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Wayne Chappelle
U.S. Air Force School

Tanya Goodman
Neurostat Analytical Solutions

Laura Reardon
Neurostat Analytical Solutions

William Thompson
Neurostat Analytical Solutions

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Wayne Chappelle [a,*,1], Tanya Goodman [b], Laura Reardon [b], William Thompson [b]

[a] U.S. Air Force School of Aerospace Medicine, 2510 5th Street, Building 840, Wright-Patterson AFB, OH 45433-7913, United States
[b] Neurostat Analytical Solutions, LLC, 709 Sonterra Boulevard, San Antonio, TX 78258, United States

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ABSTRACT

Remotely piloted aircraft (RPA), commonly referred to as "drones," have emerged over the past decade as an innovative warfighting tool. Given there is a paucity of empirical research assessing drone operators, the purpose of this study was to assess for the prevalence of PTSD symptoms among this cohort. Of the 1084 United States Air Force (USAF) drone operators that participated, a total of 4.3% endorsed a pattern of symptoms of moderate to extreme level of severity meeting criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders-4th edition. The incidence of PTSD among USAF drone operators in this study was lower than rates of PTSD (10–18%) among military personnel returning from deployment but higher than incidence rates (less than 1%) of USAF drone operators reported in electronic medical records. Although low PTSD rates may be promising, limitations to this study are discussed.

1. Introduction

Over the past decade, United States Air Force (USAF) Predator/Reaper remotely piloted aircraft (RPA; commonly referred to as "drones") have emerged as critical assets to real-time intelligence, surveillance, reconnaissance (ISR); close air support; and precision strike operations on the battlefield. Advancements in modern computer-based, satellite, and aviation technology allow drone operators to remain stationed within the nation's borders while providing around-the-clock support, 7 days a week, to various military operations across the globe. As a result of their effectiveness, such aircraft are increasingly relied upon in a wide range of ISR and close air support missions worldwide. The increased requirement for drones on the battlefield and other regions has created a rapidly expanding need for drone operators (pilots, sensor operators, and mission intelligence coordinators) to keep pace with the national and international demand for drone operations and the evolving paradigm of this modernized form of warfare.

Current technology allows such operators to directly observe and interact with ground forces through high-definition digital media in "real-time" to (a) track, target, and destroy enemy combatants and assets; (b) provide force protection to civilians and military personnel; (c) visually inspect and survey battle damages following weapons strikes; and (d) gather various forms of visual and auditory data to sustain a high level of situational awareness and intelligence through certain regions (Chappelle, McDonald, Thompson, & Swearengen, 2012). Although such drone operators are not "deployed" in hand-to-hand combat and are protected from direct threats to personal safety, they are often involved in operations in which they witness events and make decisions on the battlefield that result in death or serious injury. Furthermore, the missions they support may also involve bearing witness to the loss of U.S. or allied forces on the ground as well as unexpected collateral damage (i.e., death of innocent civilians or fratricide). As a result, exposure to and participation in real time video feed and imagery of (traumatic and non-traumatic) battlefield operations are an expected and often routine part of their daily duties.

The Diagnostic and Statistical Manual of Mental Disorders-Fifth edition (DSM-5) reports projected lifetime risk of posttraumatic stress disorder (PTSD) in the United States as 8.7%, with twelve-month prevalence among U.S. adults around 3.5% (American Psychiatric Association, 2013). Participation in war and exposure to battlefield operations increase the risk of developing PTSD (Gates et al., 2012; Ramchand, Schell, Jaycox, & Tanielian, 2011). Estimates of PTSD rates among combat-exposed military personnel vary considerably, ranging anywhere from 7.6% to 8.7% (Smith et al., 2008), 14 to16% (Gates et al., 2012), and 10 to 18% (Litz

* Corresponding author. Tel.: +1 937 938 2706; fax: +1 937 904 8743.
E-mail address: wayne.chappelle@us.af.mil (W. Chappelle).
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& Schlenger, 2009). Reported rates of PTSD among military personnel are affected by how symptoms are measured, study design, and nature of the population assessed (Coughlin, 2013). Furthermore, in their meta-analysis of prevalence estimates of combat-related PTSD, Richardson, Frueh, and Acierno (2010) found rates of PTSD between 4% and 17%, noting this variability was influenced by sampling and measurement differences; variability in how clinical impairment was assessed; timing of the assessment, and variability of combat exposure. Otto and Webber (2013) noted that the incidence of mental health problems among USAF drone operators is similar to pilots of manned aircraft who are deployed to the battlefield; their review of electronic military medical records revealed less than 1% of USAF drone operators are diagnosed with and receive treatment for PTSD.

