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16. Abstract

Introduction. This study investigated the impact of selective serotonin reuptake inhibitor (SSRI) use on the cognitive performance of pilots, aiming to assess the necessity and frequency of neurocognitive evaluations mandated by current aeromedical guidelines.

Methods. This study was conducted among medically-certificated airmen with a psychiatric diagnosis that were previously approved for SSRI use and subsequently applied for a new medical certificate between October 2019 and January 2022. Utilizing data from medically-certificated airmen with psychiatric diagnoses and approved SSRI use, the study examined variables such as age, SSRI type, psychiatric diagnoses, cognitive tests, and comorbidities. The analysis employed logistic regression to determine associations with abnormal cognitive outcomes measured by CogScreen testing.

Results. There were 425 distinct airmen who met the inclusion criteria for the study. Results revealed that age and initial class issued significantly influenced abnormal cognitive outcomes, with pilots aged 35 and older showing higher odds of abnormal results. Moreover, the study examined the testing interval's adequacy and questioned if over-testing occurred. Findings suggested that despite initial cognitive concerns, repeated testing often lead to improved scores, raising concerns about the necessity of frequent evaluations. The analysis of neuropsychologist opinions indicated a lack of alignment with Aeromedical certification decisions, emphasizing the need for further investigation into decision-making processes. Lastly, the study explored the characteristics of pilots denied issuance at their last exam, finding no significant differences in cognitive scores or other relevant variables compared to the issued group.

Conclusion. While the study provides valuable insights into SSRI-treated pilots, its limitations, such as survivorship bias, necessitate future research to comprehensively address cognitive safety in aviation and refine aeromedical protocols.

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Review of SSRI Cases to Assess Potential for Cognitive Decline

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Introduction

As aeromedical guidelines have changed over the years to allow more airmen using SSRIs to fly, policy has required closer examination of the medical certification protocol used to certificate these airmen. In 2010, the Office of Aerospace Medicine demonstrated that a single CogScreen-AE (cogscreen) was sufficient to determine qualification status of typically-functioning airmen, with repeat cogscreens annually for first- and second-class airmen and every 2 years for third-class airmen. However, limited research exists in the Aerospace Medicine Field regarding cogscreen testing in pilots. Concerns have arisen that the requirements for an airman to remain on an SSRI may not always be in the airman's best interest. The main concerns are: 1) is there an apparent association between use of SSRIs and cognitive decline in airmen and 2) is there an optimal testing interval to lessen the frequency of when a neurocognitive evaluation would be required of an airman? Using a specific population of pilots on SSRIs in the Aerospace Medicine dataset, the goal of this project was to collect data and analyze neurocognitive testing to answer the two questions above.

Methods

This study was conducted among medically-certificated airmen with a psychiatric diagnosis that were previously approved for SSRI use and subsequently applied for a new medical certificate between October 2019 and January 2022. To examine any long-term effects on cognition of SSRIs and to determine if potential over-testing has occurred, this population was selected to give us the most long-term, stable population of pilots on SSRIs. This project falls under our existing Operational Analysis IRB exempt status protocol #19029, using archival data in DIWS.

This exploratory analysis utilized exposure data from DIWS to determine if there was any association with our outcome of interest. The two Headquarter nurses diligently collected data from DIWS for every pilot who fit our study population. Because one of the main concerns was assessing cognitive decline in pilots, our outcome of interest was a suspicious case arising from abnormal values on a pilot's cogscreen. Based on discussions with Drs. Georgemiller and Flynn, we determined the definition of a suspicious case would be 1) an LRPV score higher than 0.8 on any cogscreen, 2) total Base and Taylor t-scores <40 on 3 or more categories, and 3) a combination of the two on any cogscreen test as a best predicator of a potential cognitive deficient case. Therefore, for every cogcreen administered to this population, the nurses collected LRPV scores, Base Rate Analysis 5^{th} and 15^{th} percentile scores, Taylor Aviation Factor Scores, the neuropsychologist opinion of cognitive deficits, any other battery of tests that were

subsequently performed, and finally the AAM decision for that particular cogscreen/testing outcome.

Potential exposure data collected included start date of SSRI, gender, psychiatric diagnoses, first exam date where SSRI was measured, and medications. Based on advice from Dr. Flynn, psychiatric diagnoses were categorized into 4 categories: mood, anxiety, substance abuse, and other categories. We also examined evidence for potential biological mechanisms of exposure by examining association with morbidities of interest. While many comorbidities were initially collected, based on subject matter opinion, we included diabetes, thyroid disease, and migraines as specific ones of interest. Finally, as age is a known confounder in assessing potential associations between suspicious cases and covariates, we determined a priori that age would be categorized by ≥ 35 years and <35 years, and included in any logistic regression. Statistical analyses were conducted using SAS v.9.4.

Results

We identified 425 distinct airmen who had a psychiatric diagnosis, were previously approved for SSRI use, and subsequently applied for a new medical certificate between October 2019 and January 2022.

Mean, Distribution and Frequencies of Exploratory Variables

Table 1 displays the mean and median time an airman was taking an SSRI was 9.35 and 8.26 years, respectively. The mean and median time in AAM's actual SSRI surveillance program was 4.78 and 4.01, respectively. The mean number of cogscreen tests during the program was similar to the time airmen were actively monitored, which is expected since many needed to obtain cogscreen testing every year to remain eligible. Figure 1 displays the distribution of maximum number of cogscreen tests performed by each airman, with the majority dropping out after only three or four cogscreen tests. Finally, the overall mean and median age was 42.9 and 45.6 years.

Table 1: Means, Median, and Range for Variables of Interest

Variable	N	Mean	Median	Std Dev	Minimum	Maximum
Years on SSRI	425	9.35	8.26	5.99	0.56	36.64
Time on SSRI program	425	4.78	4.01	3.1	0	17.17
Number of Cogscreens	425	4.36	4	2.72	1	13
Baseline Age	425	42.93	45.58	12.77	16.23	72.53

