Success Rates at an Air Force Pilot Academy and Its Relation to Methylphenidate Use

Shani Sarfati; Idan Nakdimon; Jonathan Tsodyks; Amit Assa; Barak Gordon

BACKGROUND: Attention deficit hyperactivity disorder (ADHD) is a chronic neurological disorder characterized by persistent patterns of inattention, impulsivity, and hyperactivity. The most common treatment for this disorder is methylphenidate, which is a disqualifying medication for flight. Candidates with previous use of methylphenidate are not necessarily disqualified from the Israeli Air Force (IAF) flight academy.

METHODS: Flight cadets from 12 consecutive flight courses who have used methylphenidate at least once in the past were identified according to their medical records. The graduation ratio of cadets with previous use of methylphenidate was compared with that of the rest of the cadets. A comparison was also made with regard to the causes of disqualification from the flight course. Statistical significance was assessed using the Fischer Test.

RESULTS: Among the 90 flight cadets who have used methylphenidate, only 2 (2.2%) successfully graduated from the IAF flight academy. Among the 2983 flight cadets who have no history of methylphenidate use, 461 (15.4%) successfully graduated. We found no significant differences in the disqualification causes between the two groups.

CONCLUSION: The IAF flight academy graduation rate was meaningfully and significantly lower among cadets who reported previous use of methylphenidate. The study design, however, limits the inference of causal relationship.

KEYWORDS: ADHD, attention deficit hyperactivity disorder, methylphenidate, pilots.

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Methylphenidate is one of the most prescribed drugs for patients who suffer from attention deficit hyperactivity disorder (ADHD). The drug is a stimulant of the central nervous system; however, it has a calming effect on the human body and helps the person who is using it to be more focused.[10] ADHD is a neuropsychiatric condition, usually diagnosed in childhood or adolescence, and is characterized with a persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development.[1] Between 30–70% of the children who suffer from ADHD will continue to suffer from it in their adult life.[2,4] There is a concerning growing trend of people who use the drug without prescription for its focusing effects without a diagnosis of ADHD.

The reluctance of the Israeli Air Force (IAF) to accept candidates who have used methylphenidate in the past was due to the fact that little is known about the impact of cognitive impairments on flight skills in cadets with ADHD. ADHD is known as a condition with detrimental effects on cognitive functioning and performance under pressure; in fact, evidence suggests that it has adverse effects on flight safety and that there might be a correlation between ADHD and fatal accidents in civil aviation.[9] Studies of road accident risk have shown that subjects with ADHD are more likely to be involved in car crashes, tend to have more bodily injuries, and to be at fault more than control subjects.[3,5,11]

The selection process to the IAF flight academy includes successful completion of tests performed by the Air-Crew Selection Unit (ACSU) which consist of a flight simulator, cognitive tests, and a psychological personal interview. Following the ACSU approval, candidates go through a medical evaluation in the Aero-Medical Center. After receiving medical approval, the candidates go through a 5-d long field assessment

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test at the flight academy, by the end of which approximately 50% of the remaining applicants are selected to enroll into the IAF flight academy. The IAF flight course is 3 yr long and consists of 6 stages, each stage lasting about 6 mo. During the 3-yr period of the course, in addition to pilot training in several aircraft, the cadets complete basic training, the officer's course, and a B.A. degree. The IAF flight course is considered as one of the most challenging military courses in the Israeli armed forces, as illustrated by the high attrition rate; about one-sixth of the cadets who enroll into the IAF flight academy graduate the course to become active aviators.

As a policy, the candidates who need continuous methylphenidate for functioning are not fit for the flight academy. However, since 2008, candidates with a history of methylphenidate treatment who have ceased the use of the drug are considered valid candidates. The whole selection process is performed without the use of methylphenidate. As methylphenidate use is not allowed during flight due to potential hazardous side effects such as elevated blood pressure and cardiac arrhythmia, candidates are forbidden from using it during stages in the course which include flight training.

Both the U.S. Air Force and the U.S. Navy have a strict policy regarding methylphenidate which prevents acceptance of applicants who have reported methylphenidate usage in the 12 mo prior to their admission. On top of that, the cadets are not allowed to use methylphenidate at any stage throughout the course, regardless of whether or not it includes flight training.[13,14] The purpose of this study was to determine the graduation rate of cadets who have used methylphenidate in the past in order to have a better understanding on the effects of ADHD on an individual's success in aircrew training.

METHODS

Subjects

This retrospective cohort study was approved by the institutional review board of the Israeli Defense Forces Medical Corps, with a waiver of informed consent. Every candidate for the IAF flight academy is required to go through vigorous physical, cognitive, and mental evaluation, during which they fill out a personal questionnaire at the ACSU and a comprehensive medical questionnaire at the Aero-Medical Center. In both the questionnaires, the applicants are asked about any medications that they had taken in the past. Later on, the candidates are examined by a flight surgeon who also asks them about any history of medication use.