Evaluating for symptoms of PTSD among military personnel returning from deployment is standard practice within military medical facilities. However, psychological screening for PTSD among USAF drone operators presents a conundrum in that they are continually "deployed" in garrison with no definitive boundaries to the deployed experience. Furthermore, defining combat or trauma exposure for this population is complex. Drone operators provide around-the-clock, real-time support to ongoing military operations worldwide, requiring sustained situational awareness and hypervigilance to threat. For the population assessed in this study, we defined exposure time as time allotted to surveillance of real-time battlefield operations; any operator assigned full time would therefore experience 30–50 h per week of exposure to war-time imagery (i.e., potential traumatic events).

Ouma, Chappelle, and Salinas (2011) investigated self-reported stress and burnout among 296 USAF Predator/Reaper drone operators stationed within U.S. borders and supporting battlefield operations. The results of their survey revealed 14–26% had high levels of exhaustion (i.e., those self-reporting on average one or more days a week feeling "burned out," "emotionally drained" from work, and "used up" at the end of the workday) and 7–17% had high levels of cynicism (i.e., those self-reporting on average one or more days a week thoughts of cynicism and doubt regarding the significance of their work). The results of these studies suggest drone operators are faced with emotionally challenging and demanding operational stressors that negatively affect their psychological disposition. Given the restricted access to this population, there has been only one study to date screening for self-reported PTSD symptoms in USAF drone operators (Chappelle et al., 2012). The study involved analyses of self-report surveys from 670 MQ-1 Predator and MQ-9 Reaper (ISR and weapons strike) drone operators from several different units spread across the United States and supporting battlefield operations on a daily basis. The results of the study revealed 5% of drone operators participating in the survey had total PCL-M scores equal to or greater than 50 and thus were at high risk for PTSD.

Although the survey conducted by Chappelle et al. (2012) elevated situational awareness to the incidence rates of PTSD, it had several logistical shortcomings. Furthermore, anecdotal discussions with USAF drone commanders regarding the reliability of the study findings reveal uncertainty as to whether the results (i.e., 5% of drone operators at high risk for PTSD) of the Chappelle et al. (2012) study were, in part, influenced by unknown temporal and situational events at the time it was conducted. As a result, a web-based version of the survey was developed at the request of AF drone and medical leadership so drone operators could complete the survey from their workstation during duty hours and to reduce costs associated with logistical planning and administration of the survey.

1.1. Purpose of the study

The primary objectives of this study were to (a) measure the frequency and severity of self-reported PTSD symptoms in USAF MQ-1 Predator/MQ-9 Reaper AF drone operators; and (b) assess for demographic and operational predictors for those meeting PTSD DSM-IV symptom criteria. We hypothesized that we would find similar rates of drone operators meeting PTSD criteria as the Chappelle et al. (2012) study (i. e., around 5%). The authors of this study utilized the PCL-M to allow for comparison with previously published studies. The current study utilized the web-based survey to compare with the earlier in-person screening study conducted by Chappelle et al. (2012). Additionally, this study expands on the prior study by studying patterns of PTSD scores across three symptom clusters (re-experiencing, avoidance, and hyperarousal) as defined in the DSM-IV (APA, 2000).

2. Methods

2.1. Participants

A total of 1084 USAF RPA operators participated in the study. The response rate from the Chappelle et al. (2012) study was 39%. With a 6-week sampling period, we estimated a higher response rate than the previous study, and response rate from the current study exceeded the previous study at 49%. The total number of MQ-1 Predator/MQ-9 Reaper drone operators assigned to each unit based in CONUS was obtained from AF operational leadership. This number was then compared with the number of drone operators who participated in the survey to obtain an overall response rate. Twenty three individuals initiated the survey, but did not wish to participate in the survey; these individuals were not included in the estimated response rate. The response rates across MAJCOMS at various locations spread across the continental United States (CONUS) were as follows: 57% (95% confidence interval (CI) = 55–60%) ACC, 47% (95% CI = 42–51%) ANG, and 27% (95% CI = 23–32%) AFSOC. Approximately 75% of the RPA operators participating in the study had no prior combat experience before being assigned to RPA operations. Twenty five percent of the respondents had previous combat deployment experience prior to being assigned to the RPA platform, serving as members of aircrew in manned airframes (e.g., F-16, C-130, HH60G Pave Hawk helicopter, AC-130 Gunship, etc.). See Table 1 for demographics of participants. Although response rates for online surveys tend to be lower than paper-based surveys, the online response rate for this study was higher than those found in several analyses comparing mean response rates of in-person vs online surveys (Cook, Heath, & Thompson, 2000; Dommeyer, Baum, Hanna, & Chapman, 2004; Nulty, 2008).

