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Combat and operational risk factors for post-traumatic stress disorder symptom criteria among United States air force remotely piloted aircraft "Drone" warfighters

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ABSTRACT

The prevalence and expression of post-traumatic stress disorder (PTSD) symptoms among United States Air Force remotely piloted aircraft (RPA; commonly referred to as "drones") warfighters exposed to battlefield trauma via remote, electronic warfare is relevant and critical to the effective delivery of mental health care for this population. RPA warfighters (n = 715) with real-time exposure to at least one traumatic event participated in an online survey. Measures included the PTSD Checklist for DSM-5 (PCL-5) and survey of exposure to traumatic events during the course of operational combat missions. A total of 6.15% met PTSD symptom criteria; those in the age ranges of 31–35 and 36–40 and those working 51 or more hours per week had greater odds of meeting symptom criteria. For combat-related events, the number of events in which RPA warfighters witnessed civilian bystanders being killed by enemy forces or felt shared responsibility for the injury or death of bystanders were also significant predictors, regardless of whether the risk was anticipated or unanticipated. The results of this study suggest that specific types of exposure and participation in missions with specific outcomes, albeit via electronic, remote means, are associated with an increased risk for meeting PTSD symptom criteria.

1. Introduction

Having an accurate understanding of the expression and pattern of PTSD symptoms is needed to develop effective assessment and treatment interventions for specific military populations with unique forms of exposure to combat. Determining the prevalence and expression of PTSD symptoms among RPA warfighters exposed to battlefield trauma via remote, electronic warfare is particularly relevant given (a) the rapidly expanding and projected growth of this form of warfare (Gertler, 2012), (b) the inclusion of trauma exposure via electronic means as a legitimate form of a triggering event for PTSD if the exposure is work-related (American Psychiatric Association, 2013), and (c) the variation of expression of PTSD symptoms for military personnel engaged in RPA warfare when compared with those who are physically located on the battlefield.

United States Air Force (USAF) RPA warfighters (weaponized RPA pilots, sensor operators, and mission intelligence coordinators) represent a unique group of military personnel. Crew members typically perform their duties within the protective borders of the United States yet are continuously exposed to high levels of combat through remote, electronic streams of real-time video and auditory surveillance of the battlefield and various regions of conflict across the globe. The exposure to combat remotely is both universal and unique to RPA warfighters (Chappelle, McDonald, & McMillan, 2011; Chappelle, McDonald, McDonald et al., 2014, Chappelle, McDonald, Prince et al., 2014; Chappelle, McDonald, Thompson, & Swearengen, 2012; Ouma, Chappelle, & Salinas, 2011). Their combat-related duties include identifying, tracking, targeting, and killing enemy combatants and destroying enemy assets, witnessing (via real-time video) the torture and death of civilian bystanders and U.S. military forces by enemy combatants, directing and protecting ground forces, safeguarding convoys, and surveying post-strike battle damage. Post-strike battle damage assessments often involve witnessing grief reactions in friends and family of those killed, the observation of first responders recovering bodies and body parts, and witnessing mortuary and burial services. Such surveillance is often vivid and prolonged. As can be surmised, RPA

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warfighters are not physically in a deployed environment, but they are otherwise fully engaged in the combat arena and directly involved in missions that involve killing enemy combatants and protecting the lives of ground forces and civilian bystanders.

Evaluating symptoms of PTSD among military personnel physically deployed to or returning from combat zones following exposure to battlefield events is standard practice within military and veteran medical facilities (United States Air Force, 2014). However, assessing such symptoms among USAF RPA warfighters presents a conundrum in that they are continually "deployed" in garrison with no definitive end to their exposure and participation in real-time combat and battlefield events. Although several studies have identified operational stressors (i.e., excessively long work hours, constantly rotating and changing shift work) as significant contributors to elevated levels of emotional exhaustion, medically significant distress, and increased utilization of mental health services among USAF RPA warfighters (Chappelle et al., 2012; Chappelle, McDonald, McDonald et al., 2014, Chappelle, McDonald, Prince et al., 2014), studies assessing the prevalence rate of PTSD-related symptoms among military weaponized RPA operators remain limited.

It is well known that military personnel who have physically deployed to combat zones to participate in war and who have been exposed to battlefield operations are at an increased risk for 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% to 16% (Gates et al., 2012), and 10% to 18% (Litz & Schlenger, 2009). Meta-analyses also reflect wide prevalence estimates, from between 4% and 17% (Richardson, Frueh, & Acierno, 2010) to between 1.09% to 34.84% (Xue et al., 2015), with variability affected by how symptoms are measured, study design, and nature of the population assessed (Coughlin, 2013). In the meta-analysis by Xue et al. (2015) both pre-trauma (demographics and occupational factors) and trauma-related risk factors for PTSD emerged. Trauma-related risk factors included increased combat exposure, discharging a weapon, witnessing someone being wounded or killed, and history of severe trauma.