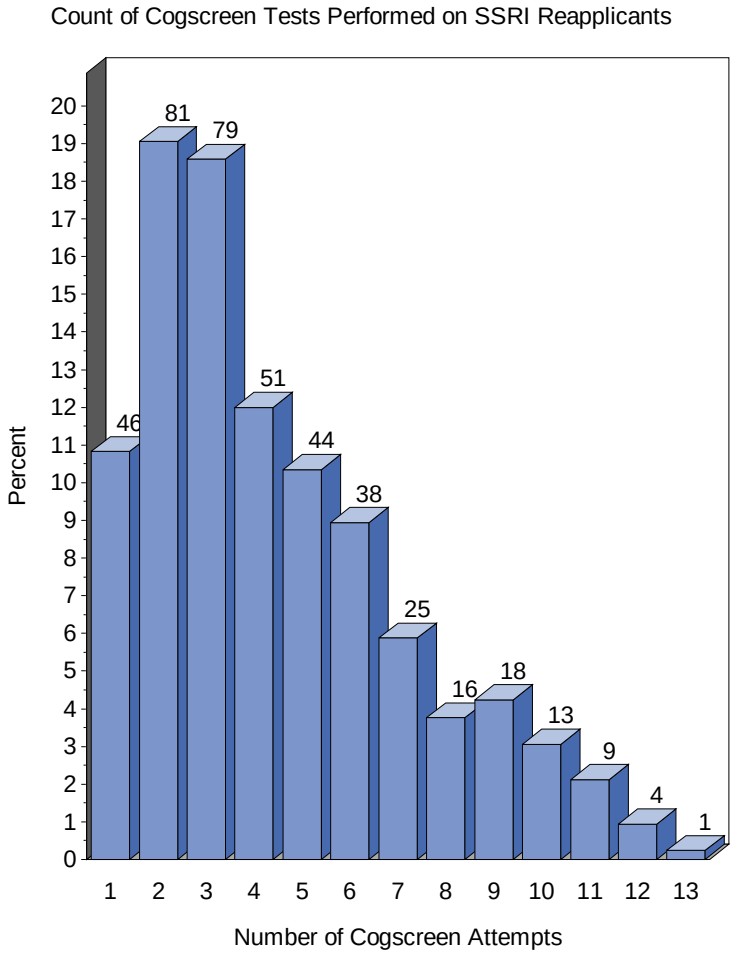


Figure 1

Table 2 gives frequencies for the rest of the variables of interest. Over 10 percent of this airman population was female. Each airman in our study reported taking only one SSRI medication at baseline. Lexapro was the top SSRI type used (38%). The majority of airmen reported mood and/or anxiety disorders. Of those with a mood disorder, 28% were taking Zoloft, 19% took Prozac, 35% took Lexapro, and 18% took Celexa. For airmen with anxiety disorders, 32% took Zoloft, 18% took Prozac, 40% took Lexapro, and 10% took Celexa. Of those with substance abuse disorders, 24% were taking Zoloft, 20% took Prozac, 40% took Lexapro, and 16% took Celexa. Finally, for "other" disorders not categorized by the earlier three, 26% took Zoloft, 21% took Prozac, 29% took Lexapro, and 24% took Celexa. Please note that an airman could have up to three psychiatric diagnoses noted, so there is overlap between these groups. While number of medications an airman took varied from one to eight, only 17% took four or more, and 44% reported their SSRI as the only medication they were currently taking. While initially these specific conditions were of interest to the SMEs, very few airmen reported having diabetes (2.8%), thyroid disease (4.9%), or migraines (3.8%). Finally, at the time of their first cogscreen,

while 80% were initially issued, there were 93 of the 425 airmen who were denied or deferred at the start of their SSRI surveillance.

Table 2: Frequencies of Baseline Variables

Variables	Frequency N=425 (%)
Gender	
Female	43 (10.1)
Male	382 (89.9)
SSRI Use	
Celexa	62 (14.6)
Lexapro	161 (37.9)
Prozac	78 (18.4)
Zoloft	124 (29.2)
Psychiatric Disorders*	
Mood	243 (57.2)
Anxiety	252 (59.3)
Substance Abuse	45 (10.6)
Other	38 (8.9)
Number of Medications	
1 only	187 (44.0)
2	103 (24.2)
3 or more	135 (31.8)
Baseline Class Issued	
First	180 (42.4)
Second	30 (7.1)
Third	122 (28.7)
Unissued	93 (21.9)
Diabetes	
Yes	12 (2.8)
No	413 (97.2)
Thyroid Disease	
Yes	21 (4.9)
No	404 (95.1)
Migraines	
Yes	16 (3.8)
No	409 (96.2)

*Percentages will total greater than 100 because airman can be in multiple categories

Assessment of Variables with Time in the SSRI Program

Next, we assessed variables that were independently associated with overall time in the study. The ten figures at the bottom of this summary detail the variable effects on duration in the study. Pilots who were younger than 35 years old at baseline dropped out of the surveillance program earlier than those 35 years or older ($p<0.001$). While overall not statistically significant, females dropped out at a higher rate than males within the first 5 years of surveillance. Those airmen taking Celexa stayed in the program longer than any other SSRI medication group ($p=0.0548$).

Interestingly, the initial class an airman was given did not affect the overall number of years in the study. In fact, those initially unissued, whether deferred or denied, appeared to stay in the system just as long if not longer than many who were initially issued a first- or third-class certificate, although not significant.

Number of psychiatric diagnoses did not affect how long an airman stayed in the system. However, airmen reportedly taking only their SSRI medication and no other medications were associated with a shorter time overall in our system compared with those taking more than one medication ($p=0.0053$). Finally, those with a reported mood disorder stayed in the system longer than those who did not report that diagnoses ($p=0.0047$), while the opposite was true for those reporting an anxiety disorder. Only 34% of those reporting anxiety were still in the program after 5 years, compared with 48% who did not report anxiety disorders ($p=0.0001$). Finally, although not statistically significant, those with substance abuse dropped out slightly earlier than those not reporting that diagnoses.

Cogscreen Outcome Assessment

In order to assess our hypotheses regarding presence of cognitive deficiency, we examined our outcome of interest from results of the airmen's individual cogscreens.

Table 3 below details the means of LRPV scores and total Base and Taylor t-scores <40 on 3 or more categories, categorized by age less than 35 and those 35 and older. The mean and median initial LRPV score for those over 35 are 0.4 and 0.26, respectively, compared with the lower means of 0.17 and 0.04, respectively, for those under 35 years old ($p<0.001$). The mean and median initial lower t-scores equal to 3 or more for those over 35 are 1.61 and 1.00, which is significantly higher than the 1.13 and 0.00 mean and median in those younger than 35 ($p=0.0246$). This trend holds true for both variables in the age categories throughout all the cogscreen time-points. Interestingly, both mean LRPV and low t-scores equaled 3 or greater are highest at the initial cogscreen, and then drop down significantly during the second cogscreen time-point, regardless of age category.

