Associations between spouse and service member prescriptions for high-risk and long-term opioids: A dyadic study

Alicia C. Sparks [a,*], Sharmini Radakrishnan [a], Nida H. Corry [a], Doug McDonald [a], Kenneth Carlson [a], Carlos E. Carballo [b,c], Valerie Stander [b]

[a] Division of Health and Environment, Abt Associates, Rockville, MD, United States
[b] Deployment Health Research Department, Naval Health Research Center, San Diego, CA, United States
[c] Leidos, Reston, VA, United States

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ABSTRACT

Background: Estimates suggest approximately 2.4% of service members, and 15% of service members who have engaged in recent combat, report misusing pain relievers in the past year. This study explores the extent to which military spouses' obtainment of opioids is associated with their service member partners' obtainment of opioid prescriptions, in addition to other factors such as service member health, state prescribing patterns, and socio-demographic characteristics.
Methods: Data were drawn from the Millennium Cohort Family Study, a large, longitudinal survey of married spouses of service members from all service branches, and archival data analyzed from 2018 to 2020. The dependent variables were spouse long-term opioid therapy and spouse opioid prescriptions that pose a high risk of adverse outcomes.
Results: Seven percent of spouse and service member dyads met the criteria for high-risk opioid use, generally because they had purchased a prescription for a ≥90 Morphine Milligram Equivalents daily dose (76.7% for spouses, 72.8% for service members). Strong associations were found between spouse and service member opioid therapies (OR = 5.53 for long-term; OR = 2.20 for high-risk).
Conclusions: Findings suggest that reducing the number of long-term and high-risk opioid prescriptions to service members may subsequently reduce the number of similar prescriptions obtained by their spouses. Reducing the number of service members and spouses at risk for adverse events may prove to be effective in stemming the opioid epidemic and improve the overall health and safety of military spouses and thus, the readiness of the U.S. Armed Forces.

1. Introduction

Between 2018 and 2019, opioid-involved overdose deaths claimed roughly 48,000 lives in the United States (U.S.). (Scholl, Seth, Kariisa, Wilson, & Baldwin, 2018) Nearly 5% of adult civilians in the U.S. have reported misusing prescription pain relievers annually. (Substance Abuse and Mental Health Services Administration, 2016) There is also concern regarding opioid misuse in the U.S. military, although prior research indicates that this may be less prevalent than in the civilian population. Using data collected in 2015, one study estimated that about 2.4% of service members (SM) misused pain relievers annually, and 0.7% over-used opioids. (Meadows et al., 2018) Of particular concern is prescription drug misuse among combat veterans and those exposed to

operational stress. A study of Operation Enduring Freedom soldiers found that 15.1% of soldiers exposed to combat reported opioid use in the past month, of which 38.5% reported only mild pain. (Toblin, Quartana, Riviere, Walper, & Hoge, 2014)

In recent years, the Department of Defense (DoD) has implemented programs to reduce the prescribing of risky opioid prescriptions at military medical facilities. (United States and Congress, 2018) Such programs aim to protect all members of the military community with military healthcare coverage, including SMs and their spouses. However, little is known about how the opioid epidemic has impacted military family members, who may be at heightened risk due to stressors related to military life (e.g., family separation due to deployment patterns, spouse responsibility for children, injury or disability) and/or

exposure to the prescription drug use of a family member in the aftermath of military occupational exposures/injuries.

Living in the same house as someone with an opioid prescription is associated with increased likelihood of subsequently obtaining one's own opioid prescription. (Seamans et al., 2018; Shei et al., 2015) One study found that children under 10 years old who presented to emergency rooms for opioid overdose were more likely to have a mother who had been prescribed opioids. (Finkelstein et al., 2017) A 2019 study found a dose–response relationship between the amount of opioids dispensed to family members and the likelihood of overdose among individuals receiving no opioid prescription themselves. (Khan, Bateman, Landon, & Gagne, 2019) While there has been research on the relationship between opioid use among families, there is little focus on how opioid use and misuse among spouses is associated with their partners' use. Existing research on substance misuse in couples is primarily limited to alcohol and illicit drugs. (Cavacuiti, 2004; Simmons, 2006) The alcohol literature has focused on interaction patterns in relationships where only one partner has an alcohol use disorder, while research on heroin use in couples generally addresses how partners collude to obtain and use illegal drugs in order to avoid withdrawal sickness. (Simmons & Singer, 2006) Such research provides a basis for understanding substance use in the context of relationship dynamics, but opioid misuse among couples, particularly military couples, has not been directly studied.