Another issue for consideration affecting PTSD outcomes includes the act of (and the responsibility for) killing. Maguen et al. (2010) found in their study of over 2700 U.S. Army service members that, after controlling for combat exposure, the acts of "killing" and "being responsible for killing" were associated with higher levels of post-traumatic stress symptoms as compared to soldiers not engaged in such warfare, as well as other emotional and behavioral problems. Komarovskaya et al. (2011) found in a sample of 400 police officers that after controlling for demographics and exposure to life threat, killing or seriously injuring someone in the line of duty was significantly associated with PTSD symptoms. Also, MacNair (2002) found that Vietnam veterans who reported killing in combat had higher PTSD symptom levels than veterans who did not, supporting her contention that killing-related PTSD might be associated with greater severity of symptoms than non killing-related PTSD.

Campo (2015) conducted a methodological study involving semi-structured interviews with 111 RPA warfighters actively engaged in battlefield operations from multiple squadrons. The results of the study revealed participation in remote warfare elicited emotionally and socially complex responses that included a sense of responsibility and psychological connectedness to the battlefield. The study also showed weaponized RPA operators engaged in missions that involved killing often experienced emotional reactions consistent with what Maguen and colleagues described in traditional warfighters (Campo, 2015; Maguen et al., 2010). A study conducted by Chappelle, Skinner, Goodman, Swearingen, and Prince, (2018) involving semi-structured interviews of RPA warfighters revealed that many experience heightened states of autonomic arousal, as well as cognitive and emotional reactions prior to, during, and following weapon strikes similar to those engaged in combat operations on the battlefield. Taken together, these studies suggest that the act of killing results in clearly observable emotional and social consequences, regardless of whether killing occurred from 30 feet or 3000 miles away from the enemy.

Studies assessing the prevalence of combat-related stress reflect varying estimates of PTSD symptoms among RPA warfighters (Chappelle, Goodman, Reardon, & Thompson, 2014; Otto & Webber, 2013; Wood et al., 2016). A study reviewing the electronic health records of military personnel revealed that less than 1% of RPA warfighters were diagnosed with PTSD (Otto & Webber, 2013). Another study assessing the prevalence rate of PTSD via a standardized clinician administered PTSD scale among a small sample (less than 0.01% of the population) of volunteer RPA warfighters conducted at their worksite did not identify any military personnel meeting PTSD symptom criteria (Wood et al., 2016). A study conducted by Chappelle, Goodman et al. (2014) found much higher estimated rates of PTSD. Their comprehensive psychological assessment of 1084 USAF RPA warfighters (49% of the general population from targeted units) engaged in full-time surveillance and weapon-strike operations revealed a total of 4.3% met the symptom criteria for PTSD using the PTSD Checklist – Military Version (PCL-M) (based on the DSM-IV; American Psychiatric Association, 2000).

The purpose of this study is to determine the prevalence of RPA warfighters meeting PTSD symptom criteria and to build upon the literature by accounting for specific types and frequency of combat-related exposures and events (e.g., number of times engaged in weapon strikes, surveillance of killing, and strikes with collateral damage) that potentially elevate the risk for meeting PTSD symptom criteria. We hypothesize that direct participation in the act of killing will have a greater impact on elevating the risk for PTSD than combat-related events that involve surveillance of the battlefield and witnessing acts of killing by others. Additionally, we hypothesize that we will find comparable results to the 2014 PCL-M study in regard to the most frequently endorsed items of moderately or higher severity levels. Although the PCL-5 is not a direct replica of the PCL-M, the most commonly endorsed items from the 2014 study have similarly worded items in the PCL-5.

2. Method

2.1. Participants

A total of 715 MQ-1 Predator/MQ-9 Reaper RPA operators (pilots, sensor operators, and mission intelligence coordinators) participated in the study. Their daily duties involved surveillance of the battlefield, and responsibility for tracking and deploying RPA weapon strikes to kill enemy combatants and destroy enemy assets to protect ground forces. Participants included only those with reported real-time exposure to at least one traumatic event (i.e., witnessing or causing the serious injury or death of military or enemy combatants and/or civilian adults or children) via their involvement in surveillance combat operations in the past 12 months. Demographics are found in Table 1.

2.2. Measures

2.2.1. Demographics questionnaire

Participants were asked to complete a demographics and occupational questionnaire composed of several items that assessed gender, age range, whether or not the participant had children dependents at home, 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), and frequency of shift rotation. The questionnaire did not ask for personally identifiable information to ensure participant anonymity and encourage genuine self-disclosure.

Table 1
Demographics of RPA Operator Participants.

Variable	n	%
Demographic Variables		
Gender		
Male	637	89.09
Female	75	10.49
Missing	3	< 1
Age Range, yr		
18-25	121	16.92
26-30	199	27.83
31-35	181	25.31
36-40	109	15.24
41 +	101	14.13
Missing	4	< 1
Marital Status		
Single	260	36.36
Married	453	63.36
Missing	2	< 1
Child Dependents Living at Home	364	50.91
Operational Variables		
Military Affiliation		
Air Force active duty	469	65.59
Air National Guard	196	27.41
Air Force Reserves	47	6.57
Rank Range		
Enlisted (SO & MIC)	354	49.51
Officer (Pilot & MIC)	356	49.79
Missing	5	0.70
Time on Station, mo		
≤24	301	42.10
≥25	413	57.76
Missing	1	< 1
Hours Worked per Week		
≤50	417	58.32
≥51	298	41.68
Shift Schedule		
Standard day (non-shift)	116	16.22
12-h day shift	84	11.75
12-h night shift	56	7.83
8-h day shift	149	20.84
8-h mid shift	161	22.52
8-h night shift	145	20.28
Missing	4	< 1
Frequency of Shift Rotation		
Every 30 days or less	207	28.95
Every 31-60 days	312	43.64
Every 61 days or more	47	6.57
Permanent or not applicable	142	19.86
Missing	7	0.98

Note. SO = sensor operator; MIC = mission intelligence coordinator.