2.2. Instruments

2.2.1. Demographics questionnaire

Participants were asked to complete a demographics and occupational questionnaire composed of several items that assessed gender, age range, rank range, marital status, length of time serving in their duty position, average number of hours worked in a typical week, current shift schedule (i.e., day, swing, night), frequency of shift rotation, average number hours of sleep obtained before going to work, and previous combat experience. The demographics and occupational questionnaire did not ask for personally identifiable information such as name or date of birth to sustain participant anonymity and encourage genuine self-disclosure. See Table 1 for descriptive frequencies and percentages of demographic and operational variables for participants who responded to the survey.

Table 1
Demographics of RPA operator participants.

Variable	N	%
Demographic[a]		
Gender		
Male	956	88.19
Female	124	11.44
Missing	4	<1
Age range		
18–25	222	20.48
26–30	363	33.49
31–34	182	16.79
35–39	150	13.84
40+	165	15.22
Missing	2	<1
MAJCOM		
AFSOC	140	12.92
ANG	217	20.02
ACC	727	67.07
Rank range		
Enlisted (SO & MIC)	557	51.38
Officer (pilot)	518	47.79
Missing	9	<1
Marital status		
Single	395	36.44
Married	685	63.19
Missing	4	<1
Operational		
Time on station		
≤24 mo	634	58.49
≥25 mo	449	41.42
Missing	1	<1
Shift schedule		
Standard day shift	191	17.62
12-h day shift	85	7.84
12-h mid shift	38	3.51
12-h night shift	52	4.80
8-h day shift	271	25.00
8-h mid shift	245	22.60
8-h night shift	196	18.08
Missing	6	<1
Hours worked per week		
≤50 h	665	61.35
≥51 h	418	38.56
Missing	1	<1
Frequency of shift rotation		
Every 30 days	385	35.52
Every 60 days	301	27.77
Every 90 days	45	4.15
N/A	200	18.45
Missing	153	14.11

MAJCOM: major command; AFSOC: air force special operations command; ANG: air national guard; ACC: air combat command; SO: sensor operator; MIC: mission intelligence coordinator.
[a] Discussion with ACC, AFSOC, and ANG leadership regarding participant demographics indicated participants appeared representative of the population of USAF RPA operators.

2.2.2. PCL-M

The PCL-M is a 17-item screening instrument based on DSM-IV criteria for PTSD (Weathers, Litz, Herman, Huska, & Keane, 1993). The PCL-M is commonly used across a wide range of civilian, Department of Defense, and Department of Veterans Affairs medical and mental healthcare settings for evaluating symptoms of PTSD. Participants were asked to report the severity of PTSD symptoms they are currently experiencing due to a military-related event. They were asked to rate how much they have been bothered by each symptom (i.e., problem) over the past month on a five-point scale with each item being scored on a 1 (not at all) to 5 (extremely) rating scale. A total symptom severity score ranges from 17 to 85 and can be obtained by summing the scores from each of the 17 items. The instrument has high reliability, validity, and diagnostic utility (Blanchard, Jones-Alexander, Buckley, & Forneris, 1996; Weathers et al., 1993) and is one of the most commonly used instruments for PTSD research over the past decade.

2.3. Procedures

Participation in the survey was encouraged by USAF drone unit leadership (wing, group, and squadron commanders) via a mass email to all MQ-1 Predator/MQ-9 Reaper drone operators based within CONUS. Commanders informed drone operators that survey participation was voluntary and anonymous. The group request for participation had an internet link to the USAF School of Aerospace Medicine (USAFSAM) web-based survey. The website contained an opening page with an introductory script further explaining the study was conducted by independent researchers and participation was voluntary and anonymous. Participants were instructed they could withdraw at any time without negative repercussions and that operational leadership would not have access to individual responses.

The survey was available via USAFSAM on a web site approved for use via the Department of Defense. Requests for participation were sent to drone operators every 2 weeks during the 6-week survey period. Furthermore, upon opening the web link for the survey and upon reading the introductory script, participants were asked to respond to a question asking if they understood the nature, purpose, and instructions of the survey and were voluntarily consenting to participate. Those who endorsed "yes" were then allowed to proceed and take the survey. The 23 individuals who endorsed "no" were not given the survey and were re-directed to another web page that instructed them on how to contact the independent researchers of the study for additional information. A total of four drone operators who endorsed "no" contacted the researchers to clarify the purpose of the study.