Table 3: Means of LRPV scores and total Base and Taylor t-scores <40 on 3 or more categories for each cogscreen time point by Age Category

Baseline Age	N Obs	Variable	N	Mean	Median	Std Dev	Minimum	Maximum
≥ 35 Years	314	LRPV score Time 1	312	0.40	0.26	0.37	0.00	1.00
		LRPV score Time 2	282	0.23	0.08	0.30	0.00	1.00
		LRPV score Time 3	232	0.29	0.12	0.32	0.00	1.00
		LRPV score Time 4	173	0.21	0.08	0.28	0.00	1.00
		LRPV score Time 5	137	0.23	0.07	0.30	0.00	0.99
		LRPV score Time 6	99	0.24	0.09	0.29	0.00	0.99
		LRPV score Time 7	70	0.19	0.05	0.28	0.00	0.98
		LRPV score Time 8	50	0.19	0.09	0.26	0.00	0.99
		LRPV score Time 9	39	0.16	0.04	0.27	0.00	0.92
		LRPV score Time 10	24	0.12	0.04	0.17	0.00	0.70
		LRPV score Time 11	11	0.12	0.03	0.18	0.00	0.50
		LRPV score Time 12	4	0.03	0.03	0.02	0.01	0.05
		LRPV score Time 13	1	0.33	0.33	.	0.33	0.33
		Total t-score <40 Time 1	314	1.61	1.00	2.03	0.00	10.00
		Total t-score <40 Time 2	285	0.87	0.00	1.39	0.00	7.00
		Total t-score <40 Time 3	233	0.63	0.00	1.01	0.00	5.00
		Total t-score <40 Time 4	174	0.67	0.00	1.20	0.00	7.00
		Total t-score <40 Time 5	137	0.55	0.00	0.94	0.00	4.00
		Total t-score <40 Time 6	99	0.41	0.00	0.86	0.00	4.00
		Total t-score <40 Time 7	70	0.37	0.00	0.78	0.00	4.00
		Total t-score <40 Time 8	50	0.38	0.00	0.57	0.00	2.00
		Total t-score <40 Time 9	39	0.23	0.00	0.48	0.00	2.00
		Total t-score <40 Time 10	24	0.42	0.00	1.10	0.00	5.00
		Total t-score <40 Time 11	11	0.55	0.00	1.04	0.00	3.00
		Total t-score <40 Time 12	4	0.50	0.00	1.00	0.00	2.00
		Total t-score <40 Time 13	1	0.00	0.00	.	0.00	0.00
<35 Years	111	LRPV score Time 1	110	0.17	0.04	0.25	0.00	0.98
		LRPV score Time 2	93	0.07	0.01	0.18	0.00	0.98
		LRPV score Time 3	65	0.12	0.03	0.20	0.00	0.99
		LRPV score Time 4	45	0.05	0.01	0.10	0.00	0.52
		LRPV score Time 5	31	0.08	0.01	0.18	0.00	0.90
		LRPV score Time 6	25	0.07	0.02	0.12	0.00	0.51
		LRPV score Time 7	16	0.04	0.01	0.06	0.00	0.21
		LRPV score Time 8	11	0.05	0.03	0.07	0.00	0.25
		LRPV score Time 9	6	0.12	0.02	0.24	0.00	0.60
		LRPV score Time 10	3	0.08	0.01	0.12	0.00	0.21
		LRPV score Time 11	3	0.00	0.00	0.00	0.00	0.01
		LRPV score Time 12	1	0.03	0.03	.	0.03	0.03
		LRPV score Time 13	0	.	.	.	.	.
		Total t-score <40 Time 1	111	1.13	0.00	1.71	0.00	9.00
		Total t-score <40 Time 2	94	0.56	0.00	1.06	0.00	4.00
		Total t-score <40 Time 3	65	0.37	0.00	0.86	0.00	4.00
		Total t-score <40 Time 4	45	0.33	0.00	0.77	0.00	3.00
		Total t-score <40 Time 5	31	0.16	0.00	0.45	0.00	2.00
		Total t-score <40 Time 6	25	0.36	0.00	0.70	0.00	2.00
		Total t-score <40 Time 7	16	0.31	0.00	0.79	0.00	3.00
		Total t-score <40 Time 8	11	0.82	0.00	1.33	0.00	4.00
		Total t-score <40 Time 9	6	0.33	0.00	0.82	0.00	2.00
		Total t-score <40 Time 10	3	0.33	0.00	0.58	0.00	1.00
		Total t-score <40 Time 11	3	0.00	0.00	0.00	0.00	0.00
		Total t-score <40 Time 12	1	0.00	0.00	.	0.00	0.00
		Total t-score <40 Time 13	0	.	.	.	.	.

Because our main goals were twofold-to determine if AAM is over-testing, and if there is any evidence of cognitive decline in these pilots- we further assessed our 3 categories of suspicious cases. In order to determine if AAM is truly over-testing these airmen, this study assessed every case that is flagged as suspicious even by one of these definitions. Table 4 provides a breakdown of number and percentages of suspicious cases flagged for each of our three definitions at each cogscreen time-point. To note, the third definition of a suspicious case where cogscreens have both an abnormal LRPV value and 3 or more t-scores with values less than 40 is the most stringent definition because it combines the first two criteria. It is noteworthy that the number and percentage of flagged cases in each category fall drastically after the initial cogscreen. After the third cogcreen, the percentages level out, although only about half of the airmen remain in the program at that time.

Table 4: Number and Percentage of the Three Definitions of Suspicious Cogscreens per Test

	Number of Airmen Remaining	Number of Cogscreens with abnormal LRPV value (%)	Number of Cogscreens with at least 3 t-scores less than 40 (%)	Number of Cogscreens with both an Abnormal LRPV and t-scores (%)
Cogscreen 1	425	80 (18.8%)	96 (22.6%)	42 (9.9%)
Cogscreen 2	379	28 (7.4%)	38 (10.0%)	8 (2.1%)
Cogscreen 3	298	33 (11.1%)	21 (7.1%)	7 (2.4%)
Cogscreen 4	219	13 (5.9%)	19 (8.7%)	4 (1.8%)
Cogscreen 5	168	15 (8.9%)	8 (4.8%)	3 (1.8%)
Cogscreen 6	124	8 (6.5%)	5 (4.0%)	1 (0.8%)
Cogscreen 7	86	5 (5.8%)	3 (3.5%)	0 (0.0%)
Cogscreen 8	61	3 (4.9%)	1 (1.6%)	0 (0.0%)
Cogscreen 9	45	3 (6.7%)	0 (0.0%)	0 (0.0%)
Cogscreen 10	27	0 (0.0%)	1 (3.7%)	0 (0.0%)
Cogscreen 11	14	0 (0.0%)	1 (7.1%)	0 (0.0%)
Cogscreen 12	5	0 (0.0%)	0 (0.0%)	0 (0.0%)
Cogscreen 13	1	0 (0.0%)	0 (0.0%)	0 (0.0%)

In-Depth Assessment of Outcome Definition 1: Number with Abnormal LRPV values

Of the 113 distinct airmen who were "flagged" for having at least one LRPV value over 0.8, 68 (60%) had at least one abnormal LRPV value without 2 normal LRPV values immediately after. This is noteworthy due to SME opinion that presence of one flagged instance would likely need two subsequent cognitive tests that were normal to be fairly certain no cognitive deficit exists. However, this also includes several airmen who had a high LRPV value but then underwent additional testing that was subsequently normal, and were issued due to additional testing. Thus, for this section, a cognitive assessment was deemed abnormal if the cogscreen LRPV score was greater than 0.80 and, if applicable, any other approved test battery was noted as a failed test.

