Mental Health Diagnoses and Counseling Among Pilots of Remotely Piloted Aircraft in the United States Air Force

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Remotely piloted aircraft (RPA), also known as drones, have been used extensively in the recent conflicts in Iraq and Afghanistan. Although RPA pilots in the U.S. Air Force (USAF) have reported high levels of stress and fatigue, rates of mental health (MH) diagnoses and counseling in this population are unknown. We calculated incidence rates of 12 specific MH outcomes among all active component USAF RPA pilots between 1 October 2003 and 31 December 2011, and by various demographic and military variables. We compared these rates to those among all active component USAF manned aircraft (MA) pilots deployed to Iraq/Afghanistan during the same period. The unadjusted incidence rates of all MH outcomes among RPA pilots (n=709) and MA pilots (n=5,256) were 25.0 per 1,000 person-years and 15.9 per 1,000 person-years, respectively (adjusted incidence rate ratio=1.1, 95% confidence interval=0.9-1.5; adjusted for age, number of deployments, time in service, and history of any MH outcome). There was no significant difference in the rates of MH diagnoses, including post-traumatic stress disorder, depressive disorders, and anxiety disorders between RPA and MA pilots. Military policymakers and clinicians should recognize that RPA and MA pilots have similar MH risk profiles.

Remotely piloted aircraft (RPA), denoted previously in the U.S. Air Force (USAF) as unmanned aerial vehicles, and known colloquially as drones, joined the aircraft inventory of the U.S. military in the 1960s. RPA pilots in the USAF were designated with a unique specialty code in October 2003, corresponding to the expanding role of these aircraft in Operations Enduring Freedom (OEF) and Iraqi Freedom/New Dawn (OIF/OND). Flight hours for the MQ-1 Predator—the premier intelligence, surveillance, and reconnaissance RPA platform in the USAF—increased tenfold from 2003 to 2009.[1] The psychological impact of this new "telewarfare" on RPA crew members has been the subject of reports in the popular press,[2,3] with some reports claiming higher rates of post-traumatic stress disorder (PTSD) among RPA crew members as compared to their counterparts deployed to the combat theater.[4]

Although a USAF white paper dismissed this claim as "sensational,"[5] the psychological health of RPA crew members remains a topic of military public health and operational concern. Research by Chappelle and colleagues at the USAF School of Aerospace Medicine, Department of Neuropsychiatry, has demonstrated high levels of stress and fatigue among the pilots, sensor operators, and image analysts who comprise the RPA crews. Among 600 crew members of the weapon-deploying Predator and Reaper RPAs who completed a voluntary survey, 15.3% reported feeling very or extremely stressed and 19.5% reported high emotional exhaustion. Among 264 crew members of the RQ-4 Global Hawk, a non-weapon-deploying RPA, these proportions rose to 19.4% and 33.0%, respectively.[6] At the Brookings Institution in 2012, Chappelle noted that 4% of active duty RPA pilots were at "high risk for PTSD" based on this survey. Although this represents a substantial number of service members, it is lower than the 12-17% of soldiers returning from OEF or OIF/OND who are placed in this high-risk category based on post-deployment questionnaires.[7]

Along with witnessing traumatic experiences, such as those associated with PTSD in traditional combat, RPA crew members may face several additional challenges, some of which may be unique to telewarfare: lack of deployment rhythm and of combat compartmentalization (i.e., a clear demarcation between combat and personal/family life);[5] fatigue and sleep disturbances secondary to shift work;[8] austere geographic locations of military installations supporting RPA missions;[6] social isolation during work, which could diminish unit cohesion and thereby increase susceptibility to PTSD;[9] and sedentary behavior with prolonged screen time, implicated as psychological challenges in the adult video gaming community.[10]

This retrospective cohort study is the first to document the frequencies, incidence rates, and trends of mental health (MH) outcomes among RPA pilots within the active component of the USAF, and how these rates compare to those among manned aircraft (MA) pilots (fixed wing and rotary wing) and among airmen in other USAF occupations during the same time period. For the purposes of this study, "combat" is defined broadly as actual or remote deployment to a combat zone, and not necessarily as engagement with enemy combatants.

METHODS

The surveillance period was 1 October 2003—the date at which an airman could first be identified as an RPA pilot by Air Force Specialty Code (AFSC)—through 31 December 2011. The surveillance population included service members who had served at any time in the active component of the USAF.