In addition to family context, the risk of opioid misuse increases with greater availability of or exposure to opioids in the community. Indicators of opioid misuse (e.g., admission to substance use treatment, overdose deaths) have closely tracked with geographic increases in opioid prescribing and sales in civilian populations. (Guy et al., 2017; Mack, Jones, & Paulozzi, 2013) However, the military is highly mobile and the DoD directs movement from location to location, which may change the nature of this association.

A previous study of military spouses participating in the Millennium Cohort Family Study (Family Study) found that nearly half (47.6%) received at least one opioid prescription during a two-year observation window, and 8.5% received an opioid prescription that posed risk to their health. (McDonald et al., 2020) The current study builds upon these findings by exploring the extent to which patterns of spouses' receipt of high-risk opioid prescriptions is associated with similar high risk prescriptions for their service member partners. Moreover, in exploring factors that may lead to interdependent patterns of opioid use, we explore the importance of common risk factors marital partners may share such as military life stress as well as the role exposure to a partners' risky opioid prescriptions may play.

The Family Study is grounded in the socioecological framework (SEF), a multi-level approach to analyzing health issues and identifying areas for prevention. This framework is critical not only for military research broadly, given the interrelated dynamics between community, the military organization, families, and individuals, but for substance use more specifically. This study analyzed variables across the SEF that are most applicable to opioid misuse in the military context, including community (e.g., opioid prescribing rates), organizational (e.g., deployment, military stress, military characteristics), family (e.g., number of children), interpersonal (e.g., relationship quality, social support), and individual (e.g., demographics, adverse childhood events, stress, injury). Our research questions focused on the extent to which community level factors, as well as interpersonal family relationships, and individual risk all may play a role in predicting opioid prescription outcomes. Specifically, our research questions included:

1. What is the association between service members' use of prescribed opioids and their spouses' high-risk and/or long-term use of prescribed opioids in a large probability-based cohort of military spouses?
2. Does the association between service members' opioid use and high-risk/long-term use by their spouses vary by county, state or region, as

the prevalence of and exposure to opioid use outside of the family-—in the general population—varies widely?
3. What are the contextual factors associated with the service member and spouse's opioid prescriptions?

2. Material and methods

2.1. Study procedures and sample

Data were drawn from the Family Study, a nationwide survey of married spouses of SMs with 2–5 years of military service. Survey questionnaires were administered between 2011 and 2013; response rates and study methods for the Family Study have been described elsewhere. (Corry, Williams, Battaglia, McMaster, & Stander, 2017; Crum-Cianflone, Fairbank, Marmar, & Schlenger, 2014; McMaster, LeardMann, Speigle, & Dillman, 2017) The sample included 8217 SM and spouses who were enrolled in the Military Health System (MHS) for at least one month during a 24-month observation period, which extended from 12 months before the date they completed the survey to 12 months after (between 2010 and 2014). Data were analyzed between 2018 and 2020. The Naval Health Research Center's Institutional Review Board and the Office of Management and Budget approved the study. Informed consent, including consent to link survey responses to medical and personnel records, was obtained from all participants. Analyses were weighted to account for the sample design and nonresponse. (Corry et al., 2017)

2.2. Data Sources

The Family Study survey obtained self-reported information about demographic characteristics, physical and mental health status, tobacco and alcohol use, family and spouse relationships, and stresses and supports. The DoD Pharmacy Data Transaction Service (PDTS) provided data about MHS-reimbursed purchases of prescribed medications from participants' medical records, including prescriptions dispensed by military, community, or mail order pharmacies. We used the National Drug Code in the PDTS and in a publicly available Centers for Disease Control and Prevention (CDC) file to identify opioid prescriptions for spouses and SMs. (Centers for Disease Control and Prevention (CDC), 2016) Inpatient and outpatient medical claims data on both spouse and SM were used to identify pain-related medical diagnoses that might be associated with opioid prescribing. The PDTS and medical records data were matched to the Family Study data to create a linked record for each dyad in the sample. Rates of dispensed opioid prescriptions by retail pharmacies in each state between 2011 and 2013 were extracted from a publicly available CDC file. (Centers for Disease Control and Prevention, 2018) These data were linked to the analytic file by survey year and spouse state of residence.