2.2.2. Trauma inducing combat-related events

Participants were asked to report on the type of military event (exposure in real-time) they were involved in during the course of their operational combat missions. Items were developed by behavioral science researchers and operational subject matter experts. The items were developed based on experiences of researchers working with this unique community and collaborating regarding the nature of weapon strike missions in which RPA operators participate. Example items included witnessing and surveillance of real-time acts of killing; sharing in the responsibility for killing; monitoring or supporting teams performing dangerous duties; and observing forces while they were within the range of imminent danger. Participants were asked to focus on the worst event as they completed the PCL-5.

2.2.3. PCL-5

Participants report the severity of symptoms over the past month they are currently experiencing in relation to a trauma-related event or exposure. Respondents rate each item on a scale from 0 (*not at all*) to 4 (*extremely*). A total symptom severity score ranges from 0 to 80 and can be obtained by summing the scores from each of the 20 items. A PTSD symptom-based diagnosis is obtained by summing the response ratings of 2 (*moderately*) or higher for at least one B, one C, two D, and two E symptoms based on requirements in the DSM-5 (American Psychiatric Association, 2013; Weathers et al., 2013).

2.3. Procedure

RPA warfighters across 30 separate operational squadrons stationed within the continental United States were asked by military leadership (group, squadron, or flight commanders) in their unit via government email to complete the assessment measures. The email invitation requesting participation informed RPA warfighters that participation was voluntary, anonymous, and for the purpose of understanding the impact of operational and combat-related stressors on their health. The email contained a link to a survey on an online platform developed by an independent group of behavioral science researchers. The voluntary and anonymous nature of participation was reiterated on the introductory page of the survey and the consent form. Participants were instructed they could withdraw at any time without negative repercussions; the data were collected by independent researchers; and military leadership would not have access to individual data at any time. The web page also provided a list of flight medicine physicians and aeromedical psychologists as points of contact if an RPA warfighter had questions or concerns related to his or her health and well-being.

Before participants could begin the electronic survey, they were asked 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. Those who endorsed “no” were not given the survey and were redirected to another web page that instructed them how to contact the independent researchers of the study for additional information. A total of 17 individuals declined participation after reading the informed consent section of the introductory web page.

2.4. Data analysis

Dichotomous variables were created for each of the 20 symptoms to identify those who endorsed “moderately” or higher on each item. Dichotomous variables were also created to identify the required number of symptoms of moderate or high severity for meeting each criteria (PTSD criteria B–E). Participants were then grouped according to those who did and did not meet full PTSD symptom criteria according to the DSM-5 (overall B–E criteria).

Frequencies and proportions for demographic and operational variables were obtained. Proportion comparisons among the overall symptom criteria (“Does not meet criteria” and “Meets criteria”) groups for each demographic, operational, and combat variable defined in the *Measures* section were run, except in instances where $n < 5$. Univariate logistic regressions with demographic, operational, and combat event predictors were run with overall PTSD symptom criteria endorsement as the outcome variable. Contingency tables were utilized to provide the n and % of each variable (with the % reflecting the percent endorsement within either the “Does not meet criteria” or “Meets criteria” group) for the comparison category.

PCL-5 total symptom severity score was computed by summing all PCL-5 items. Total scores were then grouped into five categories. While a standard cut-off for high PTSD symptom endorsement for the PCL-5 has not been established, the Department of Veterans Affairs recommends a cut-off of 33, with the caveat that a higher cut-score should be used for provisional diagnosis, but the cut-off value is not provided (https://www.ptsd.va.gov/professional/assessment/adult-sr/ptsd-checklist.asp). These five categories were then compared against overall PTSD symptom criteria endorsement. Endorsement of each of the 20 items at “moderately” or higher was then compared against overall PTSD symptom criteria endorsement.

Table 2
Demographic and Occupational Variables by Meeting Symptom Criteria, Proportion Comparisons, and Logistic Regression Models Predicting DSM-5 Criteria.