On average, it took participants 25–30 min to complete all the items on the survey. Participants who completed the survey were instructed how to obtain the general results of the study and when such information would be available. They were also instructed on local resources and points of contact for obtaining mental health care, at their discretion.

2.4. Data analysis

Total score for the PCL-M measure was obtained by summing items 1–17. Total scores were separated into low (17–36), moderate (37–49), and high (50 or more) categories to allow for greater granularity in reviewing and analyzing scores and how they were distributed in this sample. The cut-off for the high risk category was chosen because a score of 50 or more has shown to have high specificity, sensitivity, and accuracy with correctly identifying those at a high risk for PTSD, and for comparison purposes with previous research that used a score of 50 or more as the cut-off for high risk of PTSD (Blanchard et al., 1996; Chappelle et al., 2012; Forbes, Creamer, & Biddle, 2001; Hoge, 2009; Keen, Kutter, Niles, & Krinsley, 2008. When selecting for participants that met the DSM-IV criteria, a frequency distribution of PCL-M was run. The cut-off for the moderate risk category was chosen based on the minimum PCL-M score (37) for participants that met the DSM-IV criteria in our sample. Categorical variables were created for PTSD criteria B (intrusion symptoms), C (avoidance symptoms), and D (arousal symptoms) clusters listed in the DSM-IV. Furthermore, categorical variables were created for those who endorsed the required number and pattern of symptoms for meeting PTSD symptom cluster (B–D) criteria outlined in the DSM-IV.

Individuals were considered candidates meeting symptom criteria for PTSD diagnosis (as outlined in the DSM-IV) if they endorsed one or more intrusion symptoms, three or more avoidance symptoms, and two or more arousal symptoms with a severity rating of 3 (moderately) to 5 (extremely). The frequency with which each item was endorsed with a severity rating of moderately to extremely was obtained for drone operators who did (and did not) meet DSM-IV cluster criteria (see Table 3).

A binary logistic regression was used to identify demographic (gender, age range, rank range, marital status) and operational (time on station, hours worked per week, shift schedule, frequency of shift rotation) predictors of the dichotomous outcome variable PTSD DSM-IV symptom criteria. A stepwise logistic regression was used to retain predictor effects at $p < .10$. A final model including the interaction for the two predictors retained at $p < .10$ was run. The outcome variable was coded so that the model would predict for meeting the PTSD DSM-IV criteria (compared to not meeting the PTSD DSM-IV criteria). Odds ratios were converted into estimated relative risks using the formula from Osborne (2006). Relative risks were reported comparing the probabilities of demographic and occupational variable categories with meeting DSM-IV PTSD symptom criteria. See Table 1 below for participant demographics.

3. Results

3.1. PCL-M total score and DSM-IV criteria PTSD prevalence

Using the DSM-IV, participants met PTSD symptom criteria if they self-reported one or more criterion B (intrusion) items, three or more criterion C (avoidance) items, and two or more criterion D (arousal) items of moderate to extreme severity. A total of 47 (4.34%; 95% confidence interval (CI): 3.28–5.72%) participants endorsed a pattern of symptoms at the moderate to extreme level of severity, meeting PTSD symptom criteria outlined in the DSM-IV. Participants who met DSM-IV PTSD symptom criteria had total scores ranging from 37 to 85 (see Table 2).

3.2. Most commonly endorsed PTSD symptoms

The five most commonly endorsed symptoms (items 9, 10, 13, 14, and 15) on the PCL-M (for both drone operator groups) were "feeling distant or cut off from others," "trouble falling and staying asleep," "feeling irritable and having angry outbursts," "having difficulty concentrating," and "loss of interest in activities previously enjoyed."

Additional symptoms (items 1, 4, and 6) that were commonly endorsed by those who met DSM-IV criteria for PTSD were "repeated, disturbing memories, thoughts, or images of a stressful military experience," "feeling very upset when something reminded you of a stressful military experience," and "avoiding thinking about or talking about a stressful military experience or avoiding having feelings related to it." These symptoms were endorsed by over 65% of RPA operators who met the DSM-IV diagnostic symptom criteria (see Table 3).

Table 2
Percentage of PCL-M total score and DSM-IV criteria endorsement.

PCL-M total score	Meets DSM-IV criteria	
	No (% of total sample)	Yes (% of total sample)
17–36	998 (92.1%)	0 (0.00%)
37–49	39 (3.6%)	30 (2.7%)
50–85	0 (0%)	17 (1.6%)
Total	1037 (95.7%)	47 (4.3%)

PCL-M: PTSD checklist-military; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders-4th edition.