However, if the airmen took a cogscreen and then further testing and passed either time, the assessment was categorized as initially flagged but deemed normal after further testing.

- Of the 560 cogscreens the 113 airmen with at least one "flagged" LRPV underwent, 188 (33.5%) cogscreens had high LRPVs. Only 9 of these 113 airmen were under the age of 35.
- 42 of the 113 had more than one high LRPV incident.
- 80 of the 113 had suspicious cases on their baseline cogscreen. Of these 80, 36 (45%) were initially deferred/denied.
- 46 of 113 had their only suspicious case on their first exam, and none after.
- 75% of all cogscreens that had an initially high LRPV value were issued anyway
- Only 4 of the 113 never got issued after their last abnormal LRPV value. However, all 4 would have all been caught by their initial cogscreen that had a high LRPV value, and all 4 were subsequently denied. Three of the four only had one cogscreen in the system, and the fourth went on to have 2 additional cogscreens that were denied anyway.

Table 5 summarizes the categories all the airmen who had abnormal LRPV values:

	Number of Distinct Airmen*	Number of "Flagged" LRPVs
Airmen who had at least one abnormal cognitive assessment and were not issued	24 (21%)	28 (15%)
Airmen who had at least one abnormal LRPV but had subsequent normal testing and were still not issued	18 (16%)	19 (10%)
Airmen who had at least one abnormal cognitive assessment and were issued	51 (45%)	75 (40%)
Airmen who had at least one abnormal LRPV but had subsequent normal testing and were then issued	53 (47%)	66 (35%)

*totals won't add to 100% because the same airmen could be in several cells

Finally, we performed multivariate logistic regression to determine any variables that were significantly associated with having an abnormal LRPV score. Age less than 35 years and class issued at study baseline were the only variables that was significantly associated. In the final model, the odds of having at least one abnormal LRPV was 5.1 (95% 2.46, 10.62) times higher in pilots 35 years or older compared with those less than 35 years. Adjusting for age, those initially unissued were 2.5 (95% 1.42, 4.36) times more likely to have at least one abnormal LRPV score than those initially issued first class. Results did not differ between initial first and second and third class, however.

In-Depth Assessment of Outcome Definition 2: Number with Abnormal T-score values

Of the 135 airmen who were "flagged" for having at least one cogscreen exam with 3 or more t-scores below 40, 80 (59%) had at least one abnormal value without 2 subsequent normal values immediately after. However, this also includes several airmen who had an abnormal t-score flag value but then underwent additional testing that was subsequently normal, and got issued due to additional testing. Thus, for this section, a cognitive assessment was deemed abnormal if the cogscreen had three or more t-score values below 40 and, if applicable any other approved test battery was noted as a failed test. However, if the airmen took a cogscreen and then further testing and passed either time, the assessment was categorized as initially flagged but deemed normal after further testing.

- Of the 630 cogscreens the 135 airmen with at least one "flagged" t-score assessment underwent, 193 (30.1%) cogscreens were actually flagged with this abnormal t-score assessment.
- 30 (22%) of these airmen were under the age 35.
- 45 of the 135 (33.3%) had more than one abnormal t-score assessment.
- 96 of the 135 had suspicious cases on their baseline cogs. Of these 135, 31 were initially deferred/denied.
- 62 of the 135 had their only suspicious case on their first exam, and none after.
- 6 of the 135 never got issued after their last abnormal flag. However, 4 of the 6 would have been caught by initial cogscreen that had an abnormal flag and was denied. 3 of these 6 only had one cogscreen in the system and didn't come back after that. Of the other 3: One was initially flagged but subsequently issued, and then was flagged and denied on their second cogscreen, another tried 3 separate cogscreens and each time was denied. Finally, the only airman that would likely escape capturing in our system is an airman who did not have an abnormal flag until the sixth cogscreen, where we denied them for psychiatric reasons. This same airman had a flag for a high LRPV score on the initial exam and was deferred, but then had 4 normal cogscreens in between where everything was normal and issued.

Table 6 summarizes the categories all the airmen who had abnormal t-score flags:

	Number of Distinct Airmen*	Number of "Flagged" T-scores
Airmen who had at least one abnormal cognitive assessment and were not issued	25 (18.5%)	28 (14.5%)
Airmen who had at least one abnormal t-score but had subsequent normal testing and were still not issued	14 (10.4%)	14 (7.3%)
Airmen who had at least one abnormal cognitive assessment and were issued	54 (40.0%)	65 (33.7%)
Airmen who had at least one	71 (52.6%)	86 (44.6%)

abnormal t-score but had subsequent normal testing and were then issued		

*totals won't add to 100% because the same airmen could be in several cells

Finally, we performed multivariate logistic regression to determine any variables that were significantly associated with having a total of 3 or more t-scores less than 40. Gender and baseline class issued were the only variables independently associated with having this abnormal t-score flag. Adjusting for variables in the model, the odds of having at least one abnormal t-score flag was 2.1 (95% 0.93, 4.60) times higher in male pilots. Although not quite significant, being a female was protective for this definition of a flagged cognitive exam. Finally, once again, odds of having a flagged abnormal t-score was 2.0 (95% CI 1.19, 3.43) times higher in those initially unissued compared with those initially issued a first-class certificate.

In-Depth Assessment of Outcome Definition 3: Number with Abnormal LRPV and T-score Values

For the purpose of this study, the airmen who had both a high LRPV score and abnormal t-score flag on at least one cogscreen were considered to be of most concern for potential abnormal cognition. Of these 48 suspicious cases, 20 had at least one abnormal without 2 normals immediately following. However, most of these come from the fact that airmen drop out before having a chance to get 2 normals, as there is no increased trend in abnormal testing. And even if they have a few abnormal flags on their last few exams, we are issuing them anyway, with few exceptions.

- Only 4 of the 48 were below the age of 35.
- 24 of the 48 airmen (50% of the suspicious cases or 5.6% overall) had a suspicious case AND were ever denied/deferred.
- Only 11 of the 48 had more than one suspicious case incident at different times.
- 42 of the 48 had suspicious cases on their baseline cogs. Of these 42, 21 were initially deferred/denied.
- 31 of the 48 had their only suspicious case on their first exam, and none after.
- 3 of the 48 never got issued after their last abnormal case. However, those 3 would have all been caught by initial cog that flagged and deferred/denied them. 2 of these 3 only had one cogscreen ever in the system. The third was denied on all three cogscreens, although the second and third cogscreens were not flagged as suspicious cases.
- Only 4 airmen were ever a suspicious case and deferred/denied after their initial cogscreen. 2 of these 4 would have been caught by initial suspicious case, but all 4 were issued after their last deferred/denied.

