										
Guard/Reserve	.63	.20	1.88	1.27 – 2.80	.002	.50	.17	1.65	1.18 – 2.32	.004
No tobacco use	-0.36	.17	.70	.50 - .98	.038	-0.30	.14	.74	.56 - .98	.038
Deployed without combat	-0.59	.22	.55	.36 - .86	.008					
Separated from service	-0.75	.18	.47	.33 - .67	<.001					
Enlisted status	.90	.35	2.45	1.23 – 4.86	.010					
Army	.72	.25	2.05	1.25 – 3.36	.004					
Navy	.72	.29	2.06	1.17 – 3.64	.012	.45	.21	1.56	1.03 – 2.36	.036

Note: Reference group is the lowest risk participant category.

Table 9: Significant multinomial logistic regression outcomes for heavy weekly drinking among the 9,471 Panel 1 initiation subgroup participants

	Highest risk category					Variable risk category				
Variables	B	SE	OR	95% C.I.	*p*	B	SE	OR	95% C.I.	*p*
Male						-0.18	.08	.84	.72 - .97	.016
Negative PTSD						-0.40	.10	.67	.56 - .81	<.001
No tobacco use	-1.03	.21	.36	.24 - .53	<.001	-0.64	.07	.53	.46 - .61	<.001
Guard/Reserve						.23	.08	1.26	1.07 – 1.49	.005
Married						-0.20	.09	.82	.68 - .99	.034
Birth year: Pre-1960						-0.51	.19	.60	.42 - .86	.006
Birth year: 1960-1969						-0.42	.18	.66	.47 - .93	.016
Not deployed						-0.20	.08	.92	.70 - .96	.015
Army	.55	.25	1.74	1.06 – 2.86	.030	.23	.08	1.26	1.08 – 1.48	.003
Navy						.20	.09	1.22	1.02 – 1.47	.034
Separated from service	-0.55	.24	.58	.36 - .92	.020	-0.23	.08	.80	.68 - .93	.005
Race: Black						-0.52	.15	.60	.45 - .80	.001

Note: Reference group is the lowest risk participant category.

Table 10: Significant multinomial logistic regression outcomes for heavy weekly drinking among the 6,469 Panel 2 initiation subgroup participants

	Highest risk category					Variable risk category				
Variables	B	SE	OR	95% C.I.	*p*	B	SE	OR	95% C.I.	*p*
Negative PTSD						-0.25	.11	.78	.63 - .97	.024
No tobacco use	-0.95	.17	.39	.28 - .55	<.001	-0.63	.09	.54	.45 - .63	<.001
Guard/Reserve	.57	.20	1.77	1.19 – 2.62	.005					
Birth year: 1960-1969						-0.44	.18	.65	.45 - .92	.016
Birth year: 1970-1979	-0.43	.20	.65	.44 - .97	.034	-0.27	.10	.77	.63 - .93	.008
Not deployed	-0.49	.22	.62	.40 - .94	.025	-0.30	.11	.74	.60 - .92	.006
Separated from service	-0.71	.18	.49	.35 - .69	<.001					
Race: White						.23	.12	1.26	1.00 – 1.59	.049
Associate's degree or less	-0.57	.27	.57	.34 - .96	.033					
Army	.57	.22	1.77	1.14 – 2.75	.011	.24	.10	1.27	1.04 – 1.56	.020

Note: Reference group is the lowest risk participant category.

tobacco.

Collectively, these results suggest that, for participants who did not endorse heavy weekly drinking at baseline, being in the Army and using tobacco influenced subsequent endorsement of heavy weekly drinking during follow-up periods regardless of enrollment panel.

Persistence subgroup.

The Panel 1 persistence subgroup contained 1,041 participants (see Table 11 for full list of significant predictors). The sole common predictor of heavy weekly drinking between participants in the highest risk and variable risk categories included birth year such that those participants who were older (i.e., born in or before 1969) were more likely to endorse heavy weekly drinking at follow-up.