2.3. Dependent variable measures

The dependent variables were: (1) spouse prescriptions for long-term opioid therapy (LTOT) and (2) spouse opioid prescriptions that pose high risk of adverse outcomes. *LTOT* was defined as obtaining (a) an opioid prescription having ≥60 days' supply during any 3-month period, or (b) a prescription for an extended-release opioid formulation within the observation period. *High-risk opioid prescriptions* were defined as, within the observation period, obtaining (a) a prescription with a high daily opioid dosage of ≥90 morphine mg equivalent (MME) or higher, (b) high total dosage, calculated as >8190 MME (90 MME/day × 91 days) in any observed 3-month period, (c) opioid prescriptions from ≥3 pharmacies in any three consecutive months during the observation period, or (d) concurrent prescriptions, defined as ≥60 days' supply of the benzodiazepines, carisoprodol, and/or zolpidem during any 3-month period in which spouses also received ≥60 days' supply of opioids. MMEs were calculated for each opioid prescription using CDC

conversion ratios. (Peirce, Smith, Abate, & Halverson, 2012) These measures of long-term and high-risk opioid use have been found to be associated with opioid dependence, misuse, and death. (Centers for Disease Control and Prevention (CDC) (CDC), 2012; Baumblatt et al., 2014; Yang et al., 2015; Jones & McAninch, 2015; White, Birnbaum, Schiller, Tang, & Katz, 2009; Controlled Drug MART, 2019; Hall et al., 2008) Prevalence of each of these outcomes was computed by dividing the count of spouses who met each criterion by the count of spouses who were enrolled in MHS for at least 1 month during the 2-year observation period.

2.4. Independent variable measures

Independent variables included SM's LTOT and high-risk opioid prescriptions (defined the same as for their spouse's prescriptions), spouses' self-reported socio-demographic characteristics (race/ethnicity, gender, age, education, employment status, number of children, and spouses' military service history), physical and mental health indicators, reported stresses, alcohol and tobacco use, SM's military status (active duty or Reserve/National Guard), pay grade (officer or enlisted) and branch of service, and prevalence of opioid prescribing in their state (Table 1). Annual opioid prescribing rate in the spouse's state of residence during the year they completed the survey was measured as the number of opioid prescriptions dispensed annually by retail pharmacies per 100 state residents. (Centers for Disease Control and Prevention, 2017)

To measure pain, two measures from the Short Form 36 - Health Survey for Veterans (SF-36) were used. (Kazis et al., 2004; Ware, Kosinski, & Gandek, 2000) Bodily pain during the past month was measured from 1 to 6 ("none" to "very severe"). (Ware et al., 2000) The extent to which pain interfered with normal work was measured from 1 to 5 ("not at all" to "extremely"). (Ware et al., 2000) Disability days were measured as days reportedly unable to work or perform usual activities over past year due to illness or injury. Medical claims were used to assess pain-related medical diagnoses for the SM and spouse during the observation period.

Current smoking was defined as having smoked ≥100 lifetime cigarettes and having smoked in the past year. Risky drinking was defined as either heavy drinking (consuming ≥14 drinks in past week for men, or ≥7 for women) or binge drinking (having ≥5 drinks in a single occasion for men, or ≥4 for women) ≥5 times in the past year.

Spouses' mental health was captured by the PHQ-8. (Kroenke et al., 2009) Measures of stress and trauma included PTSD (PCL-C) (Felitti et al., 1998; U.S. Department of Veterans Affairs, National Center for PTSD, 1993) and adverse childhood experiences (ACE). (Felitti et al., 1998) Perceived military-related stress was measured for deployment stress, injury stress and family stress. The items were scored from 0 to 4 ("never experienced" to "very stressful"), and a mean was constructed for each domain.