The medical files of 3073 IAF flight academy cadets have been reviewed. This encompasses all cadets in 12 flight courses between the end of the 2000s up to the middle of the 2010s. The cadets in this study were both men and women; all of them young adults (ages 18–25).

Procedure

The graduation rate (%) of the cadets who have reported at least one occasion of methylphenidate use in the past (study group, $N = 90$) was compared to the graduation rate of the control group (control group, $N = 2983$). In addition, the various causes for disqualification of the cadets were reviewed and analyzed. In the IAF flight academy, there is a finite number of causes for disqualification from the flight course. The cause is determined by the course commander and entered into a personnel database. A separate comparison between the study group and the control group was performed for each disqualification cause.

Statistical Analysis

All of the data were inserted into an Excel worksheet. The analysis was performed by a two-tailed Fisher's exact test using MS-Excel ver. 2010. The test was performed on two data sets: one regarding the overall graduation and disqualification rates of each group, and the other on the prevalence of every elimination cause among the disqualified cadets of each group. *P*-values less than 0.05 were considered statistically significant.

RESULTS

Of a total of 3073 cadets, 90 declared that they used methylphenidate at least once in the past. Over the years of the study, the number of cadets who reported using methylphenidate at least once has steadily increased. In the first year of the study 9 cadets reported at least a single use and by the last year of the study 15 cadets reported it (**Fig. 1**).

Out of 90 cadets in the study group who started the flight course, only 2 (2.2%) graduated and became IAF aircrew. The graduation rate of the control group was higher. Out of 2983 cadets who started the academy, 461 (15.5%) graduated (**Fig. 2**). The difference between the groups was statistically significant ($P < 0.001$).

No significant differences in the prevalence of disqualification causes were found between the two groups; the control group demonstrated slightly higher rates of disqualification due to low flight skills (65.26%) and personal inadequacy (19.9%) in comparison to the study group (64.77% and 18.18%, respectively). Disqualification due to self-termination, on the other hand, was found to be less common in the control group, with

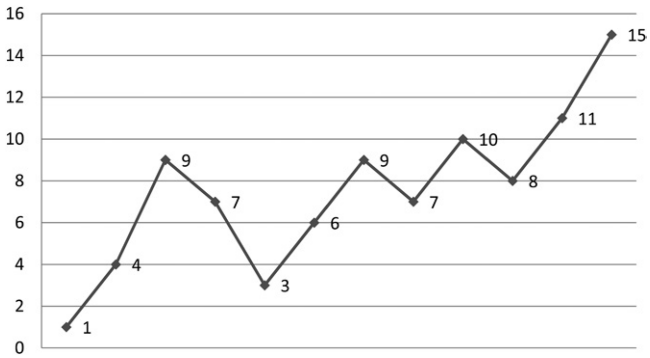

Fig. 1. Number of cadets that reported methylphenidate consumption in each course.

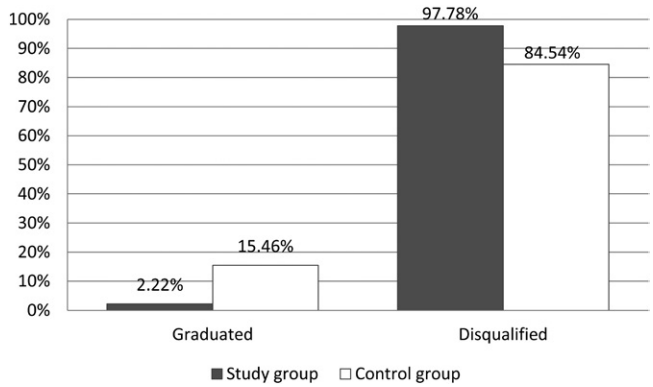

Fig. 2. Comparison of graduation and disqualification rates in each group.

just 13.4% compared to 17.04% in the study group. All in all, no particular disqualifying cause was found to be responsible for the high disqualification rate in the study group (**Fig. 3**).

DISCUSSION

The reason for choosing methylphenidate usage as the main variable in this study as opposed to relying on ADHD diagnosis lies in the difficulty in identifying and defining the disorder. ADHD is quite complicated to diagnose with absolute certainty[12] and, in many cases, may be defined as "in remission", i.e., symptoms of the disorder weaken during maturation and some may even completely cease to appear.[6]

The population selected for this study consisted of flight course cadets who had used methylphenidate at least once in their lifetime. Candidates with ADHD severe enough that they require medication treatment in order to function properly on a daily basis are not considered valid for flight course enlistment. The rigorous medical and psychological screening in the ACSU and Aero-Medical Center, combined with an intensive 5-d field easement, ensures that the individuals chosen to enroll into the IAF flight academy are generally healthy both physically and mentally.