RPA pilots were defined by the following AFSCs: 11U (RPA pilot); 18A (attack RPA pilot); 18G (generalist RPA pilot); 18R (reconnaissance RPA pilot); and 18S (special operations RPA pilot). MA pilots were defined as airmen deployed to OEF or OIF/OND for greater than 30 days and who had one of the following AFSCs: 11B (bomber pilot); 11F (fighter pilot); 11G (generalist pilot); 11H (rescue pilot); 11M (mobility pilot); 11R (reconnaissance/surveillance/electronic warfare pilot); and 11S (special operations pilot). A pilot could appear in only one cohort during the surveillance period; pilots who met criteria for both RPA and MA were classified as RPA pilots.

RPA pilots were eligible to receive a MH outcome during a window beginning 30 days after designation as an RPA pilot (to allow for development and diagnosis of the outcome) and ending at separation from active service or the conclusion of the surveillance period. MA pilots were eligible to receive a MH outcome during a window beginning 30 days after the start of their first OEF or OIF/OND deployment and also ending at separation from active service or the conclusion of the surveillance period. Pilots with a MH outcome recorded prior to the start of this window were considered prevalent cases and therefore were ineligible to become incident cases for that specific MH outcome. Those diagnosed with more than one MH outcome during the surveillance period were considered incident cases in each category for which they met case-defining criteria, but they were considered an incident case only once for any specific MH outcome. Time-sensitive covariates, such as age, were determined at the start of the surveillance period or, for those who entered after this time, at entry to active military service.

MH outcomes were categorized into two groups: actual mental health diagnoses defined by ICD-9-CM codes (e.g., adjustment disorders, alcohol abuse/dependence, anxiety disorders) and mental health counseling defined by V-codes and E-codes (e.g., suicide ideation/attempt, partner relationship problems, family circumstance problems). For all MH outcomes other than suicide attempt or ideation, cases were defined by at least one hospitalization record with the relevant diagnosis in the first or second diagnostic position, or two records of ambulatory encounters within 180 days with the relevant diagnosis in the first or second diagnostic position, or one ambulatory encounter in a psychiatric or MH care specialty setting with the relevant diagnosis in any diagnostic position **(Table 1)**. Cases of "suicide attempt" and "suicide ideation" were defined by just one ambulatory encounter or hospitalization with that diagnosis. As implied by the name, the category "all" outcomes refers to the total number of times that pilots satisfied a case definition for the outcome of interest, whereas "any" refers to the number of unique individuals who satisfied the case definition for at least one of the outcomes.

TABLE 1. Mental health outcomes and case-defining diagnostic codes, V codes and E codes (ICD-9-CM)

Outcome	ICD-9-CM codes
Adjustment disorder	309.0x-309.9x (exclude 309.81)
Alcohol abuse and dependence	303.xx, 305.0x
Anxiety disorder	300.00-300.09, 300.20-300.29, 300.3
Depressive disorder	296.20-296.35, 296.50-296.55, 296.9x, 300.4, 311
Post traumatic stress disorder	309.81
Substance abuse/dependence	304.xx, 305.2x-305.9x
Suicide ideation/attempt	V62.84, E950.xx-E958.x
Partner relationship problems	V61.0x, V61.1, V61.10 (exclude V61.11, V61.12)
Family circumstance problems	V61.2, V61.23, V61.24, V61.25, V61.29, V61.8, V61.9
Maltreatment related	V61.11, V61.12, V61.21, V61.22, V62.83, 995.80-995.85
Life circumstance problems	V62.xx (exclude V62.6, V62.83)
Mental, behavioral problems and substance abuse counseling	V40xx (exclude V40.0, V40.1), V65.42

All outcomes were obtained from the electronic health care records maintained in the Defense Medical Surveillance System (DMSS) and the Theater Medical Data Store (TMDS).

We calculated incidence rates (IR) per 1,000 person-years and incidence rate ratios (IRR) with 95% confidence intervals (CI). In multivariate analysis, IRRs were adjusted for age, number of deployments, time in service, and history of any MH outcome. Time in service was determined based on the time from entry into military service to first record as an RPA pilot or a fixed wing or rotary wing pilot. All analyses were performed with STATA/IC version 11.2 (STATACorp). P-values less than .05 were considered statistically significant; all P-values were based on 2-sided tests.