Our final multivariate model demonstrated that once again, baseline age and initial class issued were the only variables significantly associated with this most stringent suspicious case definition. After leaving both variables in the model, the odds of having at least one abnormal LPRV and t-score flag was 3.7 (95% 1.28, 10.73) times higher in pilots 35 and older compared

with their younger counterparts. The odds of having an abnormal LRPV and t-score flag was 3.01 (95% CI 1.46, 6.20) times higher in those where AAM initially did not issue compared with those issued a first class initially.

Assessment of Contribution of Neuropsychologist Opinion

There was interest in examination of agreement between the neuropsychologist's opinion of an abnormal case and this study's definition of suspicious cognitive case. Furthermore, did AAM's decision to issue align with the neuropsychologist opinion.

There were 120 cogscreens overall where the neuropsychologist opinion gave an "abnormal" status on the cognitive testing. Of these 120, AAM made the decision to issue 72 (60% of the time) anyway. However, on the initial cogscreen, AAM only decided to issue the "abnormal" opinion 44% (29/65) of the time, and 43% (6/14) on the second exam. 83% (20/24) of the neuropsychologist's abnormal opinions were issued on the third exam, and 100% of the abnormal opinions were issued after. So it appears AAM was much more discerning with those just starting out in the program, and for the most part, once the airman had established a trend of coming back for cogscreens, AAM did not place a heavy influence on the opinion of their abnormal cases. Furthermore, of this study's 3 flagged "suspicious case" definitions of high LRPV, number of low t-scores equal to 3 or greater, and a combination of these two, the neuropsychologist agreed with our abnormal definitions: 58% of the time for high LRPV scores, only 30% of the time for our low t-score definition, and 78% of the time with our combination definition.

Assessment of Last Exam for Pilots

Finally, we assessed a cross-sectional view of all the pilots at their last exam, thus far, in DIWS. There were 30 pilots who were denied on their last exam: 13 for "failure to provide", 3 for "Medical" reasons, 10 for "Psychiatric" reasons, 1 for "Cognitive", and 3 for "Other" issues, such as retirement. Of this group that had their SI withdrawn/denied on their last exam, we examined if there were any differences between this group and those that continued their issuance. Although the denied group's initial mean LRPV score was 0.41 compared with the continued issuance group's mean score of 0.34, this was not significantly different ($p=0.3335$). Furthermore, the decline in mean LRPV for both groups was fairly consistent, until the 5^{th} cogscreen time-frame. There was no difference in the mean of number of abnormal t-scores between the two groups as well. The group of denied airman did not differ from the issued group in outcome, number of diagnoses, type of SSRI, or number of medications either.

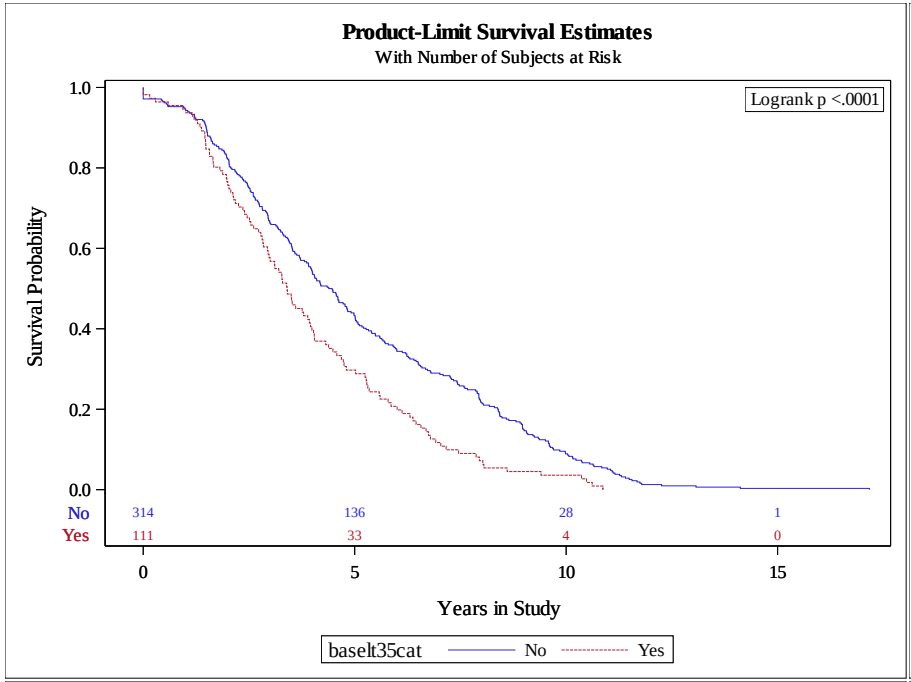
Conclusion

Due to previous limitations of difficulty in routinely collecting surveillance data and the fact that OAM's operational database was not designed to be applied for research purposes, limited research exists regarding pilots who take SSRIs. Research on pilot characteristics affecting cognitive safety is particularly important given the SSRI policy allowing FAA medical certification for selected psychiatric disorders and SSRIs has been in place for over 12 years.

This exploratory analysis allowed us to examine many aspects of the SSRI airmen population. The first scientific question was determining an association between SSRI use and cognitive decline. Based on limited research assessing the cogscreen's sensitivity and specificity to reliably measure change in cognitive function, the logical solution to test this population for potential cognitive decline was to use high LRPV values and abnormally high numbers of low t-scores as outcome surrogates, controlling for age. We failed to find any significant factors that identified trends in cognitive decline, with the exceptions of age as a significant variable, which was expected a priori, and baseline class issed. Furthermore, the highest LRPV values and number of abnormal t-scores were demonstrated on the initial cogscreen testing. From the initial test, the average scores improved dramatically thereafter. Thus, it appears that pilots may benefit from mere repetition and anticipation of future answers on the test. However, there were significant associations with certain variables and length of time an airmen stayed in the program, although none seeming to affect any cognitive deficiency the cogscreen testing could detect.

The second question was whether AAM is over-testing pilots for cognitive decline, and if there is an apparent trend that would identify a better testing interval to lessen this frequency. While no specific trend was established because so many pilots left the system before one could be reasonably established, there were a few findings to note. First, there were only 7 of the 425 distinct airmen identified by any of the three outcome definitions as never getting issued again after their last flagged abnormal value in the system. However, only one of the seven abnormal cases came after the first and second cognitive screening. Furthermore, even when airmen were getting "flagged", most of the time AAM issued regardless.