3.3. DSM-IV criteria prediction

A logistic regression with time in station and hours worked per week predicting drone operators who met PTSD DSM-IV symptom criteria (as a group) was significant, $R^2 = .03$, $\chi^2(3) = 9.38$, $p = 0.03$. Those working 25 months or more on station, and those working 51 or more hours per week were more likely to meet PTSD DSM-IV symptom criteria than their counterparts working less time on station and working less hours per week. Results from a logistic regression including all demographic and occupational predictors, and a final model including predictors retained from a stepwise logistic regression at $p < .10$ and an interaction, are shown in Table 4.

4. Discussion

Overall, the findings of this study suggest that a small subset (i.e., 4.3%) of USAF drone operators report clinically significant PTSD symptoms. Although remote participation in and video exposure to real-time battlefield operations may be perceived to elevate the risk for PTSD, the rates among such operators in this study are on the low end of rates (4–18%) of PTSD among those returning from the battlefield (Gates et al., 2012; Litz & Schlenger, 2009; Richardson et al., 2010; Smith et al., 2008) and lower than projected lifetime risk of PTSD for Americans (8.7%, American Psychiatric Association, 2013).

Demographic and operational variables revealed two significant findings. RPA operators working 25 months or more on station were 2.63 (95% CI = 1.15–5.64) times more likely to meet PTSD DSM-IV symptom criteria than those working less time on station, and operators working 51 or more hours per week were 2.36 (95% CI = 1.01–5.17) times more likely to meet PTSD DSM-IV symptom criteria than those working 30–50 h per week. Not surprisingly, length of time exposed to combat-relevant military operations may increase risk of PTSD for drone operators.

Report of PTSD symptoms among drone operators in this study is significantly higher than the rates (i.e., less than 1%) among USAF drone operators reported by Otto and Webber (2013) based upon their review of diagnoses listed in the electronic healthcare records of USAF drone pilots. The higher incidence rate in this study may be due, in part, to differences in study methodologies and the inclusion of AF drone operators in this study who may not have sought medical or mental healthcare for their symptoms.

The results of the study also revealed less than 2% of drone operators scored 50 or above on the PCL-M. A cut-off score of 50 has been established as identifying those at high risk of PTSD based upon previous research evaluating specificity, sensitivity, and accuracy of PCL cut-off scores (Blanchard et al., 1996; Forbes et al., 2001; Keen et al., 2008). When conducting research with the goal of population prevalence estimates among military personnel (e.g., excluding individuals who do not meet diagnostic criteria for PTSD), utilization of higher cut-off scores (i.e., 50 and above) with the PCL-M is recommended (Hoge, 2009). The rate of those with PCL-M scores above 50, is lower than the rate (i.e., 5%) reported in an earlier study of USAF drone operators by Chappelle et al. (2012). Although differences in study methodologies may help explain findings, it is possible that increased access to mental health care may have helped to reduce the severity of PTSD symptoms within this community. Since the study conducted by Chappelle et al. (2012) the USAF has embedded operational clinical psychologists with high level security clearances within active duty drone units. This has increased access to care and treatment to help mitigate

Table 3
RPA operators endorsing moderately to extremely on PCL-M items.

PCL-M item	DSM-IV symptom Cluster[a]	% RPA operators not meeting DSM-IV criteria ($n = 1084$) (95% CI)	% RPA operators meeting DSM-IV criteria ($n = 47$) (95% CI)
1. Repeated, disturbing memories, thoughts, or images of a stressful military experience?	B	6.55 (5.23– 8.18)	65.96 (51.67– 77.83)
2. Repeated, disturbing dreams of stressful military experiences?	B	5.26 (4.08– 6.75)	53.19 (39.23– 66.67)
3. Suddenly acting or feeling as if a stressful military experience was happening again (as if you were reliving it) ?	B	3.14 (2.26– 4.35)	44.68 (31.41– 58.75)
4. Feeling very upset when something reminded you of a stressful military experience?	B	5.44 (4.24– 6.95)	65.96 (51.67– 77.83)
5. Having physical reactions (e.g., heart pounding, trouble breathing, sweating) when something reminded you of a stressful military experience?	B	3.14 (2.26– 4.35)	46.81 (33.33– 60.77)
6. Avoiding thinking about or talking about a stressful military experience or avoiding having feelings related to it?	C	6.73 (5.39– 8.38)	72.34 (58.24– 83.06)
7. Avoiding activities or situations because they remind you of a stressful military experience?	C	3.78 (2.80– 5.09)	51.06 (37.24, 64.72)
8. Trouble remembering important parts of a stressful military experience?	C	2.12 (1.42– 3.16)	31.91 (20.39– 46.16)
9. Loss of interest in activities that you used to enjoy?	C	10.98 (9.25– 12.98)	82.98 (69.86– 91.11)
10. Feeling distant or cut off from other people?	C	14.02 (12.08– 16.21)	91.49 (80.07 – 96.64)
11. Feeling emotionally numb or being unable to have loving feelings for those close to you?	C	7.75 (6.30– 9.50)	61.70 (47.42– 74.21)
12. Feeling as if your future will somehow be cut short?	C	6.64 (5.31– 8.28)	51.06 (37.24– 64.72)
13. Trouble falling or staying asleep?	D	32.38 (29.66– 35.22)	89.36 (77.40– 95.37)
14. Feeling irritable or having angry outbursts?	D	14.48 (12.51– 16.70)	78.72 (65.09– 88.01)
15. Having difficulty concentrating?	D	12.08 (10.27– 14.16)	76.60 (62.78– 86.40)
16. Feeling jumpy or easily startled?	D	3.87 (2.88– 5.19)	34.04 (22.17– 48.33)
17. Being "superalert" or watchful or on guard?	D	8.76 (7.22– 10.59)	59.57 (45.34– 72.36)