RESULTS

A total of 709 USAF service members were identified as RPA pilots and 5,256 as MA pilots (including 4,786 fixed-wing and 470 rotary-wing) during the surveillance period **(Table 2)**. The two cohorts were relatively similar in terms of demographics and military characteristics. RPA pilots were predominantly male (94.6%) with an average (standard deviation) age of 32.3 (5.5) years. Nearly 86% were non-Hispanic whites, 74% were married, and 70% were company grade officers (i.e., lieutenants and captains). Compared to MA pilots, a greater percentage of RPA pilots had been deployed three or more times in any occupational capacity (48% versus 31%; $p<0.001$), had prior MH diagnoses (27% versus 16%; $p<0.001$) and had six or more years in service (75% versus 60%; $p<0.001$).

Of the 709 USAF service members who met criteria for an RPA pilot, only 82 were RPA pilots exclusively and had never been deployed. The majority of RPA pilots had been previously deployed as MA pilots. (While use of mutually exclusive cohorts is ideal, restricting the RPA cohort to those 82 pilots would have resulted in insufficient statistical power to conduct our analysis.)

Approximately 8.2 percent (n=58) of RPA pilots and 6.0 percent (n=313) of MA pilots had at least one MH outcome **(Table 3)**. The incidence rates of all MH

TABLE 2. Demographic and military characteristics of USAF RPA and MA pilots, 1 October 2003-31 December 2011

	RPA pilots		MA pilots	
	No.	%	No.	%
Total	709	100	5,256	100
Sex				
Female	38	5.4	142	2.7
Male	671	94.6	5,114	97.3
Age				
20-24	1	0.1	401	7.6
25-29	271	38.2	2,194	41.7
30-34	243	34.3	936	17.8
35-39	108	15.2	870	16.6
40+	86	12.1	855	16.3
Race/ethnicity				
White non-Hispanic	606	85.5	4,792	91.2
Black non-Hispanic	21	3.0	100	1.9
Hispanic	34	4.8	100	1.9
Asian/Pacific Islander	19	2.7	65	1.2
Other	29	4.1	199	3.8
Marital status				
Single	152	21.4	1,374	26.1
Married	526	74.2	3,752	71.4
Other	31	4.4	130	2.5
Education level				
College	500	70.5	3,308	62.9
Advanced degree	175	24.7	1,793	34.1
Other	34	4.8	155	2.9
No. of deployments				
0	82	11.6	0	0.0
1	148	20.9	2,001	38.1
2	138	19.5	1,627	31.0
3+	341	48.1	1,628	31.0
Total time deployed				
<6 months	283	39.9	1,978	37.6
6-12 months	239	33.7	1,959	37.3
13-18 months	140	19.7	935	17.8
18+ months	47	6.6	384	7.3
Military rank				
2LT-CPT	494	69.7	3,297	62.7
MAJ-COL	215	30.3	1,959	37.3
Time in USAF prior to AFSC				
<6 years	178	25.1	2,126	40.4
6-10 years	253	35.7	1,129	21.5
11-15 years	187	26.4	1,487	28.3
16+ years	91	12.8	514	9.8
Prior MH outcome	191	26.9	852	16.2

Abbreviations: AFSC, Air Force Specialty Code; MA, manned aircraft; MH, mental health; RPA, remotely piloted aircraft; USAF, United States Air Force

outcomes among RPA pilots was 25.0 per 1,000 person-years and among MA pilots was 15.9 per 1,000 person-years (adjusted IRR=1.1, 95% CI=0.9-1.5). After adjustment, RPA pilots and MA pilots had statistically equivalent incidence rates of total and individual MH outcomes evaluated **(Table 3, Figure 1)**. Adjustment disorder and depressive disorder were the two most common diagnoses in both RPA and MA pilots, while partner relationship and life circumstance problems were the two most common counseling codes.

The trend of annual rates (unadjusted) of MH outcomes among RPA pilots markedly differed from the trend among MA pilots. For example, annual rates of MH outcomes among MA pilots slowly increased throughout OEF and OIF/OND and were highest (29 per 1,000 person-years) in 2011. In contrast, among RPA pilots, annual rates remained relatively stable from 2005 through 2008, increased markedly in 2009 and 2010, and then nearly returned to baseline in 2011. Of note, each year from 2005 through 2011 (and particularly in 2009 and 2010), rates (unadjusted) of MH outcomes were higher among RPA than MA pilots **(Figure 2)**.