The Panel 2 persistence subgroup contained 922 participants (see Table 12 for full list of significant predictors). The sole common predictor of heavy weekly drinking between participants in the highest risk and variable risk categories was being in the Navy.

Heavy Episodic Drinking

Initiation subgroup.

The Panel 1 initiation subgroup contained 4,975 participants (see Table 13 for full list of significant predictors). Common predictors of heavy episodic drinking between participants in the highest risk and variable risk categories included experiencing combat deployment, birth year, race, gender, being in the Army, and tobacco use. Participants were more likely to endorse heavy episodic drinking throughout follow-up waves if they were deployed and experienced combat, were younger (i.e., born in or after 1980),

Table 11: Significant multinomial logistic regression outcomes for heavy weekly drinking among the 1,041 Panel 1 persistence subgroup participants

	Highest risk category					Variable risk category				
Variables	B	SE	OR	95% C.I.	*p*	B	SE	OR	95% C.I.	*p*
Birth year: Pre-1960	2.16	.53	8.67	3.07 – 24.43	<.001	1.08	.36	2.96	1.46 – 5.99	.003
Birth year: 1960-1969	1.45	.50	4.25	1.60 – 11.31	.004					
Not deployed	.50	.24	1.65	1.02 – 2.66	.040					
Deployed without combat						-0.48	.20	.62	.42 - .92	.017

Note: Reference group is the lowest risk participant category.

Table 12: Significant multinomial logistic regression outcomes for heavy weekly drinking among the 922 Panel 2 persistence subgroup participants

	Highest risk category					Variable risk category				
Variables	B	SE	OR	95% C.I.	*p*	B	SE	OR	95% C.I.	*p*
Male	.71	.24	2.04	1.28 – 3.26	.003					
Army						.47	.22	1.59	1.04 – 2.45	.033
Navy	.80	.32	2.22	1.19 – 4.13	.012	.61	.26	1.84	1.10 – 3.05	.020

Note: Reference group is the lowest risk participant category.

Table 13: Significant multinomial logistic regression outcomes for heavy episodic drinking among the 4,975 Panel 1 initiation subgroup participants

	Highest risk category					Variable risk category				
Variables	B	SE	OR	95% C.I.	*p*	B	SE	OR	95% C.I.	*p*
Male	1.33	.18	3.80	2.68 – 5.38	<.001	.50	.08	1.65	1.43 – 1.92	<.001
Negative PTSD						-0.37	.11	.70	.57 - .87	.001
No tobacco use	-0.67	.16	.51	.37 - .70	<.001	-0.41	.09	.66	.56 - .79	<.001
Birth year: Pre-1960	-3.01	.40	.05	.02 - .11	<.001	-1.67	.29	.19	.11 - .34	<.001
Birth year: 1960-1969	-2.41	.38	.09	.04 - .19	<.001	-1.16	.29	.31	.18 - .55	<.001
Birth year: 1970-1979	-1.77	.38	.17	.08 - .36	<.001	-0.72	.29	.49	.28 - .85	.012
Not deployed	-0.43	.17	.65	.47 - .90	.009	-0.37	.09	.69	.59 - .82	<.001
Army	.58	.16	1.79	1.31 – 2.46	<.001	.17	.08	1.19	1.02 – 1.39	.031
Navy						.22	.09	1.25	1.04 – 1.49	.017
Enlisted status	.66	.20	1.93	1.32 – 2.85	.001					
Race: Black	-0.67	.28	.52	.30 - .89	.016	-0.35	.13	.70	.54 - .91	.007
Associate's degree or less						.34	.09	1.40	1.17 – 1.69	<.001

Note: Reference group is the lowest risk participant category.

identified as a race besides Caucasian or Black, were male, and used tobacco.