2.5. Statistical analyses

We generated descriptive statistics on spouse characteristics and opioid use outcomes. For each outcome, we conducted bivariate analyses and developed a multiple logistic regression model to estimate the association of spouses' receipt of opioid prescriptions with spouse demographics, reported life stress, social support, self-reported health, personal military service history, service members' receipt of prescription opioids and military characteristics, as well as opioid prescribing prevalence rates in each spouse's state of residence. Non-response analyses conducted for the survey data, including second stage non-response bias for this wave of data collection, are described elsewhere. (Corry et al., 2017) Design and non-response weights were applied to all analyses.

Table 1
Description of dyads in study population.

Characteristic[a]	Unweighted N[b] (N = 8217)	Weighted %
Spouse pain and disability		
Severity of bodily pain in past month		
None (1)	2392	28.0
Very mild (2)	2656	31.9
Mild (3)	1618	20.4
Moderate	1115	14.9
Severe (5)	291	4.0
Very severe (6)	60	0.8
Mean (SE)	2.37 (0.02)	
Pain interference with work in past month		
Not at all (1)	4974	58.0
A little bit (2)	2093	27.3
Moderately (3)	656	9.0
Quite a bit (4)	311	4.2
Extremely (5)	98	1.5
Mean (SE)	1.64 (0.01)	
Disability days in past year[c]		
0	5033	61.9
1	448	5.4
2–5	1406	16.5
6–10	488	6.1
11–15	236	3.0
16–20	125	1.6
More than 20	415	5.5
Mean (SE)	3.17 (0.10)	
Spouse received pain-related diagnosis	3901	48.8
SM received pain-related diagnosis	4638	58.0
Other spouse substance use		
Current smoker	1387	20.5
Risky drinking	1701	24.0
Spouse perceived stress and mental health	Mean (SE)	
PHQ depression scale (6–32)	12.01 (0.08)	
Military stress (deployment, injury, family) (0–4)[d]	1.35 (0.01)	
Family satisfaction (FACES IV) score (10–50)	37.33 (0.15)	
PTSD checklist score (PCL-C) (15–85)	25.87 (1.19)	
Adverse Childhood Events (ACE) score (0–8)	1.46 (0.03)	
Spouse perceived support		
How much spouse is bothered by having no one to turn to		
Not bothered (1)[d]	5906	69.8
Bothered a little (2)	1506	19.5
Bothered a lot (3)	696	10.7
Mean (SE)	1.41 (0.01)	
Military efforts to help spouse and family		
Poor (0)	1423	19.2
Fair (1)	1978	24.9
Good (2)	2481	29.3
Very good (3)	1390	15.3
Excellent (4)	821	11.1
Mean (SE)	1.74 (0.02)	
Number of opioid prescriptions per 100 state residents per year		
Mean (SE)	81.66 (0.33)	

Note: The study population includes spouses who are married to service members with 2–5 years of service and enrolled in the Military Health System for at least one month during the two year observation window.

[a] All characteristics refer to the Family Study (spouse) respondent unless otherwise indicated.

[b] The N's do not consistently add up to 8217 because of missing data.

[c] This variable is a categorical variable, with each category representing a range of disability dates. The number in parenthesis beside each range is the midpoint of the range and was used to compute the mean and as the continuous measure in the models.

[d] All numbers in parentheses indicate the ranges of the scales and/or coding used in the models.

3. Results

Most spouses were female (86%), white non-Hispanic (70%) (Table 1), and 25–34 years old. More than half had completed some college or an associate's degree, and 30% had a bachelor's degree or higher. About one-third (%) were employed full-time, 17% were

unemployed, and 38% identified as a homemaker or student. About 20% of the spouses had served in the military, half of whom were actively serving at the time of survey completion. Approximately half (48.5%) of their SM partners served in the Army, 19.0% in the Air Force, 14.4% in the Marine Corps, 14.8% in the Navy, and 3.2% in the Coast Guard. Table 1 below presents descriptive statistics for the mental and physical health characteristics of the sample.

3.1. Receipt of prescription opioids

Nearly half of spouses (47.6%, 95% CI: 46.0%–49.1%) received at

Table 2
Prevalence of Spouses and Service Members Receiving Long-Term and High-Risk Opioid Prescriptions (Unweighted N = 8217).