RPA: remotely piloted aircraft; PCL-M: PTSD checklist-military; DSM-IV: Diagnostic and Statistical Manual of Mental Disorders-4th edition; CI: confidence interval.
[a] Cluster B: re-experiencing, C: avoidance, D: arousal.

the impact of potentially troublesome and emotionally challenging events.

While the majority of drone operators did not meet symptom criteria for PTSD as outlined in the DSM-IV, the percentage of operators who endorsed subclinical symptoms of arousal is concerning due to the potential contributions to flight mishaps (Luna, 2003) and medical incompatibility with USAF flying operations (U. S. Air Force, 2013). On the PCL-M, arousal symptoms (i.e., "having difficulty concentrating," "feeling irritable or having angry outbursts," and "trouble falling or staying asleep") were

Table 4
Relative risks for meeting DSM-IV PTSD criteria.

Logistic regression predicting: Yes for meeting DSM-IV PTSD criteria (Yes $n = 42$, no $n = 874$)	n[a]	p	Relative risks	95% CI
All predictors				
Gender		0.37		
Male[b]	818 vs 98		1.72	0.53–5.22
Age range		0.75		
26–30[c]	316 vs 178		1.07	0.42–2.55
31–34[c]	154 vs 178		0.97	0.31–2.90
35–39[c]	131 vs 178		0.47	0.11–1.85
≥40[c]	137 vs 178		1.12	0.35–3.30
Rank range		0.15		
Enlisted[d]	460 vs 456		1.63	0.84–3.08
Marital status		0.43		
Married[e]	590 vs 326		1.32	0.66–2.53
Time on station		0.08		
≥25 months[f]	372 vs 544		1.77*	0.93–3.27
Hours worked per week		0.13		
≥51 h[g]	360 vs 556		1.65	0.86–3.07
Work schedule		0.44		
12-h day shift[h]	70 vs 184		1.72	0.38–6.39
12-h mid shift[h]	33 vs 184		6.40	1.32–15.81
12-h night shift[h]	46 vs 184		3.55	0.60–12.39
8-h day shift[h]	222 vs 184		2.63	0.66–8.20
8-h mid shift[h]	201 vs 184		2.58	0.54–9.01
8-h night shift[h]	160 vs 184		3.31	0.76–10.20
Frequency of shift rotations		0.16		
Every 30 days[i]	380 vs 198		0.32	0.08–1.19
Every 60 days[i]	295 vs 198		0.22	0.05–0.88
Every 90 days[i]	43 vs 198		0.54	0.10–2.66
Final model				
Time on station		0.02		
≥25months[f]	418 vs 664		2.63*	1.15–5.64
Hours worked per week		0.05		
≥51 h[g]	449 vs 633		2.36*	1.01–5.17
Interaction (time on station × hours worked per week)		0.26	0.50	0.15–1.66

Reference categories: [b]Female; [c]Age range 18–25; [d]Officer; [e]Single; [f]0–24 months; [g]30–50 h; [h]Standard day (not shift work); [i]No rotation.
* Significant relative risk at $p < .10$.
[a] Comparison category n vs reference category n.