Variable	Does Not Meet Symptom Criteria n (% of 671)	Meets Symptom Criteria n (% of 44)	p^a	Logistic Regression Results		
				p	OR	95% CI
Demographic Variables						
Gender[b]						
Male[c]	595 (89.07)	42 (95.45)	–			
Female	73 (10.93)	2 (4.55)	–	0.20	0.39	0.09 – 1.64
Age Range[d], yr						
18-25	113 (16.92)	8 (18.60)	0.39	0.14	2.28	0.77 – 6.73
26-30[c]	193 (28.89)	6 (13.95)	0.29			
31-35	167 (25.00)	14 (32.56)	0.14	0.05	2.70*	1.01 – 7.17
36-40	100 (14.97)	9 (20.93)	0.15	0.05	2.90*	1.00 – 8.36
41 +	95 (14.22)	6 (13.95)	0.48	0.23	2.03	0.64 – 6.47
Child Dependents Living at Home						
Dependents	340 (50.67)	24 (54.55)	0.31	0.62	1.17	0.63 – 2.16
No dependents[c]	331 (49.33)	20 (45.45)	0.31			
Marital Status[e]						
Married[c]	423 (63.23)	30 (68.18)	0.25			
Single	246 (36.77)	14 (31.82)	0.25	0.54	0.81	0.42 – 1.57
Operational Variables						
Months on Station[f]						
0-24[c]	286 (42.69)	15 (34.09)	0.14			
25 +	384 (57.31)	29 (65.91)	0.14	0.27	1.44	0.76 – 2.74
Rank Range[g]						
Enlisted	333 (49.93)	21 (48.84)	0.45			
Officer[c]	334 (50.07)	22 (51.16)	0.45	0.89	0.96	0.52 – 1.77
Work Hours Per Week						
40-50[c]	400 (59.61)	17 (38.64)	0.00			
51 +	271 (40.39)	27 (61.36)	0.00	0.01	2.34*	1.25 – 4.39
Shift Work[h]						
Shift work	556 (83.36)	39 (88.64)	0.18			
Non-shift work[c]	111 (16.64)	5 (11.36)	0.18	0.36	1.56	0.60 – 4.04
Shift Rotations Frequency[i]						
N/A or permanent shift[c]	136 (20.48)	6 (13.64)	0.14			
Every 30 days or less	189 (28.46)	18 (40.91)	0.04	0.11	2.16	0.84 – 5.58
Every 31-60 days	295 (44.43)	17 (38.64)	0.23	0.58	1.31	0.50 – 3.39
Every 61 + days	44 (6.63)	3 (6.82)	–	0.55	1.55	0.37 – 6.44

Note. OR = odds ratio; CI = confidence interval.
[a]Proportion comparisons. Participants were not required to answer any item, items with a reduced response are indicated. [b]n = 668, n = 44. [c]Comparison category for logistic regressions. [d]n = 668, n = 43. [e]n = 669, n = 44. [f]n = 670, n = 44. [g]n = 667, n = 43. [h]n = 667, n = 44. [i]n = 664, n = 44.
*OR $p < 0.05$.

3. Results

Frequencies for demographic and operational variables are shown in Table 1, demographic and operational variable predictors of PTSD symptom criteria are shown in Table 2, and frequency of combat exposure based on participant engagement and predictors of PTSD symptom criteria is shown in Table 3. The majority of participants were male (89.09%), active duty (65.59%), and married (63.36%). While every individual in the study indicated some form of engagement in witnessing or being responsible for serious injury or death of another, 88.95% of participants indicated that this combat exposure was to witness U.S. or allied forces being seriously injured or killed by enemy forces. The percentages for other exposure were lower, with 53.94% of the combat exposure in the form of witnessing civilians being seriously injured or killed by enemy forces.

A total of 66.90% of participants indicated employing weapons as a part of their operational duties in the past year. In regard to having shared responsibility for a death, 88.52% endorsed shared responsibility of an enemy force death, 22.19% endorsed shared responsibility of death of a bystander where risk for collateral damage was anticipated, and 41.61% endorsed sharing responsibility of death of a bystander where risk for collateral damage was unanticipated. The majority of participants (96.90%) endorsed tracking, targeting, and subsequent elimination of an enemy individual.

Following the symptom criteria outlined in the DSM-5, participants met PTSD symptom criteria if they self-reported one or more criteria B (intrusion), one or more criteria C (avoidance) items, two or more criteria D (negative cognitions/mood) items, and two or more criteria E (arousal) items of *moderate* to *extreme* severity on the PCL-5. A total of 44 (6.15%; 95% CI: 4.39 – 7.92%) participants endorsed a pattern of symptoms of *moderate* to *extreme* severity meeting PTSD symptom criteria outlined in the DSM-5 (see Table 4).

3.1. DSM-5 PTSD symptom criteria and PCL-5 total scores

Participants who met DSM-5 PTSD symptom criteria had PCL-5 total scores ranging from 16 to 80 (see Table 4). PCL-5 total score was categorized into five categories. Assessing and categorizing total scores between those who met and did not meet criteria provides insight in the potential false positive and false negative rates if clinicians choose to use defined cut-offs. The results of the study reveal that higher cut-off scores (i.e., 48 or more) reduce false positive rates, but at the expense of increasing false negative rates, especially since there is significant variability in the range of total scores for those meeting PTSD symptoms criteria.