Finally, incidence rates (unadjusted) of any mental health outcomes were lower among RPA and MA pilots than USAF members in health care, administrative/supply, combat-specific, and "other" occupations, as well as among USAF members overall **(Figure 3)**.

EDITORIAL COMMENT

This report documents the frequencies, incidence rates, and trends of MH outcomes among RPA pilots within the active component of the USAF compared to those among USAF MA pilots during the same time period. Between October 2003 and December 2011, approximately one of every 12 RPA pilots and one of every 17 MA pilots received at least one incident MH outcome (i.e., first diagnosis of the outcome during their military careers). After adjusting for the effects of several factors that differed between the RPA and MA pilots, incidence rates among the cohorts did not significantly differ. Despite self-reports of high levels of stress and fatigue among RPA pilots, this study did not find higher adjusted rates of MH outcomes among this cohort compared to MA pilots.

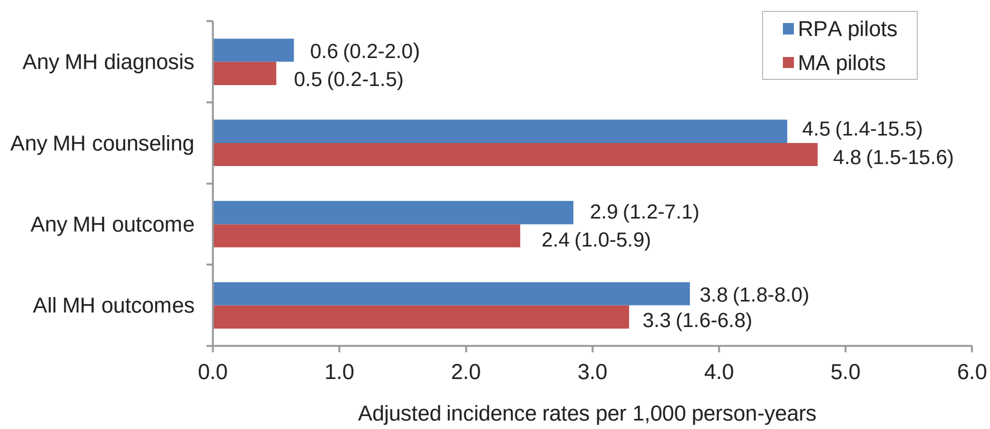
RPA and MA pilots had lower unadjusted incidence rates of any MH outcome as compared to USAF members overall and to specific occupational groups within the USAF. Several factors may explain this finding. First, as a highly screened and selected group, USAF pilots are likely less prone to MH outcomes as compared to airmen in other occupations. All USAF pilots are college graduates who have passed stringent physical requirements, psychological standards, legal and behavioral

TABLE 3. Incidence rates and rate ratios of mental health outcomes by pilot type, 1 October 2003-31 December 2011

	Mental health outcomes	RPA pilots No.	RPA pilots IR[a] (95% CI)	MA pilots No.	MA pilots IR[a] (95% CI)	Unadjusted IRR (95% CI)	Adjusted IRR[b] (95% CI)
Diagnoses	Adjustment disorders	22	6.6 (4.4-10.1)	104	3.6 (2.9-4.3)	1.9 (1.2-2.9)	1.4 (0.9-2.3)
	Alcohol abuse/dependence	3	0.9 (0.3-2.7)	25	0.9 (0.6-1.3)	1.0 (0.3-3.4)	1.0 (0.4-2.7)
	Anxiety disorder	9	2.7 (1.4-5.1)	36	1.2 (0.9-1.7)	2.2 (1.0-4.5)	1.3 (0.6-2.9)
	Depressive disorder	11	3.3 (1.8-5.9)	46	1.6 (1.2-2.1)	2.1 (1.1-4.0)	1.4 (0.7-2.9)
	Posttraumatic stress disorder	3	0.9 (0.3-2.7)	20	0.7 (0.4-1.0)	1.3 (0.4-4.3)	0.6 (0.2-2.2)
	Substance abuse/dependence	1	0.3 (0.0-2.1)	1	0.0 (0.0-0.2)	8.6 (0.5-138)	---
	Any mental health diagnosis	37	10.9 (7.9-15.0)	176	6.0 (5.2-7.0)	1.8 (1.3-2.6)	1.3 (0.9-1.9)
Counseling	Suicide ideation/attempt	0	0.0	1	0.0 (0.0-0.2)	---	---
	Partner relationship problems	14	4.2 (2.5-7.1)	101	3.5 (2.9-4.2)	1.2 (0.7-2.1)	1.0 (0.5-1.7)
	Family circumstance problems	2	0.6 (0.1-2.4)	7	0.2 (0.1-0.5)	2.5 (0.5-11.8)	1.9 (0.4-9.6)
	Maltreatment related	0	0.0	4	0.1 (0.1-0.4)	---	---
	Life circumstance problems	16	4.8 (2.9-7.8)	85	2.9 (2.4-3.6)	1.6 (1.0-2.8)	1.3 (0.7-2.2)
	Mental, behavioral problems, substance abuse	4	1.2 (0.4-3.1)	34	1.2 (0.8-1.6)	1.0 (0.4-2.9)	0.7 (0.2-1.9)
	Any mental health counseling	30	8.8 (6.2-12.6)	205	7.0 (6.1-8.0)	1.3 (0.9-1.8)	1.0 (0.6-1.4)
Any mental health outcome		58	17.1 (13.2-22.1)	313	10.7 (9.6-12.0)	1.6 (1.2-2.1)	1.2 (0.9-1.6)
All mental health outcomes		85	25.0 (20.2-30.9)	464	15.9 (14.5-17.4)	1.6 (1.3-2.0)	1.1 (0.9-1.5)