Measure of opioid use	Count (numerator)	Percent[a]	95% CI	
Spouse received an opioid prescription during observation period	3771	47.6%	46.0%	49.1%
Spouse long-term or high-risk opioid use	700	8.5%	7.7%	9.3%
Spouse long-term opioid use	272	3.3%	2.7%	3.8%
Spouse received ≥60 days' supply of opioids within a 3-month period	249	90.5%	85.5%	95.4%
Spouse received extended release prescription	110	44.2%	36.0%	52.3%
Spouse high-risk opioid use	595	7.2%	6.5%	8.0%
Spouse received at least one prescription with daily dose ≥90MME	462	76.7%	72.2%	81.2%
Spouse high total opioid dosage (>90 MME) within a 3-month period	33	5.6%	2.8%	8.3%
Spouse obtained opioids from at least 3 different pharmacies in a 3-month period	219	37.8%	32.6%	43.0%
Spouse concurrent long-term use of opioids and sedatives/hypnotics	33	3.9%	2.3%	5.5%
Service member received an opioid prescription during observation period	3179	42.0%	40.5%	43.5%
Service member long-term or high-risk opioid use	715	9.4%	8.5%	10.3%
Service member long-term opioid use	381	5.3%	4.6%	6.0%
Service member received ≥ 60 days' supply of opioids within a 3-month period	331	85.2%	80.1%	90.2%
Service member received extended release prescription	159	41.9%	35.4%	48.3%
Service member high-risk opioid use	557	7.1%	6.3%	7.8%
Service member received at least one prescription with daily dose ≥ 90MME	413	72.8%	68.0%	77.6%
Service member high total opioid dosage (>90 MME) within a 3-month period	41	7.6%	4.6%	10.5%
Service member obtained opioids from at least 3 different pharmacies in a 3-month period	238	43.8%	38.4%	49.1%
Service member concurrent long-term use of opioids and sedatives/hypnotics	25	4.8%	2.7%	6.9%

[a] Estimates are weighted to represent the population of spouses who are married to service members with 2–5 years of service and enrolled in the Military Health System for at least one month during the two year observation window. Percentages for subcategories are presented as percentages of spouses/service members who fall into the broader opioid outcome category (e.g. spouses engaged in long term opioid use.) Unweighted N = 8217.

least one opioid prescription during the two-year observation period (Table 2), with an average of 3.6 prescriptions. Slightly fewer SMs (42%, CI: 40.5–43.5%) received an opioid prescription. Three percent of spouses (CI: 2.7%–3.8%) received prescriptions for LTOT, as did 9.4% of SMs. Of spouses and SMs receiving long-term opioid prescriptions, most obtained ≥60-days' supply of opioids during a 90-day span (90.5% of spouses, 85.2% of SMs), while nearly half (44.2% of spouses, 41.9% of SMs) received a prescription for an extended release opioid.

Seven percent of both spouses and SMs met at least one of the criteria for high-risk opioid use, generally because they had purchased a prescription for a ≥90 MME daily dose (76.7% of spouses, 72.8% of SMs). Fewer (37.8% of spouses, 43.8% of SMs) obtained opioids from ≥3 different pharmacies within a three = month period. Among spouses and SMs receiving high-risk prescriptions, 3.9% of spouses and 4.8% of SMs obtained prescriptions for sedatives or hypnotics concurrently with opioid prescriptions. Approximately 2% of all spouses, and 4% of spouses receiving any opioids, were prescribed both long-term and high-risk opioids prescriptions.

3.2. Association between spouse and service member receipt of opioid prescriptions

Unadjusted analyses demonstrated strong associations between spouse and SMs' opioid therapies. If a SM was in LTOT, their spouse had five times the odds of having received a long-term opioid prescription compared to spouses whose SM did not receive a long-term opioid prescription (OR = 5.53). If a SM received prescriptions indicative of high-risk use, their spouse had twice the odds of receiving a high-risk prescription (OR = 2.20).