The Panel 2 initiation subgroup contained 2,808 participants (see Table 14 for full list of significant predictors). Common predictors of heavy episodic drinking between participants in the highest risk and variable risk categories included birth year, race, gender, deployment status, and tobacco use. Participants were more likely to endorse heavy episodic drinking throughout follow-up waves if they were younger (i.e., born in or after 1980), identified as a race other than Caucasian or Black, were male, had deployed with combat exposure, and used tobacco.

Together, these results suggest that, for participants who did not endorse heavy episodic drinking at baseline, being younger in age, identifying as a race other than Caucasian or Black, being male, deploying with combat exposure, and using tobacco influenced subsequent endorsement of heavy episodic drinking during follow periods regardless of enrollment panel.

Persistence subgroup.

The Panel 1 persistence subgroup contained 5,537 participants (see Table 15 for full list of significant predictors). Common predictors of heavy episodic drinking between participants in the highest risk and variable risk categories included education, birth year, gender, active duty status, and tobacco use. Participants were more likely to endorse heavy episodic drinking throughout follow-up waves if they had an associate's degree or less, were younger (i.e., born in or after 1980), were male, belonged to the National Guard/Reserve, and used tobacco.

The Panel 2 persistence subgroup contained 4,583 participants (see Table 16 for full

Table 14: Significant multinomial logistic regression outcomes for heavy episodic drinking among the 2,808 Panel 2 initiation subgroup participants

	Highest risk category					Variable risk category				
Variables	B	SE	OR	95% C.I.	*p*	B	SE	OR	95% C.I.	*p*
Male	.88	.13	2.42	1.88 – 3.10	<.001	.38	.10	1.46	1.21 – 1.78	<.001
No tobacco use	-0.71	.13	.49	.38 - .63	<.001	-0.37	.11	.69	.56 - .86	.001
Birth year: Pre-1960	-2.15	.62	.12	.03 - .39	.001	-2.51	.54	.08	.03 - .23	<.001
Birth year: 1960-1969	-1.48	.24	.23	.14 - .37	<.001	-0.94	.17	.39	.28 - .55	<.001
Birth year: 1970-1979	-0.88	.15	.41	.31 - .55	<.001	-0.51	.11	.60	.48 - .75	<.001
Never married	.62	.26	1.85	1.10 – 3.10	.020					
Not deployed	-0.37	.15	.69	.51 - .93	.014	-0.40	.12	.67	.53 - .84	.001
Army	.59	.15	1.80	1.34 – 2.40	<.001					
Navy	.45	.19	1.56	1.09 – 2.25	.016					
Race: Black	-0.85	.24	.43	.27 - .68	<.001	-0.56	.18	.57	.41 - .81	.001

Note: Reference group is the lowest risk participant category.

Table 15: Significant multinomial logistic regression outcomes for heavy episodic drinking among the 5,537 Panel 1 persistence subgroup participants

	Highest risk category					Variable risk category				
Variables	B	SE	OR	95% C.I.	*p*	B	SE	OR	95% C.I.	*p*
Male	1.27	.11	3.57	2.87 – 4.45	<.001	.59	.11	1.81	1.47 – 2.22	<.001
No tobacco use	-0.72	.11	.49	.39 - .60	<.001	-0.49	.11	.61	.50 - .75	<.001
Reserve/Guard	.53	.12	1.69	1.34 – 2.13	<.001	.35	.12	1.42	1.13 – 1.78	.003
Birth year: Pre-1960	-0.69	.29	.50	.28 - .89	.018	-0.66	.29	.52	.29 - .90	.020
Birth year: 1960-1969						-0.59	.27	.55	.32 - .94	.029
Associate's degree or less	.36	.13	1.44	1.12 – 1.85	.005	.36	.13	1.43	1.12 – 1.84	.004
Navy	.27	.13	1.31	1.03 – 1.68	.030					

Note: Reference group is the lowest risk participant category.