This population was chosen to save time, as the SMEs already had identified mental health diagnoses and made summary sheets of them. The group is a set of pilots who, for the vast majority, have been issued an SI for SSRI use at least once before. Therefore, studying only this group does invite some survivorship selection bias, since they are more likely to be consistent and stable enough to provide the needed information. Future studies could compare these results by examining pilots who initially applied for an SSRI SI, performed cognitive testing, and were denied while never reapplying. However, these results imply that regulatory cognitive testing frequency is not identifying worrisome pilots with enough cognitive decline to withdraw their SI. Future research may also involve examining other known diseases and specific medications in these pilots, but this was outside the scope of this particular project.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0.2
0.0
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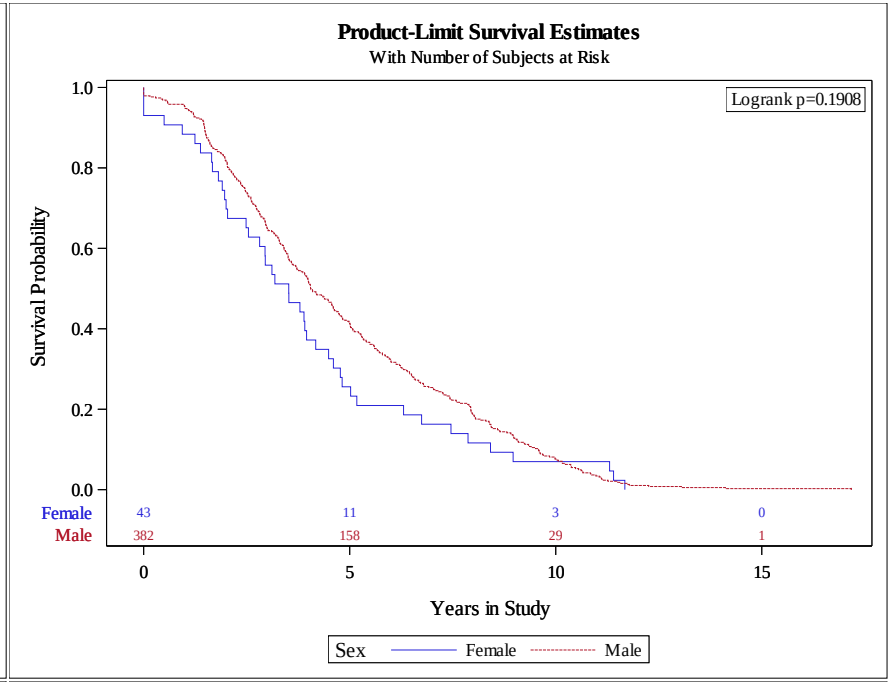
5
10
15
Years in Study
baselt35cat No Yes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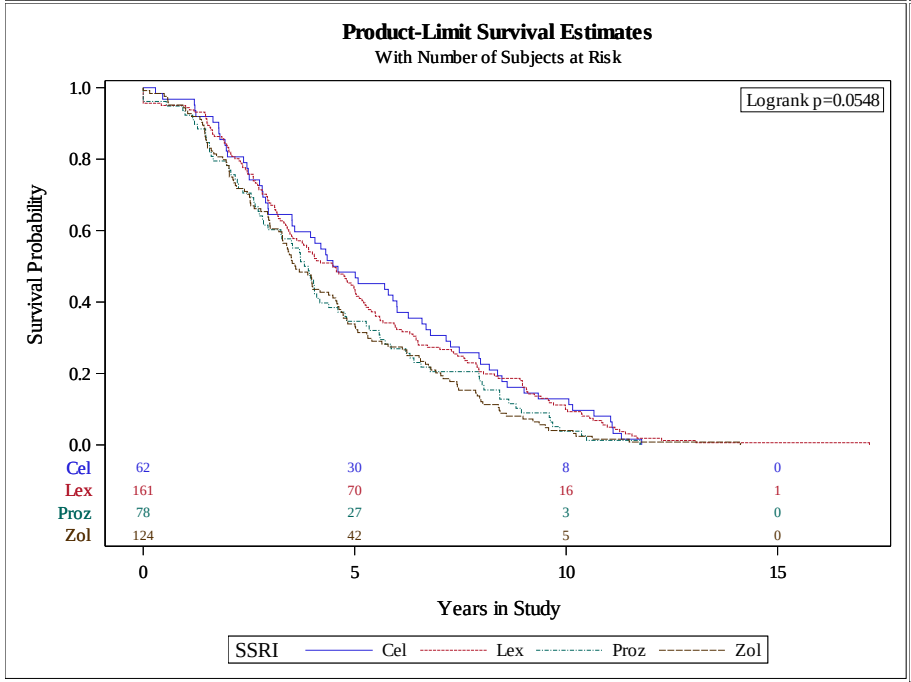
0
5
10
15
Years in Study
Sex Female Male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0.2
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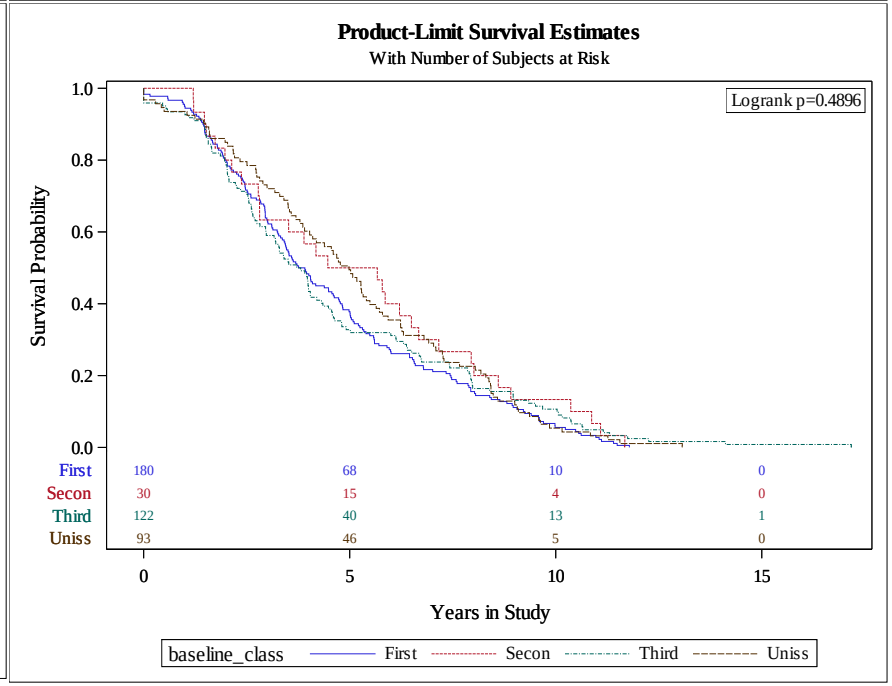
Proz 78 27 3 0
Zol 124 42 5 0
0
5
10
15
Years in Study
SSRI Cel Lex Proz Zol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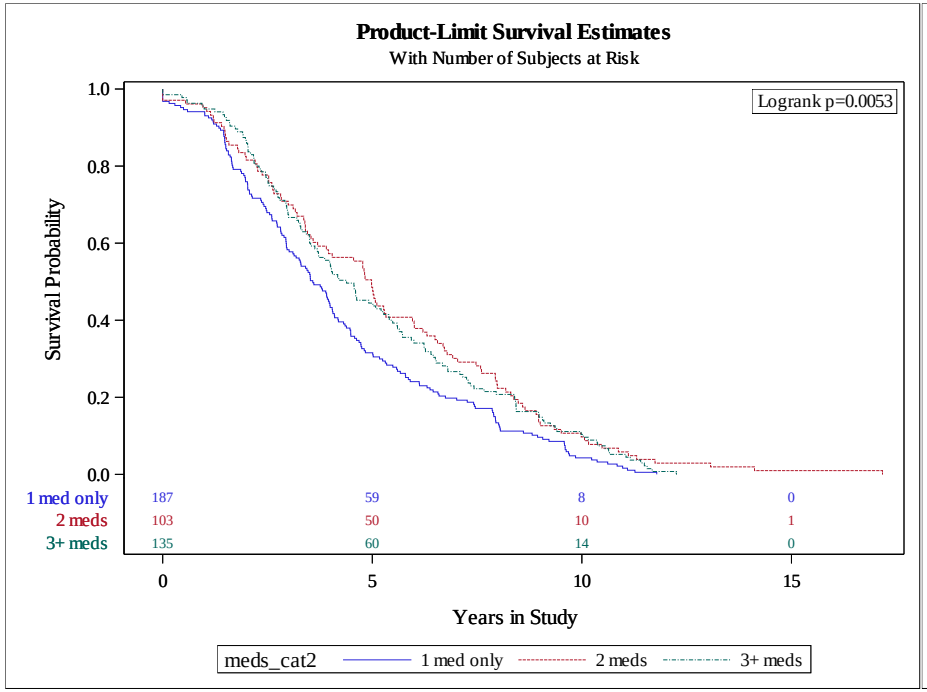
0
5
10
15
Years in Study
baseline_class First Secon Third Uniss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0.4
0.2
0.0
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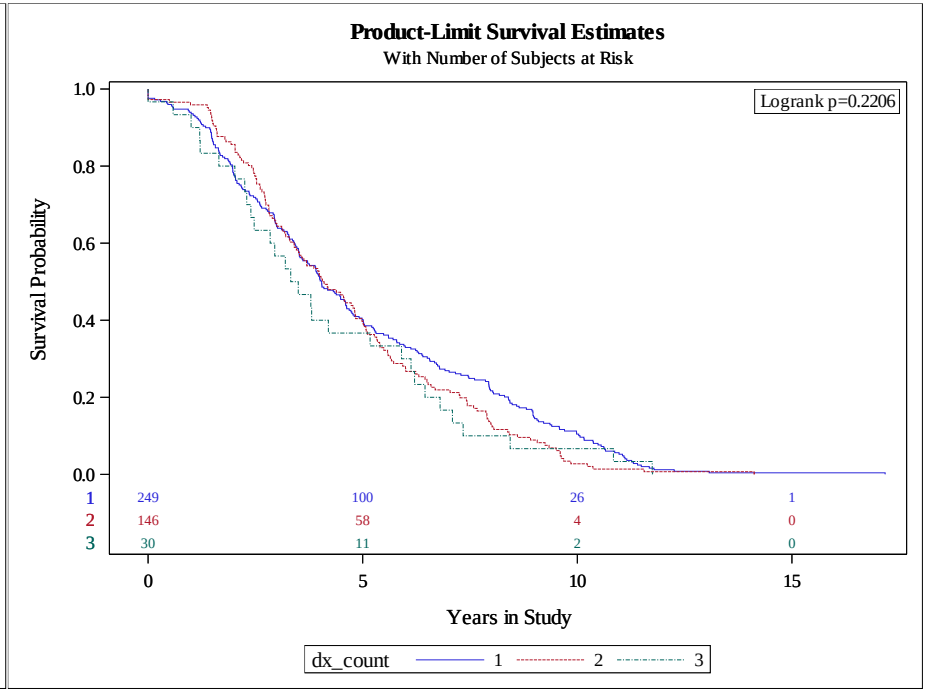
2 meds 103 50 10 1
3+ meds 135 60 14 0
0
5
10
15
Years in Study