endorsed by 76–89% of drone operators who met PTSD symptom criteria and by 12–32% of operators who did not meet criteria, respectively. Sleep disturbance was the most commonly endorsed symptom by both groups of drone operators as indicated in Table 3. This is particularly concerning for a military population expected to be fully alert and well rested ready prior to each mission. This finding of common sleep disturbance raises concern regarding increased risk for problems with attention, learning, memory, and higher order cognitive processes (i.e., reasoning and decision making) (Ahrberg, Dresler, Niedermaier, Steiger, & Genzel, 2012; Eschenko & Sara, 2008) that are deemed critical to the performance of USAF MQ-1 Predator/MQ-9 Reaper drone operators (Chappelle et al., 2010; Chappelle, McDonald, & McMillan, 2011a). Such sleep related difficulties are also known to lead to decreased frustration tolerance, and increased symptoms of depression and anxiety (Killgore, 2010) that negatively affect daily performance. Furthermore, Picchioni et al. (2010) found sleep symptoms partially mediated the relationship between combat stress and other mental health symptoms, suggesting sleep problems likely contribute to the development or maintenance of other psychological difficulties. Also, symptoms of arousal, as measured on the PCL-M, have been found to serve a causal role in chronic PTSD symptomology and, if more pronounced at baseline, are less likely to remit overtime (Marshall, Schell, Glynn, & Shetty, 2006; Schell, Marshall, & Jaycox, 2004).

It is possible the endorsement of arousal symptoms in this sample may be driven by operational issues (e.g., frequent shift work changes and long shift schedules disruptive to circadian rhythms) rather than combat-related factors (e.g., visual exposure to battlefield operations). Sleep disturbance is commonly reported among individuals engaged in shift work schedules, particularly those adapting to swing shift (Saksvik et al., 2011). Shift work has also been associated with chronic health problems (Smith et al., 1999), particularly for those individuals reporting little social support (Tucker & Rutherford, 2005). In a study by Chappelle, Salinas, & McDonald, 2011b shift work and poor sleep hygiene were found to be significant contributors to high levels of self-reported occupational stress among USAF drone operators. Perhaps the development of more optimal shift work rotations and schedules will help to mitigate problematic issues (physical and psychological) with sleep and fatigue.

Qualitative analyses of group responses to screening test items reveal avoidance symptoms as another potential area of concern. Approximately 72–90% of drone operators who met criteria (as well as 7–14% who did not meet criteria) endorsed “avoiding thinking about or talking about a stressful military experience or avoiding having feelings related to it,” “loss of interest in previously enjoyable activities,” and “feeling distant or cut off from other people.” These findings identify areas of functioning for military mental health providers to consider when assessing for negative changes in emotional and social functioning among such operators. Outreach efforts to promote self-disclosure among USAF drone operators may help more readily identify those suffering distress, regardless of whether or not the operator meets diagnostic criteria for a disorder. Although there are no baseline data to assess for changes in operator participant functioning prior to engaging in drone duties, the nature of surveillance and deploying weapons in support of real-time battlefield operations (albeit from a geographically separated and safe distance) may also logically lead to stressful and difficult experiences that operators do not want to recall and/or think about. It is also reasonable to speculate that the decline in emotionally rewarding activity and loss of connection with others may result from occupational factors (e.g., 10–12 h shift work schedules, constantly changing shift work rotations every 30 to 90 days) that make it difficult to sustain a normal, routine home life. Regardless of the potential causes, the prevalence of avoidance symptoms among such operators may provide additional justification for AF drone unit and medical leadership to co-locate experienced military mental health providers with high level security clearances within operational units to observe and consult with operators. This would likely help increase access to mental health care so operators can freely discuss troublesome changes in their emotional and social disposition that are tied to classified drone events (i.e., surveillance, targeting, and eliminating enemy combatants).

5. Limitations of the study

Although this study used a large sample of drone operators with a reliable and valid screening tool for PTSD, there are notable limitations to this study. Due to the absence of validity scales within the PCL-M, it is difficult to know the degree of impression management that drone operators may have engaged in while completing the PCL-M. It is also possible that some drone operators may have perceived a lack of anonymity (or concerns regarding how results would be used). As a result, it is unclear how many drone operators may have minimized the degree of PTSD symptoms they were experiencing when completing the screening tool, which may suggest the actual rates of PTSD symptoms may be higher than observed in this study.