Table 16: Significant multinomial logistic regression outcomes for heavy episodic drinking among the 4,583 Panel 2 persistence subgroup participants

	Highest risk category					Variable risk category				
Variables	B	SE	OR	95% C.I.	*p*	B	SE	OR	95% C.I.	*p*
Male	1.15	.10	3.15	2.62 – 3.80	<.001	.46	.10	1.58	1.30 – 1.91	<.001
No tobacco use	-0.49	.09	.61	.51 - .73	<.001	-0.22	.10	.80	.67 - .97	.023
Guard/Reserve	.44	.11	1.55	1.24 – 1.93	<.001					
Birth year: Pre-1960	-1.76	.47	.17	.07 - .43	<.001	-1.18	.51	.31	.11 - .83	.020
Birth year: 1960-1969	-1.12	.20	.33	.22 - .48	<.001	-0.51	.20	.60	.41 - .89	.011
Birth year: 1970-1979	-0.47	.11	.63	.51 - .77	<.001					
Not deployed	-0.31	.11	.73	.59 - .92	.007					
Army	.26	.11	1.29	1.05 – 1.59	.017					
Navy	.57	.13	1.77	1.36 – 2.29	<.001					
Race: White	.34	.12	1.40	1.11 – 1.77	.005					

Note: Reference group is the lowest risk participant category.

list of significant predictors). Common predictors of heavy episodic drinking between participants in the highest risk and variable risk categories included birth year, gender, and tobacco use. Participants were more likely to endorse heavy episodic drinking throughout follow-up waves if they were younger (i.e., born in or after 1980), were male, and used tobacco.

These results suggest that, for participants who endorsed heavy episodic drinking at baseline, being younger in age and using tobacco influenced subsequent endorsement of heavy episodic drinking during follow periods regardless of enrollment panel.

Sample Selection Analyses

The use of multinomial logistic regression resulted in list-wise deletion of participants for each of the three alcohol use outcome variables. Initially, Panel 1 included 62,582 participants; however, after excluding those participants with incomplete data for all follow-up waves, the primary analyses included 11,210 participants for the problem drinking outcome variable and 10,512 participants for both the heavy weekly drinking and heavy episodic drinking variables. Similarly, Panel 2 initially included 18,665 participants, and ultimately included 7,847 participants for the problem drinking outcome variable and 7,391 participants for both the heavy weekly drinking and heavy episodic drinking variables after excluding those participants with incomplete data.

Selection analyses explored whether predictor variables could predict inclusion in or exclusion from the primary analyses. A cutoff value of $p < .25$ was used to identify predictor variables from the primary analyses that would be retained in the selection analyses. Once these predictors were identified and retained, Cox and Snell R^2 values derived from binary logistic regression models were identified to assess whether

predictor variables predicted participant inclusion in or exclusion from the primary analyses (Cox & Snell, 1989). It was found that all predictor variables met this criterion in at least one participant subgroup for each alcohol use outcome; as such, all predictor variables were included in the selection analyses.

Binary logistic regression models were run using an outcome variable of being included in or excluded from the primary analyses for each alcohol use outcome variable. Cox and Snell R^2 values varied by participant subgroup and alcohol use outcome. Participants in the Panel 1 initiation subgroup had the smallest range of Cox and Snell R^2 values (.08 to .10), while participants in the Panel 2 persistence subgroup had the largest range of Cox and Snell R^2 values (.18 to .27). These analyses suggest that the predictor variables included in the logistic models together accounted for between 8.32% and 27.31% of the explanation for inclusion in the primary analyses. Interestingly, the binary logistic regression models suggested that participants screening positive for PTSD were consistently less likely to be included in the primary analyses across every participant subgroup and alcohol use outcome variable more than any other predictor variable. In fact, when holding the other predictor variables constant and depending on the alcohol use outcome variable, participants who screened positive for PTSD were 65.56% to 97.62% less likely to be included in the primary analyses. This suggests that participants with incomplete follow-up data (who were subsequently excluded from the primary analyses) had higher rates of screening positive for PTSD, resulting in the attenuation of the true effect of screening positive for PTSD in the primary analyses. This bias would lead the results to be a more conservative estimate of the effect of PTSD on alcohol use outcomes.