Incidence rates per 1,000 person-years
Abbreviations: CI, confidence interval; IR, incidence rate; IRR, incidence rate ratio; MA, manned aircraft; RPA, remotely piloted aircraft
[a]Unadjusted incidence rates
[b]Adjusted for age, number of deployments, time in service, and history of any mental health outcome

FIGURE 1. Adjusted incidence rates[a] of MH outcomes, by pilot type, U.S. Air Force, 1 October 2003-31 December 2011



[a]Incidence rates per 1,000 person-years with 95% confidence intervals
Abbreviations: MH, mental health; RPA, remotely piloted aircraft

background checks, and rigorous operational training programs.[11] Flight surgeons evaluate all pilot candidates for occupational suitability, which includes emotional and behavioral screening. Discovery of psychoses, neuroses, or personality disorders, for example, may result in disqualification.[12] Second, these findings may reflect the effects of special preventive measures for pilots. As compared to airmen in other occupations, pilots undergo more robust periodic health assessments and may have better access to care given the relatively low ratio of pilots to flight surgeons.

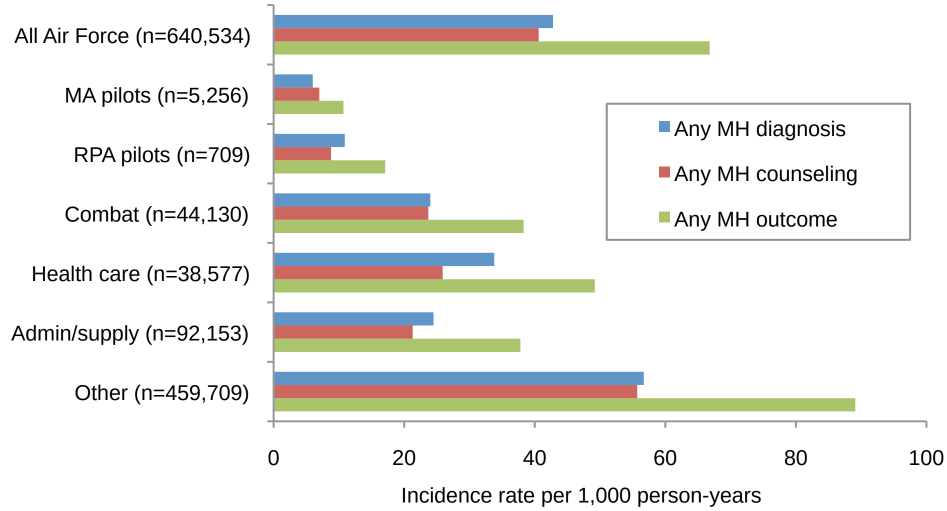
Conversely, the relatively low rates of mental disorder diagnoses among Air Force pilots compared to their counterparts may reflect artificial underreporting of the concerns of pilots due to detrimental career ramifications from incurring MH diagnoses (but not counseling); the career-threatening effects of MH diagnoses include removal from flying status, loss of flight pay, and diminished competitiveness for promotion. Current USAF aeromedical policy requires that pilots with a MH diagnosis be immediately "grounded," or removed from flying status. An aeromedical waiver to resume flight duty cannot be submitted until the individual has been appropriately treated and has been asymptomatic and without medications for a specified time period. Although this time period varies by diagnosis and flight surgeon discretion, it typically ranges from six months to one year. A pilot with an alcohol abuse or dependence diagnosis, for example, cannot return to flying status until completion of alcohol rehabilitation, which includes abstinence training and 90 days in a post-treatment aftercare program.[13] Some MH diagnoses may require a medical evaluation board for the individual to remain in the USAF.[14]