3.2. Most commonly endorsed PTSD symptoms

The most commonly endorsed symptoms for those endorsing overall PTSD symptom criteria were, in descending order, *Trouble falling or staying asleep* (item 20, 95.45%), *Avoiding memories, thoughts, or feelings related to the stressful experience* (item 6, 95.45%), *Irritable behavior, angry outbursts, or acting aggressively* (item 15, 84.09%), *Having difficulty concentrating* (item 19, 84.09%), *Feeling distant or cut off from other*

Table 3
Combat Variables by Meeting Symptom Criteria, Proportion Comparisons, and Logistic Regression Models Predicting DSM-5 Criteria.

Variable	Does Not Meet Symptom Criteria n (% of 671)	Meets Symptom Criteria n (% of 44)	p^a	Logistic Regression Results		
				p	OR	95% CI
Combat-Related Surveillance						
In how many separate events have you witnessed U.S. or allied forces seriously injured or killed by enemy forces?						
0 events[b]	76 (11.33)	3 (6.82)	–			
1-5 events	376 (56.04)	16 (36.36)	0.01	0.91	1.08	0.31 – 3.79
6-10 events	79 (11.77)	8 (18.18)	0.10	0.18	2.57	0.66 – 10.03
11+ events	140 (20.86)	17 (38.64)	0.00	0.08	3.08	0.88 – 10.83
In how many separate events have you witnessed U.S. or allied forces being seriously injured or killed by friendly forces?						
0 events[b]	386 (57.53)	22 (50.00)	0.16			
1-5 events	193 (28.76)	12 (27.27)	0.42	0.81	1.09	0.53 – 2.25
6-10 events	31 (4.62)	4 (9.09)	–	0.16	2.26	0.73 – 6.98
11+ events	61 (9.09)	6 (13.64)	0.16	0.26	1.73	0.67 – 4.43
In how many separate events have you witnessed civilians being seriously injured or killed by enemy forces?[c]						
0 events[b]	314 (47.08)	13 (30.23)	0.02			
1-5 events	257 (38.52)	13 (30.23)	0.14	0.62	1.22	0.56 – 2.68
6-10 events	52 (7.80)	9 (20.93)	0.00	0.00	4.18*	1.70 – 10.27
11+ events	44 (6.60)	8 (18.61)	0.00	0.00	4.39*	1.72 – 11.19
Precision Weapon Strike Engagements						
How many times in the past 12 months have you employed weapons as part of your current duties?[d]						
0 events[b]	223 (33.28)	13 (30.23)	0.34			
1-5 events	213 (31.79)	11 (25.58)	0.20	0.77	0.87	0.39 – 2.02
6-10 events	92 (13.73)	9 (20.93)	0.09	0.25	1.68	0.69 – 4.06
11+ events	142 (21.19)	10 (23.26)	0.37	0.66	1.21	0.52 – 2.83
In how many separate events have you felt a sense of shared responsibility for an enemy force death?[d]						
0 events[b]	80 (11.94)	2 (4.55)	–			
1-5 events	166 (24.78)	8 (18.18)	0.18	0.41	1.93	0.40 – 9.27
6-10 events	106 (15.82)	7 (15.91)	0.47	0.23	2.64	0.53 – 13.04
11+ events	318 (47.46)	27 (61.36)	0.03	0.10	3.39	0.79 – 14.56
In how many separate events have you felt a sense of shared responsibility for the injury or death of non-combatant bystanders, when the risk was ANTICIPATED/ACCEPTED?[e]						
0 events[b]	531 (79.37)	23 (53.49)	0.00			
1-5 events	105 (15.70)	10 (23.26)	0.10	0.04	2.20*	1.02 – 4.76
6-10 events	15 (2.24)	4 (9.30)	–	0.00	6.16*	1.89 – 20.02
11+ events	18 (2.69)	6 (13.95)	0.00	0.00	7.70*	2.79 – 21.21
In how many separate events have you felt a shared sense of responsibility for the injury or death of non-combatant bystanders when the risk was UNANTICIPATED?[f]						
0 events[b]	400 (59.97)	14 (33.33)	0.00			
1-5 events	222 (33.28)	18 (42.86)	0.10	0.02	2.32*	1.13 – 4.75
6-10 events	23 (3.45)	5 (11.90)	0.00	0.00	6.21*	2.06 – 18.74
11+ events	22 (3.30)	5 (11.90)	0.00	0.00	6.49*	2.15 – 19.66
In total, how many separate events have you participated in involving the tracking and targeting of an enemy individual for multiple hours and the subsequent elimination of that target?[g]						
0 events	22 (3.30)	0 (0.00)	–			
1-5 events[b]	133 (19.94)	6 (13.95)	0.17			
6-10 events	101 (15.14)	5 (11.63)	0.27	0.88	1.10	0.33 – 3.70
11+ events	411 (61.62)	32 (74.42)	0.05	0.23	1.73	0.71 – 4.22

Note. OR = odds ratio. CI = confidence interval.
[a]Proportion comparisons. Participants were not required to answer any item; items with a reduced response are indicated. [b]Comparison category for logistic regressions. [c]n = 667, n = 43. [d]n = 670, n = 43. [e]n = 669, n = 43. [f]n = 669, n = 42. [g]n = 667, n = 43.
*OR $p < 0.05$.