In addition, univariate analyses assessed whether predictor variables interacted with having a healthcare occupation, screening positive for PTSD, and/or enlisted status when predicting inclusion in the primary analyses as these were the three primary variables of interest with regards to alcohol use outcomes. Univariate logistic regression analyses revealed that there were interaction effects between multiple predictors and occupation as a healthcare professional, having a positive PTSD screening, and/or with enlisted status; however, the number and strength of these interactions varied by participant subgroup and alcohol use outcome variable.

The most common interaction occurred between birth year category and PTSD status. These significant interactions were present in all three alcohol use outcomes for participants in Panel 1 such that younger participants (i.e., born in or after 1980) who screened positive for PTSD were 72.79% to 88.90% less likely to be included in the primary analyses than those who were older and/or screened negative for PTSD. Interestingly, among Panel 2 participants, the interaction between birth year category and PTSD status was only significant for the problem drinking outcome by which younger participants screening positive for PTSD were 85.97% less likely to be included in the primary analyses than older participants and/or participants screening negative for PTSD. Among Panel 2 participants, analyses found that significant interactions between birth year category and occupation as a healthcare professional were present for the heavy weekly drinking and heavy episodic drinking outcomes such that younger participants who identified as healthcare professionals were 84.35% to 88.70% less likely to be included in these analyses than those who were older and/or who did not work as a healthcare provider. Few interaction effects were found between predictor variables and

enlisted status. The most salient interactions were between holding officer status and being in the Navy such that Panel 1 participants with these characteristics were 84.39% less likely to be included in the heavy weekly drinking analyses and 94.35% less likely to be included in the problem drinking analyses as compared to enlisted personnel in the Army.

Overall, these significant interactions may suggest that the results of the primary analyses are biased toward participants who are older, especially among those who screen positive for PTSD. These interaction effects suggest that, while some predictor variables may have had some predictive utility regarding whether participants would be included in the primary analyses, this was not a constant effect and was influenced for some variables (in particular, birth year category) by the presence of having a healthcare occupation, screening positive for PTSD, and/or being enlisted status.

CHAPTER IV: DISCUSSION

Interpretation of Findings

Military healthcare professionals face many of the same military service-related stressors as service members in non-healthcare roles, yet are frequently underrepresented in research and clinical settings. In fact, in some ways they may experience more stressors because their role makes them more likely to come in contact with frequent mass combat injuries and casualties. This study examined the influence of serving in the armed forces as a healthcare professional, screening positive for PTSD, and being of enlisted status on problem drinking, heavy weekly drinking, and heavy episodic drinking across two unique participant enrollment panels with distinct levels of baseline alcohol use. Participants were followed for up to nine years following baseline, which enabled the analyses to explore the effect that time may have played on alcohol use outcomes.

The study results indicate that occupation as a military healthcare professional did not enhance the risk for problem drinking, heavy weekly drinking, or heavy episodic drinking among service members enrolled in the Millennium Cohort Study. This is surprising given the literature suggesting that healthcare professionals in general are at risk for alcohol misuse (Bennett & O'Donovan, 2001; Brooks et al., 2011; Gibbons et al., 2012). In addition, it does not appear that risk factors for alcohol misuse stemming from being a healthcare professional and from serving in the military are cumulative and enhance one's risk for problem drinking, heavy weekly drinking, or heavy episodic drinking. Instead, it appears as though aspects inherent to being a member of the military (e.g., deployments, combat exposure, stressful work environment) play more of a role in alcohol misuse than one's specific military occupation (Gutierrez et al., 2006; Jacobson et

al., 2008; Schumm & Chard, 2012). This information may be beneficial to military leadership as it suggests that occupation-specific interventions targeting alcohol misuse may be unnecessary, and prevention and intervention efforts can be designed and implemented for all service members regardless of occupation.