Several important factors distinguish these findings from those reported

FIGURE 2. Unadjusted incidence rates[a] of MH outcomes[b], by pilot type, U.S. Air Force, 1 October 2003-31 December 2011

[a]Incidence rates per 1,000 person-years
Abbreviations: MA, manned aircraft; MH, mental health; RPA, remotely piloted aircraft

FIGURE 3. Unadjusted incidence rates[a] of MH outcomes by USAF occupation, 1 October 2003-31 December 2011



[a]Incidence rates per 1,000 person-years (non-RPA and non-MA pilots are included in "Other")
Abbreviations: MA, manned aircraft; MH, mental health; n, number of unique individuals; RPA, remotely piloted aircraft; USAF, United States Air Force

in case series and the lay press. The results presented here reflect healthcare provider-assigned clinical diagnostic codes entered into the electronic medical records of service members. In contrast, other published studies have relied upon self-reported data from anonymous questionnaires, which reflect symptoms rather than formal diagnoses.

The findings of this report should be interpreted within the context of at least four limitations. First, capture of incident MH outcomes may be incomplete. Incident cases were ascertained from ICD-9-CM diagnostic codes recorded on standardized administrative records of medical encounters. As such, the findings only reflect outcomes that were clinically detected. To the extent that pilots received care from sources not captured by DMSS (e.g., private practitioner), or did not seek care (e.g., due to career concerns outlined above, social stigmas, or the unavailability of MH providers), the numbers reported here are underestimates. Moreover, diagnoses used to identify cases for this report were not confirmed by medical record review. In addition, while TMDS captures most MH outcomes diagnosed in deployed medical facilities, this data source may be incomplete. However, since the percentage of total person-time deployed was small and comparable—6% among MA pilots and 5% among RPA pilots—this is unlikely to introduce bias.

Second, analyses for this report were limited to the medical encounters of active component members of the USAF only. This report does not contain data for the Air Force Reserves or Air National Guard, nor does it include data on other services within the active component (i.e., Army, Navy, and Marine Corps). Its findings, therefore, may not be generalizable to other military components and services.

Third, this study utilized AFSCs as surrogates for exposure (i.e., remote combat or traditional combat). In reality, both RPA and MA pilots likely experienced differential levels of exposure. An ideal analysis would incorporate hours exposed to remote combat in the RPA cohort and the hours exposed to traditional combat in the MA cohort, but such granular data were unavailable. Instead, deployment and demographic records were employed to determine exposure time, and multivariate analysis was used to control for deployment duration. Even if hours engaged in combat were identical in the two cohorts, combat experiences may diverge. Both RPA and MA pilots conduct different types of missions with different objectives (e.g., conducting surveillance or deploying munitions). Given the lack of evidence linking type of aerial mission with likelihood of mental health outcomes, we did not stratify within each cohort. In addition, airmen were classified as RPA pilots even if they also met criteria as MA pilots during the surveillance period; without mutual exclusivity of the cohorts, there may be bias toward the null.

Fourth, the findings are based on incident, dichotomous MH outcomes. Recurrent outcomes were not assessed, and the diagnostic codes used to determine cases do not reflect the clinical severity of the outcome.

In summary, the findings of this report suggest that remote combat does not increase the risk of MH outcomes beyond that seen in traditional combat. Military policymakers and clinicians should recognize that RPA pilots have a similar MH risk profile as MA pilots. Although unadjusted rates of MH outcomes among both cohorts of pilots were much lower than rates among those in other USAF occupations, further research is needed to evaluate the impact of aeromedical policy on these rates, as well as the effect of remote combat on other RPA crew members.

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