In multivariable models controlling all other covariates and predictors, SM opioid prescriptions remained strong independent correlates of spouse use, (AOR = 5.30 for long-term; AOR = 1.63 for high-risk (see Table 3). Additionally, several physical health measures were associated with both long-term and high-risk opioid prescribing. Although most spouses reported low levels of bodily pain and half (58%) reported having no pain interference with work (Table 1), a one-unit increase in bodily pain was associated with a 65% increase in the odds of obtaining a long-term prescription (Table 3). A one-unit increase in pain interference at work was associated with a 42% increase in the odds of obtaining a long-term prescription and a 24% increase in the odds of obtaining a high-risk prescription. Spouses with a pain-related medical diagnosis had over five times the odds of obtaining a long-term prescription (AOR = 5.48), and over two times the odds of obtaining a high-risk prescription (AOR = 2.43). Each additional disability day was associated with a 5% increase in the odds of being prescribed opioids for long-term use and a 4% increase of receiving high-risk prescriptions (Table 3).

One-fifth of spouses reported being a current smoker at the time of the survey. Current smokers had more than twice the odds of obtaining LTOT and 51% higher odds of obtaining high-risk prescriptions (AOR = 1.51). Each additional ACE was associated with a 10% increase in the odds of obtaining a high-risk opioid prescription (AOR = 1.1). Spouses 25–34 years old had over 2.5 times the odds (AOR = 2.61) of obtaining LTOT, and 51% higher odds of receiving high-risk prescriptions, compared to spouses 17–24 years old; those who were 35 and older were not at increased risk. Those with some college education had twice the odds (AOR = 2.01) of receiving LTOT than those with a high school degree or less. Spouse family satisfaction, depression, and PTSD were not significantly associated with either long-term or high-risk prescriptions, nor were the community and organizational variables of military life stress and opioid prescribing rates in the spouses' states.

While current spouse military service was not significantly associated with a risky opioid prescription, having previously served in the military was associated with 40% lower odds of receiving high-risk opioid prescriptions. Officer status and service branch of SMs were associated with LTOT, but not high-risk prescribing. Spouses of officers

Table 3

Multiple Logistic Regression for Spouses' Long-Term and High-Risk Opioid Therapy.