While the results of this study did not find an effect of occupation on alcohol use outcomes, it found that screening positive for PTSD was often associated with problem drinking, heavy weekly drinking, and heavy episodic drinking across enrollment panels and initiation/persistence groups. This result is consistent with the ample literature identifying that PTSD tends to co-occur with alcohol abuse among military populations (Bohnert et al., 2013; Creamer et al., 2001; Hawkins et al., 2010; Jacobsen et al., 2001; Jacobson et al., 2008; Jakupcak et al., 2010; Kessler et al., 1995). It is important to note that PTSD was only assessed in the parent study via the PCL-C, which is only intended for use as a screening tool and cannot alone provide a diagnosis. Thus, it is possible, and in fact quite likely, that not every participant in this study who screened positive for PTSD would have met full diagnostic criteria. However, a positive screening for PTSD co-occurred with alcohol use outcomes often enough in this study (combined with the relevant literature also noting an association between PTSD and alcohol abuse) to suggest that military leadership and those providers working with military personnel and veterans should regularly screen for PTSD and provide alcohol use information, screening, and intervention for those with PTSD symptoms. In addition, post-deployment debriefing could include information related to the co-occurrence of PTSD and alcohol use symptoms to help educate service members on how to recognize the symptoms and seek appropriate treatment resources.

Finally, this study hypothesized that military service members holding an enlisted status would be at greater risk for alcohol misuse than those holding officer status. This outcome was not consistently observed in our sample, save for some moderate effects related to problem drinking in the Panel 2 initiation and persistence subsamples and on heavy episodic drinking among the Panel 1 initiation subsample. This lack of effect is surprising given the literature suggesting that enlisted service members tend to be at a greater risk for alcohol misuse than officers, and it is unclear why this effect was not observed in this sample (Bohnert et al., 2013; Burnett-Zeigler et al., 2011; Jacobson et al., 2008; Milliken et al., 2007). It is possible that this effect was observed for problem drinking among our Panel 2 participants as participants in that enrollment group tended to be younger and may take more risks associated with experiencing negative outcomes from alcohol use (Ames et al., 2007; Jacobson et al., 2008; Taft et al., 2007). Although having enlisted status did not play as large of a role on alcohol misuse as variables such as positive screening for PTSD, it is still recommended that military leadership focus screening and interventions for alcohol misuse (primarily on the negative consequences of alcohol misuse) on enlisted personnel to increase these members' awareness of possible outcomes of risky alcohol use. Furthermore, other variables that may be associated with holding enlisted rank (e.g., using tobacco, combat exposure, younger in age) have been found in the literature to be associated with alcohol misuse which may highlight the need for interventions targeting this population (Bohnert et al., 2013; Burnett-Zeigler et al., 2011; Jacobson et al., 2008; Milliken et al., 2007).

These results do not appear to raise the need for alcohol misuse interventions targeted at military healthcare professionals. However, they do continue to highlight the

need for alcohol use screening and intervention efforts for the groups identified as having the highest risk for alcohol misuse concerns including service members screening positive for PTSD, who use tobacco, who are younger, male, in the Army, and those serving in the National Guard/Reserve. As the literature has suggested (Calhoun et al., 2015; Felker, Hawkins, Dobie, Gutierrez, & McFall, 2008; Fernandez, Hartman, & Olshaker, 2006), it is quite likely that military healthcare professionals will be on the front lines of addressing alcohol use concerns with these service members. Therefore, focusing on training healthcare providers on evidence-based screening and intervention approaches for alcohol use could make alcohol use treatment much more available to service members. Having military healthcare professionals become more aware of alcohol use guidelines could better enable them to identify service members presenting as at-risk for alcohol misuse, and could enable these providers to implement effective brief interventions as a preliminary source of treatment prior to referring service members to more specialized alcohol use treatment. Taking this approach may ensure that service members are having their alcohol misuse addressed in a setting that may carry less stigma and potential career repercussions versus only having alcohol use addressed in a mental health or substance use treatment setting.