The results of the graduation rate comparison between the two groups strongly suggest a link between ADHD and failure

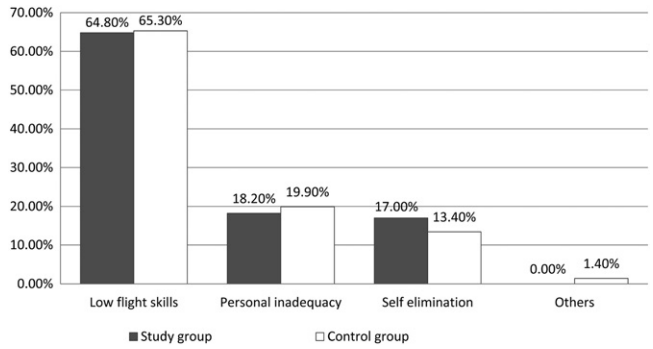

Fig. 3. Prevalence of elimination causes in both groups: "low flight skills" – elimination due to lacking flight abilities; "personal inadequacy" – elimination due to subpar personal evaluation; and "self elimination" – elimination due to cadet's decision to withdraw.

to graduate from the IAF flight academy. In order to better understand the underlying reasons for the results, another comparison was made between the groups regarding the following possible reasons for disqualification, which are self-elimination, low flight skills, personal inadequacy, and combined other reasons which included: insufficient academic achievements, failing the conversion exam, higher priority assignment, and medical reason. None of the causes for disqualification were found to be significantly more prevalent in either of the groups, meaning that no particular absent skill can be attributed to the overwhelming disadvantage of these cadets. Even though the results are hardly disputable, the reason behind them remains somewhat unclear.

We expected to see a difference between the two groups in the "low flight skill" cause of elimination. The reason we expected to see that is because flying a plane requires a pilot to perform under high cognitive load conditions. The skills essential to deal with this load, such as high multitasking and working memory abilities, are known to be impaired among adults with ADHD.[7,8] And yet, quite counterintuitively, disqualification due to low flight skills was not more prevalent in the study group compared to the control.

It is important to mention that the study group does not consist of individuals with a positive diagnosis of ADHD, and the actual number of cadets with the disorder is unclear. This might explain why the adverse cognitive effects of ADHD did not have a significant influence on the flight skills of the study group. Even if the cognitive abilities of the study group cadets were indeed inferior to those of the control group's cadets, it is possible that higher motivation in the study population contributed to a compensatory effect that improved their flight skills.

At this point, a recommendation to exclude applicants who suffer from ADHD from IAF flight academy would be premature, due to some limitations in this type of research. One such limitation is that there might have been applicants who concealed their methylphenidate usage history (mainly because of the fear of being disqualified during the admission process). Another limitation is that there are candidates who consumed methylphenidate several times (before exams, to concentrate in class, etc.) or took it once, for the sole purpose of experience, and did not use it again. These candidates were included in the study group due to their methylphenidate usage, although we cannot associate occasional methylphenidate consumption with an attention disorder of any kind, making the link between ADHD and failure in the IAF flight academy more ambiguous. Moreover, because of the retrospective design of the study, we could not infer causality. A study with a randomized controlled design or with a larger study group ($N > 90$) will offer results with higher validity and, therefore, a much more definite conclusion.

There is much to learn from this comparison and it might affect the entire IAF's screening process. Yet follow-up studies are in order; further studies may include a review of additional factors, such as stage of elimination, motivation levels, and social appreciation by fellow cadets (determined by a

sociometric questionnaire). Such studies may shed some more light on the issue and will certainly help to reach a more educated decision regarding the acceptance of applicants who have been diagnosed with ADHD or have a history of methylphenidate usage.

Over the years, cadets with ADHD have become a more prominent part of the IAF flight academy. Perhaps this phenomenon occurs as a result of the increasing number of people who are diagnosed with ADHD in Israel's total population over the last decade, though it can also be attributed to the gradually fading fear of applicants of confessing they have used methylphenidate in the past, since it is not a disqualifying statement any longer. Up to the year 2008, applicants with ADHD were not given medical qualification by the Aero-Medical Center. Since the decision was made to accept candidates with ADHD diagnosis and/or self-reported methylphenidate usage, their numbers in the IAF flight academy have increased and it is likely that this trend will continue in the future.

The aim of this study was to compare the graduation rate of IAF flight academy cadets with history of methylphenidate treatment to that of cadets with no such background. The study results, which are statistically significant, show that cadets with a history of methylphenidate treatment are in a substantially disadvantaged position and are far less likely to complete the academy successfully. As far as we know, this is the first research ever to investigate the relationship between methylphenidate usage history and success in the flight course. Therefore, there is not enough data for us to attain a decisive conclusion. However, this study is a milestone on the way to discovering the full effects of ADHD on a pilot's performance.

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