Furthermore, with a response rate of 49% we cannot speak to whether the respondents to the survey are an accurate representation of the drone operator cohort as a whole. Self-report surveys are prone to response bias from a self-selected sample that might affect generalization of results. Whenever assessing for the impact within an organization it is always a possibility there will be sampling bias. This bias occurs as results of those individuals who are at risk and wanting to expose their concerns. While this is often viewed as negative sampling bias one cannot lose sight of the purpose of this survey. The survey is designed to expose those who are at risk for experiencing clinical psychological distress and or PTSD and the results should be viewed from within that framework. Sampling bias is not necessarily a negative if it helps reveal the intended, at risk population. While bias could reduce generalizability to the population at large, it may also have the beneficial effect of exposing exactly what the survey was designed to assess. At best, if a significant number of drone operators experiencing PTSD symptoms completed the survey, we may have a relatively accurate reflection of those numbers; at worst, if a significant portion of those experiencing symptoms chose not to participate, we may have an underrepresentation of the percentage of drone operators experiencing PTSD symptoms. We consider this study a starting point that suggests PTSD may be a concern among a subset of drone operators, possibly in larger numbers than what has been in reported in this study. Additionally, this study has provided additional data to suggest these operators may be more likely to present with sub-clinical symptoms, which may readily respond to education/prevention or brief treatment interventions, thus supporting the notion that embedding a mental health provider in these units may help maintain a military force that is consistently fit to fight.

Although the measure used in this study specifically asked drone operators to endorse symptomology as it relates to a “previous military experience,” the authors cannot conclude that all PTSD symptoms reported by drone operators were the direct result of drone operations. It is possible the endorsement of PTSD among some drone operators may be affected by those who have physically deployed to the battlefield in the past, particularly for the subset of drone operators who cross-trained into drone operations from a manned airframe. Finally, we did not assess for the actual traumatic events experienced by this sample (drone- or military-related or otherwise), limiting the interpretability and generalizability of our findings. These limitations also highlight the issue of self-report vs interview-based assessment of PTSD; and although the PCL-M is a widely used assessment measure, the gold standard of PTSD assessment (e.g., the Clinician-Administered PTSD Scale, Blake et al., 1995) was not administered. Furthermore, aside from assessing for PTSD, no data were collected on the overall clinical diagnostic composition of this sample, limiting the generalizability of these findings.

Although a response rate of 49% in this study is a relatively robust rate for an online survey, response rates for online surveys in general are lower than in-person rates and increase the problem of nonresponse bias (Umbach, 2004). Those who do participate in online surveys may misrepresent their responses or minimize self-disclosure due to a sense of social presence; however, there is some evidence that computer-based surveys increase self-report of sensitive information as compared to paper-based surveys (Tourangeau & Yan, 2007). There also does not appear to be a widely accepted standard for what is considered an adequate or sufficient response rate on surveys for reporting in research (Johnson & Owens, 2003). Nevertheless, online surveys represent a cost-effective, pragmatic way to collect data and should not be underestimated, and several papers make specific recommendations for improving response rates to online surveys (Nulty, 2008; Umbach, 2004).

As noted previously, although the APA published DSM-V in 2013 with changes to the definition of PTSD criteria, DSM-IV criteria were used in this study to facilitate comparison with previous research. While future research will need to accommodate the additions presented in the DSM-V, the results of this study provide salient insight into the mental health profile of this population.

Finally, the unique occupational group of participants (surveillance and weapons strike drone operators) does not allow for generalization of the results to other drone career fields. The classifications process for the selection of operators and the types of operational battlefield missions that are supported differ significantly for non-weapons-strike drone missions and airframes.

6. Conclusion

Military mental health providers and military leadership share the responsibility of maintaining and supporting a "fit to fight" and optimally ready military force. Evaluating for PTSD symptoms and for psychological symptoms in general is logically perceived as a critical step to understanding the impact that such operations have on the mental health of drone operators engaged in battlefield operations. Given the challenging nature of asymmetrical warfare, efforts should be made to ensure USAF drone operators who are supporting the front lines of the battlefield via around-the-clock ISR and weapons strikes from within U.S. national borders are routinely screened for psychological distress (to include PTSD).

Although the literature has grown, the impact of drone operations on the mental health of USAF airmen remains unclear. Additional studies are recommended to further assess the prevalence of psychological distress among drone operators to more fully determine the sort of interventions necessary for the early detection and prevention of mental health problems. Current literature is relatively scarce, and within the research that does exist (Chappelle et al., 2012), it appears that psychological distress is more related directly to operational factors (e.g., long work hours, disruptive shift schedules, daily balance of warfighter with domestic duties). Mental health providers with proper security clearances who are directly embedded within drone units may help elucidate the cause of reported symptoms and intervene, as needed, with drone operators (as well as unit leadership) as a strategy for the early detection of distress and access to mental health care.

Given the unremitting around-the-clock pace of drone operations, it is recommended that military medical treatment facilities ensure operators have regular access to healthcare. Prevention of mental health problems and maintenance of psychologically healthy, mission-ready operators will help ensure safe military operations and reduce long-term healthcare costs.

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