meds_cat2 1 med only 2 meds 3+ meds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0.2
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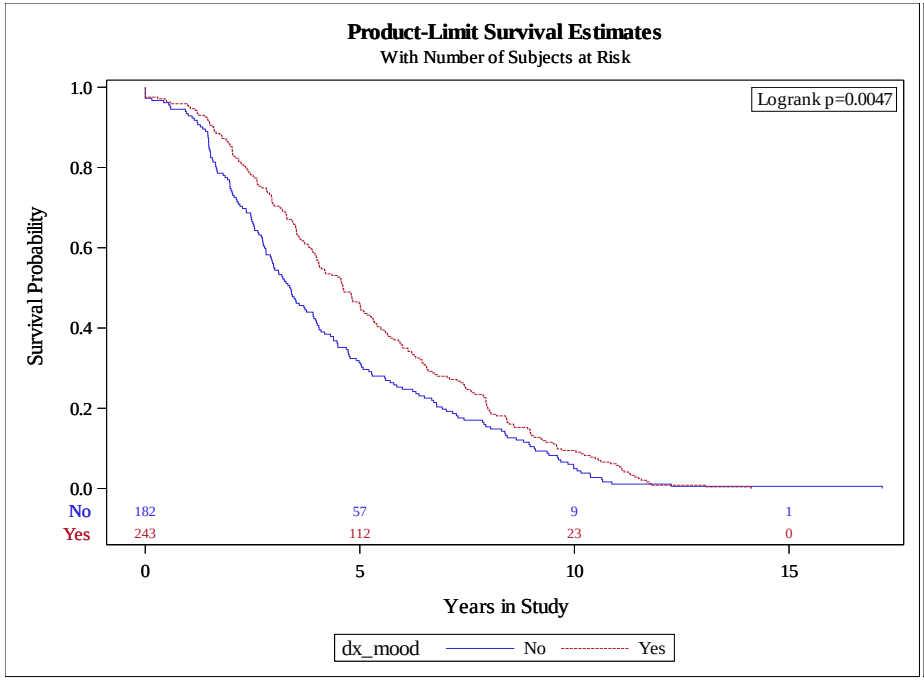
0
5
10
15
Years in Study
dx_count 1 2 3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5
10
15
Years in Study
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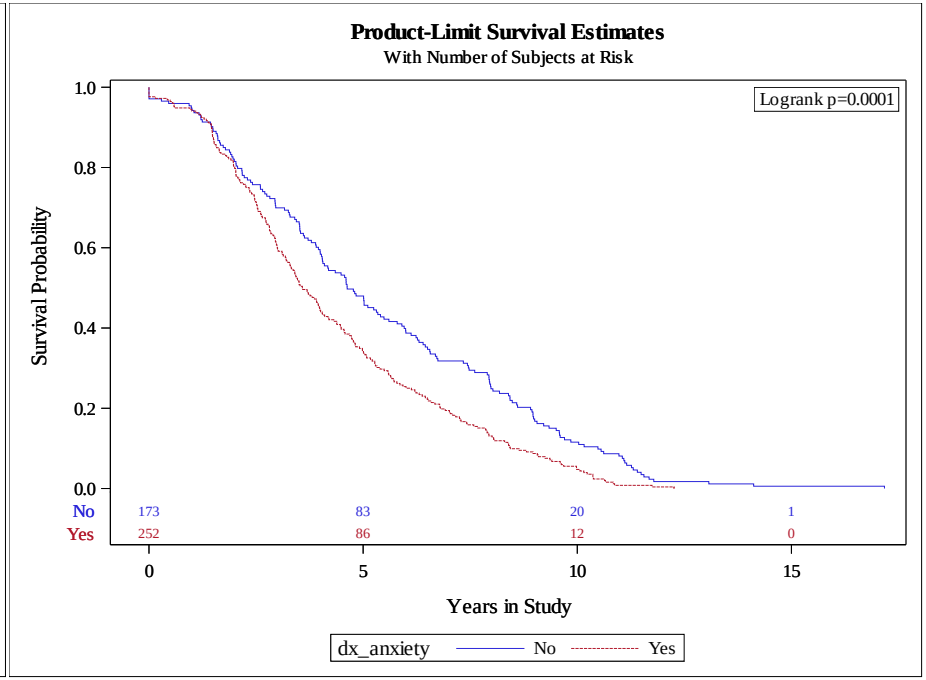
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5
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15
Years in Study
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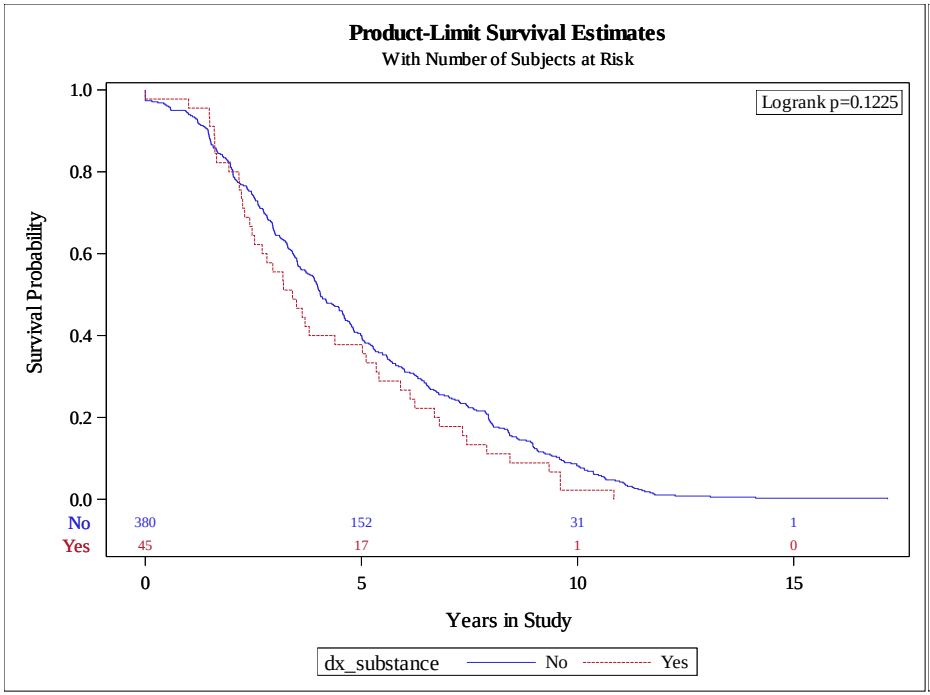
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0.4
0.2
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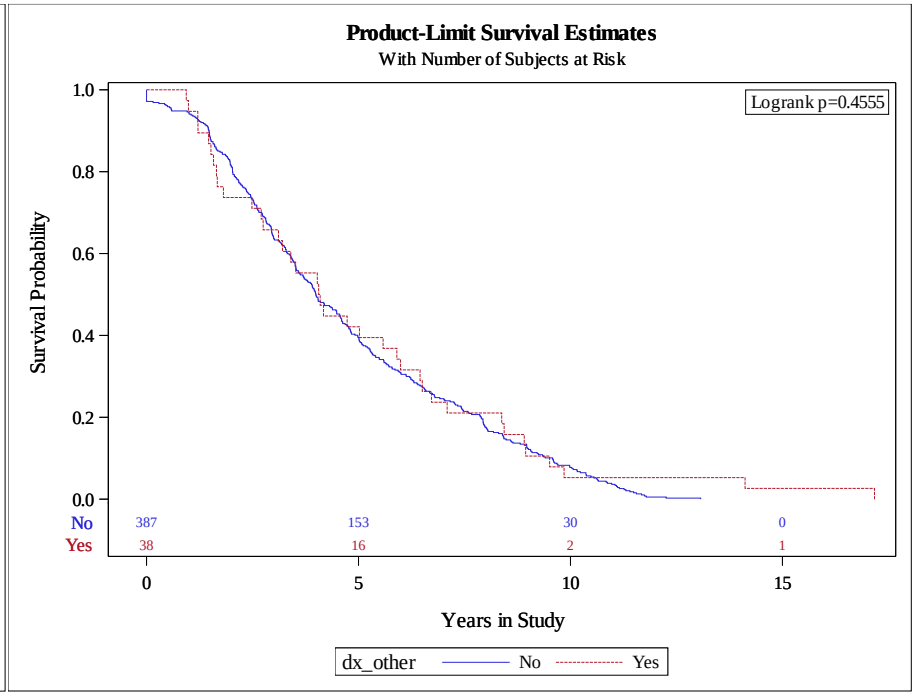
Years in Study
dx_substance No Yes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0.6
0.4
0.2
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Yes 38 16 2 1
0 5 10 15
Years in Study
dx_other No Yes