Table 4
PCL-5 Total Score and DSM-5 Criteria Endorsement.

PCL-5 Total Score	Does Not Meet Symptom Criteria n (% of 715)	Meets Symptom Criteria n (% of 715)
0-11	543 (75.94)	0 (0.00)
12-23	101 (14.13)	2 (0.28)
24-35	25 (3.50)	6 (0.84)
36-47	2 (0.28)	22 (3.08)
48-80	0 (0.00)	14 (1.96)
Total	671 (93.85)	44 (6.15)

people (item 13, 84.09%), and *Feeling very upset when something reminded you of the stressful experience* (item 4, 84.09%). Four of the six items listed above were also the highest reported among the participants who did not meet PTSD symptom criteria. When ranking the top five responses for participants who did not meet PTSD symptom criteria, the only unique item was item 17, *Being "super alert" or watchful or on guard*, but this item was still also reported by over 70% of those who met overall symptom criteria (see Table 5).

3.3. Demographic, operational, and combat event risk factors

Comparisons were run to examine if particular demographic, operational, or combat event variables made participants more likely to endorse overall symptom criteria (meet all 4 B–E criteria). The only demographic variable with a significant relationship with symptom criteria was age range. For operational variables, RPA warfighters working 51 or more hours per week had 2.34 times greater odds of meeting symptom criteria than operators working 40–50 hours per week (see Table 2).

With regard to combat-related events, the number of events in which RPA warfighters witnessed civilian bystanders being killed by enemy forces was a significant predictor of meeting PTSD symptom criteria. The number of separate events in which RPA warfighters felt a sense of shared responsibility for the injury or death of non-combatant bystanders was also a significant predictor, regardless of whether the risk was anticipated or unanticipated (see Table 3).

Table 5
RPA Operators Endorsing Moderately to Extremely on PCL-5 Items.

PCL-5 item	DSM-5 Symptom Cluster Criteria	Does Not Meet Symptom Criteria n = 671 n (%, 95% CI)	Meets Symptom Criteria n = 44 n (%, 95% CI)
1 - Repeated, disturbing, and unwanted memories of the stressful experience	B	42 (6.26, 4.43 – 8.09)	33 (75.00, 62.21 – 87.79)
2 - Repeated, disturbing dreams of the stressful experience	B	28 (4.17, 2.66 – 5.69)	30 (68.18, 54.42 – 81.94)
3 - Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)	B	11 (1.64, 0.68 – 2.60)	26 (59.09, 44.56 – 73.62)
4 - Feeling very upset when something reminded you of the stressful experience	B	42 (6.26, 4.43 – 8.09)	37 (84.09, 73.28 – 94.90)
5 - Having strong physical reactions when something reminded you of the stressful experience (i.e., heart pounding, trouble breathing, sweating)	B	21 (3.13, 1.81 – 4.45)	34 (77.27, 64.89 – 89.66)
6 - Avoiding memories, thoughts, or feelings related to the stressful experience	C	52 (7.75, 5.73 – 9.77)	42 (95.45, 89.30 – 100.00)
7 - Avoiding external reminders of the stressful experience (i.e., people, places, conversations, activities)	C	35 (5.22, 3.53 – 6.90)	33 (75.00, 62.21 – 87.79)
8 - Trouble remembering important parts of the stressful experience	D	19 (2.83, 1.58 – 4.09)	18 (40.91, 26.38 – 55.44)
9 - Having strong negative beliefs about yourself, other people, or the world (i.e., having thoughts like "I am bad," "there is something seriously wrong with me," "no one can be trusted," "the world is dangerous")	D	31 (4.62, 3.03 – 6.21)	27 (61.36, 46.98 – 75.75)
10 - Blaming yourself or someone else for the stressful experience or what happened after it	D	18 (2.68, 1.46 – 3.91)	21 (47.73, 32.97 – 62.49)
11 - Having strong negative feelings such as fear, horror, anger, guilt, or shame	D	17 (2.53, 1.34 – 3.72)	28 (63.64, 49.42 – 77.85)
12 - Loss of interest in activities that you used to enjoy	D	35 (5.22, 3.53 – 6.90)	33 (75.00, 62.21 – 87.79)
13 - Feeling distant or cut off from other people	D	64 (9.54, 7.32 – 11.76)	37 (84.09, 73.28 – 94.90)
14 - Trouble experiencing positive feelings (i.e., being unable to feel happiness or loving feelings for people close to you)	D	35 (5.22, 3.53 – 6.90)	35 (79.55, 67.63 – 91.46)
15 - Irritable behavior, angry outbursts, or acting aggressively	E	51 (7.60, 5.60 – 9.61)	37 (84.09, 73.28 – 94.90)
16 - Taking too many risks or doing things that could cause you harm	E	7 (1.04, 0.27 – 1.81)	23 (52.27, 37.51 – 67.03)
17 - Being "super alert" or watchful or on guard	E	83 (12.37, 9.88 – 14.86)	31 (70.45, 56.97 – 83.94)
18 - Feeling jumpy or easily startled	E	18 (2.68, 1.46 – 3.91)	25 (56.82, 42.18 – 71.45)
19 - Having difficulty concentrating	E	66 (9.84, 7.58 – 12.09)	37 (84.09, 73.28 – 94.90)
20 - Trouble falling or staying asleep	E	139 (20.72, 17.65 – 23.78)	42 (95.45, 89.30 – 100.00)

Note. DSM-5 Symptom Cluster Criteria: B = Re-experiencing, C = Avoidance, D = Negative cognitions/Mood, E = Arousal. CI = confidence interval.