Variable	Spouse Long-term Prescriptions (N = 6918)		Spouse High risk Prescriptions (N = 6918)	
	AOR (95% CI)	P-value	AOR (95% CI)	P-value
Service member opioid prescriptions				
Service member long-term opioid prescriptions	5.30 (2.94–9.55)	**<0.0001**		
Service member high-risk prescriptions			1.633 (1.13–2.36)	**0.01**
Spouse physical health				
Severity of bodily pain in past month	1.65 (1.26–2.15)	**0.0003**	1.13 (0.95–1.34)	0.16
Pain interference with work in past month	1.42 (1.09–1.84)	**0.0088**	1.24 (1.03–1.50)	**0.03**
Disability days in past year	1.05 (1.02–1.08)	**0.0003**	1.04 (1.02–1.06)	**<0.0001**
Spouse received pain-related diagnosis	5.48 (2.44–12.31)	**<0.0001**	2.43 (1.77–3.32)	**<0.0001**
Service member received pain-related diagnosis	0.85 (0.54–1.34)	0.49	1.09 (0.82–1.45)	0.60
Other spouse substance use				
Current smoker	2.14 (1.35–3.40)	**0.001**	1.51 (1.12–2.03)	**0.01**
Risky drinking	0.87 (0.51–1.41)	0.60	0.73 (0.522–1.02)	0.06
Spouse perceived stress and mental health				
PHQ depression scale (6–32)	0.96 (0.91–1.02)	0.22	1.02 (0.97–1.07)	0.48
Military stress (0–4)	1.08 (0.85–1.37)	0.56	1.04 (0.89–1.23)	0.62
Family satisfaction (FACES IV) scale (10–50)	1.02 (1.0–1.04)	0.15	1.01 (0.99–1.02)	0.59
PTSD Checklist score (PCL-C) (15–85)	1.01 (0.99–1.04)	0.23	0.99 (0.97–1.01)	0.36
Number of Adverse Childhood Events (ACEs)	1.04 (0.95–1.13)	0.37	1.10 (1.03–1.18)	**0.003**
Spouse perceived support				
How much spouse is bothered by having no one to turn to (1–3)	1.27 (0.95–1.71)	0.11	0.96 (0.77–1.19)	0.71
Military efforts to help spouse and family (0–4)	1.18 (1.0–1.41)	0.06	1.01 (0.91–1.13)	0.84
Number of opioid prescriptions per 100 state residents per year				
Number of opioid prescriptions per 100 state residents per year	1.01 (0.10–1.02)	0.11	1.00 (0.99–1.01)	0.74
Socio-demographic characteristics				
Gender				
Male vs Female	1.01 (0.54–1.88)	0.10	0.93 (0.55–1.57)	0.77
Age		**0.002**		**0.03**
17–24 years	Ref	Ref	Ref	Ref
25–34 years	2.61 (1.43–4.78)	**0.002**	1.51 (1.07–2.14)	**0.02**
35+ years	1.38 (0.61–3.15)	0.44	1.03 (0.60–1.76)	0.92
Race/ethnicity		0.08		
White non-Hispanic	Ref	Ref	Ref	Ref
Black non-Hispanic	0.52 (0.14–1.90)	0.32	1.00 (0.54–1.86)	1.0
Hispanic	0.54 (0.29–1.02)	0.06	0.67 (0.41–1.08)	0.10
Other	1.47 (0.77–2.80)	0.24	1.24 (0.74–2.10)	0.41
Educational attainment		**0.0005**		0.11
High school graduate, GED or less	Ref	Ref	Ref	Ref
Bachelors' degree or higher	0.71 (0.34–1.50)	0.37	0.74 (0.46–1.18)	0.21
Some college/associate's degree	2.01 (1.08–3.74)	**0.03**	1.08 (0.76–1.54)	0.65
Employment status		0.85		0.55
Full-time	Ref	Ref	Ref	Ref
Homemaker/student	1.03 (0.55–1.89)	0.94	1.07 (0.75–1.54)	0.70
Not employed	1.20 (0.61–2.36)	0.60	1.28 (0.87–1.90)	0.21
Part-time	0.81 (0.31–2.10)	0.66	1.26 (0.80–2.01)	0.32
Other spouse attributes				
Number of children		0.66		0.35
0	Ref	Ref	Ref	Ref
1	1.20 (0.71–2.02)	0.50	1.30 (0.91–1.85)	0.15
2+	0.96 (0.55–1.68)	0.89	1.181 (0.83–1.68)	0.35
Spouse military service		0.57		0.07
Never	Ref	Ref	Ref	Ref
Current	0.87 (0.41–1.83)	0.71	0.80 (0.46–1.37)	0.41
Former	0.75 (0.44–1.29)	0.30	0.59 (0.38–0.93)	**0.02**
Service member military characteristics				
Active duty	Ref	Ref	Ref	Ref
Reserve/National Guard	1.74 (0.98–3.11)	0.06	0.97 (0.66–1.42)	0.86
Warrant or commissioned officer	1.93 (1.09–3.41)	**0.03**	0.93 (0.64–1.35)	0.70
Service branch		**0.05**		0.37
Army	Ref	Ref	Ref	Ref
Air Force	1.50 (0.87–2.59)	0.15	1.23 (0.88–1.73)	0.22
Coast Guard	0.31 (0.10–0.92)	**0.03**	1.32 (0.71–2.46)	0.38
Marine Corps	0.60 (0.26–1.37)	0.22	1.04 (0.67–1.60)	0.88
Navy	1.02 (0.53–1.99)	0.95	0.80 (0.53–1.22)	0.31

Note: Family Study weights are used in all models. For each categorical variable (e.g., age), the p-value for the joint significance test for all categories is displayed in the first row for that variable. All social and military support independent variables are multi-category ordinal variables that are used as continuous measures in the models. The adjusted odds ratio reported for each of these variables corresponds to a 1-unit increase in the independent variable. Numbers in parentheses refer to the scoring of the independent variables (see Table 1 and Methods for details). Significant effects (*P* < .05) value are bolded.

had almost twice the odds of receiving LTOT than spouses of non-officers. Coast Guard spouses had 70% lower odds of receiving LTOT compared to Army spouses. Reserve/National Guard status was not significantly associated with receiving a risky opioid prescription.