In addition, the preponderance of research suggesting common risk factors for alcohol use among military service members (e.g., males, younger, PTSD diagnosis, combat exposure) provides the opportunity for medical personnel and military leadership to create brief intervention and educational opportunities related to alcohol use that could potentially be delivered to large groups of service members who meet these criteria. Incorporating alcohol use education as part of a unit's debriefing process following

deployment or as part of routine medical clearance could help service members learn about problematic alcohol use and be more likely to either change their drinking or seek assistance. Incorporating these efforts as routine interventions also may help reduce the stigma surrounding addressing alcohol use and may lead to improved troop readiness and overall functioning. Such an approach would also be consistent with the public health approach to alcohol and other drug problems recently advocated by the Surgeon General (Substance Abuse and Mental Health Services Administration & Office of the Surgeon General, 2016).

Strengths and Limitations

This study has important strengths. This is, to the author's knowledge, the first study to explore alcohol misuse specifically among healthcare professionals involved with operations supporting OEF/OIF. This population has been chronically under-represented in the literature despite potentially being at-risk for alcohol misuse. Having a better understanding of any unique aspects inherent to serving as a military healthcare professional could provide military leadership with an improved ability to prevent and address any problem areas within this group. In addition, understanding the unique role that military healthcare professionals can play with regards to identifying and treating alcohol misuse among other service members may help military leadership leverage the abilities of healthcare professionals to work with various types of service members in order to improve overall unit health and readiness.

Another major strength is the use of the participants in the Millennium Cohort Study, which were drawn from all military service branches, represented the larger armed forces population (including over-sampling of women and National Guard/Reserve troops), and

provided up to nine years of follow-up data. Using these longitudinal data enabled the present study to separate participants into subgroups based on their alcohol use patterns in order to identify whether or not risk factors varied based on initial alcohol consumption, and resulted in very large sample sizes despite the number of participants excluded for having incomplete data. Having the ability to follow the same participants over the course of nearly a decade helped identify trends in changes in alcohol use and speculate what may have changed participants' alcohol use over time. The use of a prospective study may be particularly beneficial in substance use research as many studies asking for retrospective self-reports of alcohol misuse may be inaccurate (Dawson, 2003; Feunekes, van't Veer, van Staveren, & Kok, 1999; Heeb & Gmel, 2005; Jacobson et al., 2008). In addition, having the alcohol use measures embedded in a larger survey packet may have led to more reliable self-report data as the original MCS focuses on general health outcomes among military personnel rather than substance use in particular which still faces stigma among military populations (D'Onofrio & Degutis, 2002; Johnson, Woychek, Vaughan, & Seale, 2013; Saitz, 2005).

An additional strength is that this study explored multiple predictors of alcohol use outcomes rather than only exploring occupation, PTSD screening, and enlisted status as predictors. While occupation as a healthcare professional, positive screening for PTSD, and having enlisted status were the primary predictor variables of interest, including additional demographic and military-related variables helped clarify contributing factors of alcohol misuse. Relatedly, exploring multiple alcohol use outcomes provided a more comprehensive account of participants' alcohol use rather than only focusing on quantity or frequency of use. Including multiple predictor variables and alcohol use outcomes

produced results that were in line with much of the literature establishing personal characteristics associated with alcohol use among service members involved with OEF/OIF operations (Calhoun et al., 2015; Felker et al., 2008; Fernandez et al., 2006). While there were no major revelations related to variables associated with alcohol use, these outcomes provide more information about subgroups of OEF/OIF service members who may be considered at higher risk for alcohol misuse (i.e., those screening positive for PTSD, younger, combat exposure) and may help with future intervention planning.