4. Discussion

Overall, the findings of this study reveal that a small portion of RPA warfighters engaged in battlefield operations meet the DSM-5 symptoms criteria for PTSD (i.e., 6.2%). These findings are similar to the outcome results (i.e., 4.3%) of the study conducted by Chappelle, Goodman et al. (2014) based on DSM-IV criteria. The results of this study suggest the estimated rates of PTSD in this study are at the low end of estimated rates (4–18%) when compared with military personnel returning from the battlefield. However, the 12-month prevalence rate of PTSD for participants in this study was twice the rate (i.e., 3.5%) of PTSD when compared with the general U.S. civilian population (American Psychiatric Association, 2013). This suggests this unique group of military personnel (living within and among the U.S. population) is at a higher risk for PTSD, but perhaps the prevalence rate is not as high when compared with those who have personally engaged in combat on the battlefield. However, as mentioned previously, it is difficult to fully compare outcomes across studies with RPA warfighters and military personnel returning from combat due to variability in how symptoms are measured, study design, and nature of the population assessed (Coughlin, 2013).

Additionally, the results of this study reveal that a cut-off score of 24 or higher would correctly identify 95% of RPA warfighters meeting PTSD symptom criteria while restricting the false positive rate to less than 4% of those who did not meet criteria. Subsequently lowering the PCL-5 cut-off score would correctly identify 100% of RPA warfighters who met PTSD diagnostic criteria while increasing the false positive rate to 18% among those who did not meet diagnostic criteria.

4.1. Clinical and subclinical PTSD symptoms for consideration

While the majority of RPA warfighters did not meet symptom criteria for PTSD as outlined in the DSM-5, the percentage of operators who endorsed clinical and subclinical symptoms of arousal (of moderate or higher severity) is concerning due to the potential contributions to flight mishaps (Luna, 2003) and medical incompatibility with USAF RPA operations (see Footnote 1). On the PCL-5, arousal (criteria E) symptoms (i.e., *trouble falling or staying asleep*; *being "super alert" or watchful or on guard*; *having difficulty concentrating*; *irritable behavior, angry outbursts, or acting aggressively*) were endorsed by 3–42% of operators who met PTSD symptom criteria and by 8–20% who did not meet the criteria. The finding of sleep disturbance and difficulty concentrating for both groups is concerning given that military personnel controlling one of the most sophisticated intelligence, surveillance, and reconnaissance weapon systems in the world are expected to be fully alert and well rested prior to each mission. The negative impact of

arousal symptoms may interfere with functioning of higher order cognitive processes (i.e., attention-concentration, vigilance, visual memory, reasoning, and speed and accuracy of information processing) relevant to safe, effective RPA operations (Chappelle, McDonald, & King, 2010, 2011).

It is also likely the endorsement of arousal symptoms in the sample of RPA warfighters is affected by operational issues (e.g., frequent shift changes and long shift schedules disruptive to circadian rhythms). Sleep disturbance is common to individuals engaged in shift work and has been cited by RPA operators as a primary cause of psychological distress and occupational burnout (Chappelle, McDonald, McDonald et al., 2014; Chappelle, McDonald, Prince et al., 2014). The findings of subclinical levels of marked arousal among RPA warfighters are consistent with the findings of an earlier study (Chappelle, Goodman et al., 2014) and likely the consequential outcome of the interaction between both operational and combat-related stressors. Outreach and treatment interventions aimed at addressing marked alterations in arousal and reactivity may be particularly useful at mitigating PTSD symptoms among RPA warfighters.

Additional analyses of group responses to PCL-5 items revealed other cognitive and emotional symptoms of concern. Approximately 33–42% of RPA operators who met criteria (as well as 10–14% of those who did not meet criteria) endorsed *feeling distant or cut off from people* (criteria D); a*voiding memories, thoughts, or feelings related to the stressful experience* (criteria C); *feeling very upset when something reminded [them] of the stressful experience* (criteria B); and *repeated, disturbing, and unwanted memories of the stressful experience* (criteria B). These findings identify areas of functioning for military mental health providers to consider when assessing for negative changes in emotional and social functioning among military personnel engaged in such a unique form of warfare. The identified and self-reported changes in functioning appear consistent with the findings by Campo (2015) suggesting that participation in RPA warfare is not without emotional and social consequences, despite the benefit of living at home and working within the protective borders of the United States.