4. Discussion

Overall, this study found that having a service member partner who received a risky opioid prescription increased the odds of their spouse also having a risky opioid prescription. This finding suggests that spouses' exposure to long-term or high-risk opioid use by their partner may contribute to their own high-risk use, above and beyond the other contributors analyzed. This finding confirms that individual and family factors influence opioid prescriptions among spouses, but we did not

find significant associated related to community-level stressors of pre-scribing patterns.

Our findings are consistent with the limited research available on the dyadic relationship for spousal substance use. Given that our study found that the presence of opioid prescriptions in the household may affect a military spouses' odds of obtaining a prescription, reducing potential misuse of opioid prescriptions among SMs may also help reduce rates of opioid misuse among their spouses and vice versa.

The DoD has a two-pronged approach to addressing the opioid crisis: (1) implementing a comprehensive model of pain management focused non-pharmacologic pain treatments, and (2) when opioid use is necessary, focusing on safe usage. (United States and Congress, 2018) A 2018 testimony to the House Armed Services Subcommittee on Military Personnel recognized the importance of providing education and services to all MHS enrollees who are at risk of opioid misuse, and emphasized partnerships with civilian health research agencies, as well as the importance of disseminating resources to systems that provide care to SMs and their families. The DoD could also consider the implementation of prevention and treatment programs tailored specifically for military spouses; or, if a problem with opioids is detected in a service member, the spouse or other family member should also be screened for potential misuse. Findings from this paper suggest that interventions implemented by the DoD (U.S. Department of Defense, Defense Health Agency, 2018; United States and Congress, 2018) and the use of complementary and integrative medicines may affect not only the SM, but their spouses as well. Additional research specifically evaluating the effects of programs and policies could help determine next steps in this space. This study suggests that DoD efforts to reduce potential high-risk opioid prescribing for one spouse may affect the other, thus improving the overall health of and providing potential benefits to the family unit and the broader military community.

This analysis likely underestimates spouses' purchases of prescription opioids for several reasons. Prescription data were limited to MHS reimbursement records and did not include prescriptions charged to other third-party insurers, paid for by cash, or covered by Medicaid or Medicare Part D. In addition, 17% were covered for less than three months, and were thereby precluded from meeting our definitions of long-term use. Consequently, our estimates should be interpreted as lower bounds of prevalence. We were unable to examine use of multiple prescribers, just multiple pharmacies. We were not able to measure the actual use of opioids prescribed, or illicitly manufactured and distributed ones. Patients may not have used the entire amount supplied and/ or may have taken larger doses than physicians ordered.

Although current pain was assessed, the presence of chronic pain was not measured in the Family Study. This sample is generally younger and early in their military service career, and is not representative of couples who have longer service in the military. Finally the sample included only heterosexual, married couples, so findings may not be generalizable to same sex couples or those who were co-habiting but not married. Additional research should explore the bidirectional nature of this relationship to provide the DoD with additional insight on programs to improve the broader military family.

5. Conclusions

This study suggests that reducing the number of long-term and high-risk opioid prescriptions to a SM may reduce the number of similar prescriptions obtained by their spouses. The DoD and MHS have implemented a wide variety of risk mitigation approaches to ensure that SMs are receiving appropriate opioid prescriptions, including prescription drug monitoring registries and patient and physician education; by training those who prescribe to SMs, risk may also be reduced for spouses. Reducing the numbers of SMs and spouses at risk for adverse events may prove effective in stemming the epidemic and improve the overall health and safety of military spouses and thus, the readiness of the U.S. Armed Forces.

Credit authorship contribution statement

Alicia C. Sparks: Conceptualization, Formal analysis, Writing - original draft, Supervision. **Sharmini Radakrishnan:** Software, Formal analysis, Data curation. **Nida H. Corry:** Project administration, Formal analysis, Writing - review & editing. **Doug McDonald:** Conceptualization, Writing - original draft. **Kenneth Carlson:** Formal analysis, Writing - review & editing, Supervision. **Carlos E. Carballo:** Formal analysis, Data curation, Writing - review & editing. **Valerie Stander:** Writing - review & editing, Supervision.

Declaration of Competing Interest

Disclaimer

Center Institutional Review Board in compliance with all applicable Federal regulations governing the protection of human subjects. Research data were derived from an approved Naval Health Research Center Institutional Review Board protocol number NHRC.2015.0019. This study has not been published elsewhere.

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