One limitation to this study is that time was not included as a random variable across follow-up waves, and the analyses resulted in list-wise deletion and the exclusion of a substantial number of participants. Given the importance of separating the participants into subgroups by enrollment panel and baseline alcohol use, it was not possible to achieve a sufficient number of participants in each subgroup to explore the random influence of time on these subgroups using mixed modeling. The inclusion of time as a random variable may have helped clarify the influence that time played on risk factors for alcohol outcomes. While this issue was addressed by only including participants with completed data across all available time points and incorporated the effect of time as best as possible, the ability to use mixed modeling approaches would have allowed for the inclusion of participants with missing data to enhance the generalizability of the results. In addition, selection analyses suggested that our estimates of the effects of certain predictors (i.e., positive PTSD screening) may be attenuated by the fact that participants with these characteristics were excluded from the analyses. It is preferable to have a more conservative estimate of the effects rather than a more robust estimate as this leaves room for future studies to address these effects.

Another limitation was the manner in which alcohol use information was gathered among participants. Given that this study used data from a larger study, variables and data used for analyses were limited to what had been previously collected. It may have been beneficial to obtain alcohol use data over a longer period of time (i.e., longer than the seven days preceding survey completion) to obtain a more reliable estimate of alcohol use among this sample. This may have better enabled the participants to be split into baseline alcohol use groups more representative of their actual use rather than solely based on their use during the week prior to completing the survey. In addition, information related to prior experience with alcohol treatment services would have helped the groups to be divided into clinical and non-clinical samples, which may have influenced alcohol use over time. It is unknown, however, what effect this may have had on the role of occupation on alcohol use.

One final limitation is the inability to separate healthcare occupations into those providing direct clinical care versus those in more administrative or laboratory roles. Healthcare occupation was determined via self-reported endorsement of a set of occupation codes on the survey. These codes combined clinical and non-clinical healthcare occupations, and it was not feasible to separate them based on their occupational descriptions. Having more clearly defined healthcare occupation categories may help determine whether some specific occupations (i.e., those with direct clinical care) may be at risk for alcohol misuse and thus need additional preventative and intervention attention.

Future Directions

Unfortunately, it seems unlikely that combat deployments will cease occurring for

military personnel. Given this reality, it is vital that research continues to assess risk factors for alcohol misuse among military personnel of all occupations, ranks, backgrounds, and experiences. As the MCS is a longitudinal study, it is planned that additional participants will be added and followed over time. This presents the opportunity for future analyses that explore alcohol misuse among all occupations using a mixed modeling statistical approach to account for participants with incomplete data and to better explore the influence of time on alcohol misuse. While it is possible that these types of analyses will not find an effect of occupation on alcohol use, they may provide more information about other risk factors for alcohol misuse among military members and lead to more targeted screening and intervention approaches.

This study only focused on alcohol misuse among military healthcare professionals; however, literature on civilian healthcare providers has suggested that other substances (e.g., illicit drugs, prescription medications) may be abused by providers and may vary depending on the providers' specialty practice area (Bennett & O'Donovan, 2001; Brooks et al., 2011; Kenna & Wood, 2004). Future studies should explore the prevalence of misuse of other substances among military healthcare providers as this area has been understudied and could be an issue that influences patient care. Future studies can continue to focus on physical and mental health concerns prevalent among military healthcare professionals in order to identify any trends among this potentially vulnerable group. In addition, gaining a better understanding of coping skills utilized by military healthcare professionals may lead to a better approach for necessary interventions specifically for this population.

Finally, while the military has made efforts to assess for and prevent alcohol-related

issues among service members, it is clear that alcohol abuse remains a prevalent concern. As future studies continue to identify risk factors and more alcohol use prevention, screening, and intervention approaches are implemented within the military, studies will need to continually assess their utility and effectiveness to ensure troop readiness and health. Continuing to make mental health treatment a priority may help continue the trend of decreasing stigma in seeking necessary services. Educating members of the military about substance use, mental health, and physical health could also lead to a military that is healthier, more aware of warning signs of health issues, and more ready to successfully carry out their duties.

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