4.2. Combat, operational, and demographic risk factors for PTSD

The results of this study suggest that specific types of exposure to and participation in missions with specific outcomes (and in particular having a shared responsibility in the act of killing), albeit via electronic, remote means, are associated with an increased risk for meeting PTSD symptom criteria. However, the number of times RPA warfighters deployed weapons to kill enemy combatants (and/or destroy enemy assets), the number of times witnessing real-time acts of killing by enemy or U.S.-allied forces, or sharing in the responsibility for killing enemy combatants (to include missions involving long-term surveillance before killing the combatant) does not necessarily increase the risk for PTSD among RPA warfighters. That being said, those who reported witnessing or sharing in the responsibility of events that involved killing civilian bystanders (whether anticipated or unanticipated) were at substantially higher risk for meeting symptom criteria for PTSD. The risk for PTSD was greatest as the number of combat-related events with civilian casualties increased. This is a potentially interesting expansion on previous research supporting that killing in general increases risk of PTSD symptoms (i.e., Maguen et al., 2010; Komarovskaya et al., 2011; and MacNair, 2002). The responses of RPA warfighters suggest there is a differential response to killing; one might hypothesize that if the killing is considered "justified" (killing enemy combatants) versus killing innocent witnesses, it takes less of an emotional toll on the warfighter. Regardless, involvement in the killing of blameless victims, even within the context of the complexities and unpredictability of the battlefield, appears to be much more difficult for warfighters to process.

The results of the study also revealed RPA warfighters between the ages of 31–40, as well as those working 51+ hours a week, had higher proportions meeting PTSD symptom criteria. These findings raise several questions. It is possible that those in this age range have greater exposure to combat-related events that provoke PTSD. Although postulating on the exhaustive possibilities and explanations for this finding is beyond the scope of this study, the results suggest there is a possible interaction between age and experience with the type and number of exposures to combat-related events (particularly those involving the killing of civilian bystanders). The relationship between age and experience is partially supported by the finding that RPA warfighters who are engaged in such warfare 50+ hours or more a week are at higher risk for meeting PTSD symptom criteria when compared with those who work less time. Regardless, the results of this study have identified a specific age group at an elevated risk who may benefit in particular from outreach efforts.

Furthermore, outreach efforts aimed at the promotion of self-disclosure among USAF weaponized RPA operators may help identify those suffering from distress, regardless of whether or not the operator meets diagnostic criteria for a disorder (e.g., adjustment, anxiety, or trauma-related disorder). The nature of surveillance and deployment of weapons in support of real-time combat operations (albeit from a safe, remote distance within the protective borders of the United States) may logically lead to traumatizing experiences that operators do not want to recall or discuss with others. It is also reasonable to speculate that feeling distant or cut off from others may be the result of operational issues (e.g., 12-hour shift work, constantly changing shift rotations) as well as the requirement to avoid discussion of sensitive and/or classified military operations with non-military personnel. Regardless of the potential causes, the proportion of RPA warfighters suffering from PTSD-related symptoms may provide additional justification for co-locating experienced military mental health providers with the appropriate security clearances within operational units to observe and consult with operators prior to, during, and following operational missions, especially those missions involving the killing of civilian bystanders. This may help increase access to mental health care so operators can discuss troublesome changes in functioning that stem from participation in classified events (i.e., surveillance, targeting, and killing).

4.3. Limitations of the study

Despite meaningful results, this study has limitations that bear consideration. First, a lack of insight and reticence to self-disclose, particularly among military personnel with Top Secret clearance, may have affected results. Although participation was anonymous, the supportive remarks from military leadership encouraging participation may have had the opposite effect of causing participants to feel pressured to minimize self-reporting of symptoms. Second, the results of this study may not generalize to other military personnel. Third, the cross-sectional design of the study limits our ability to understand and examine longitudinal trends. Longitudinal studies are needed to fully assess how the frequency of specific types of exposure leads to changes in emotional, social, and behavioral functioning.

Finally, the use of self-report methodology could affect outcomes due to response bias and motivated responding. When conducting operational field studies where access to military personnel within Top Secret classified environments is highly restricted, there will always be the possibility for sampling bias. This bias occurs because those individuals experiencing distress and wanting to expose their concerns are perceived to be more likely to participate. Although this is often viewed as negative sampling bias, one cannot lose sight of the purpose of the study: this study was designed to expose those who are at risk for experiencing PTSD and the results should be viewed from within such framework. Sampling bias is not necessarily negative if it helps to reveal the intended, at-risk population. Although bias could reduce generalizability to a larger military population, it may also have the benefit of exposing those whom the survey was designed to target. Despite these limitations, the results of the study provide meaningful insight into the

experiences of RPA warfighters and the potential emotional, social, and behavioral consequences of this form of warfare.

5. Conclusions

RPA warfighters are involved in various types of exposure to real-time, combat-related events that include witnessing and sharing in the responsibility for killing. The findings of this study shed light on the prevalence of and risk factors for meeting PTSD symptom criteria. Furthermore, responsibility for, or witnessing, the killing of innocent bystanders may convey higher risk for PTSD symptoms as compared to the killing of enemy combatants. However, the results of this study subsequently raise additional questions. Further research investigating the diagnostic underpinnings of PTSD among RPA warfighters will serve to enhance conceptual understanding of the disorder and inform the genesis of more effective prevention and intervention strategies implemented by aeromedical operational psychologists supporting RPA units.

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