



U.S. AIR FORCE



AFRL

NATO Pulmonary Screening of Aircrew RTG 299

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Disclaimer statement

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Overview

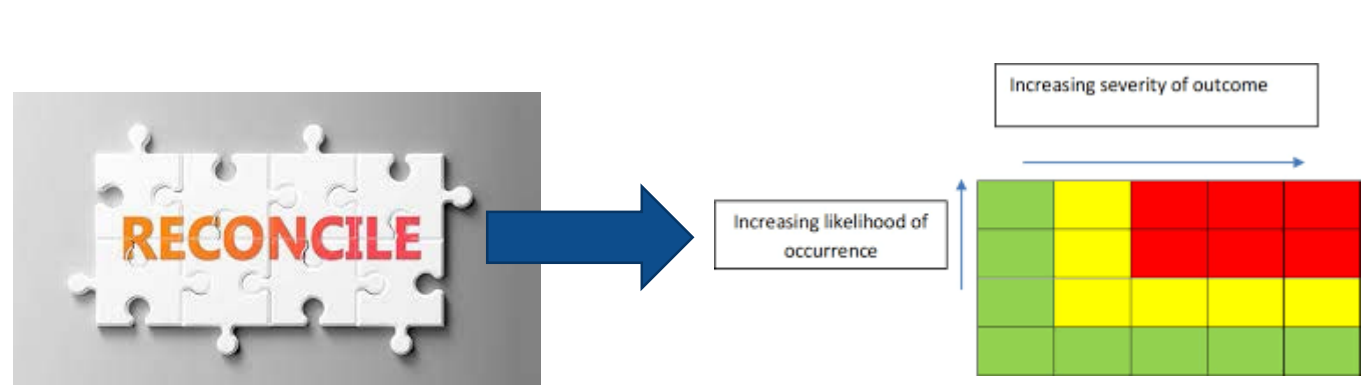
- **Introduction**
- **Why we need pulmonary function standards for aircrew**
- **Pulmonary screening policies in NATO**
- **Asthma incidence in NATO pilots**
- **Pulmonary function in medically cleared NATO pilot candidates**
- **Conclusion**

Why we need pulmonary function standards for aircrew



Introduction

- **Global prevalence of respiratory disorders and risk factors for respiratory disorders continues to increase**
 - **Asthma**
 - **Premature births**
 - **Allergic rhinitis**
 - **Eczema**
 - **And now.....COVID-19**





Lung Function in Young Adults is Predictive

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Patterns of Growth and Decline in Lung Function in Persistent Childhood Asthma

M.J. McGeachie, K.P. Yates, X. Zhou, F. Guo, A.L. Sternberg, M.L. Van Natta,

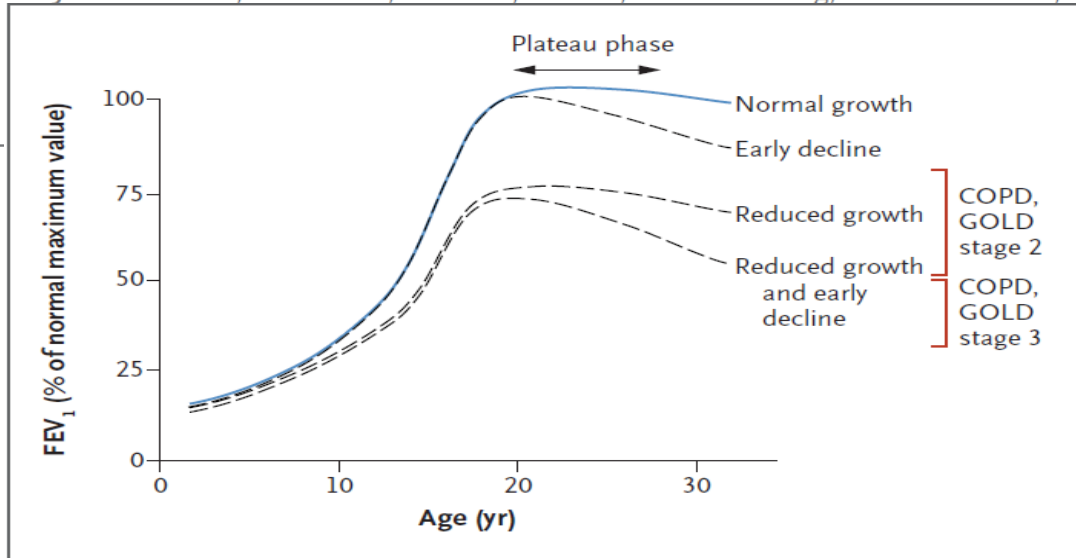


Figure 1. Longitudinal Lung-Function Trajectories.

Lung Function in Young Adults Predicts Airflow Obstruction 20 Years Later

Ravi Kalhan, M.D., M.S.¹, Alexander Arynchyn, M.D., Ph.D.², Laura A. Colangelo, M.S.¹, Mark T. Dransfield, M.D.², Lynn B. Gerald, PhD, MSPH³, and Lewis J. Smith, M.D.¹

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Abstract

Rationale—The burden of obstructive lung disease is increasing, yet there are limited data on its natural history in young adults.

Objectives—To determine in a prospective cohort of generally healthy young adults the influence of early adult lung function on the presence of airflow obstruction in middle age.

Methods—Longitudinal study of 2,496 adults who were 18-30 years of age at entry, did not report having asthma, and returned at Year 20. Airflow obstruction was defined as an FEV₁/FVC ratio less than the lower limit of normal.



Applicant pool





Why we need pulmonary function standards for aircrew

Safety of flight/risk mitigation



The 'high bar' – universal paradigm that medically cleared pilot candidate can potentially fly any airframe in the fleet



The high cost of training a pilot and keeping them flying through a career

Safety of flight/risk mitigation: Prevention of physiologic events

Your Air Force

**13 hypoxia-like events in one week led to T-6
fleet grounding**

By Stephen Losey



**F-35 fighter wing grounded after pilots report
problems with the oxygen system**

Alex Lockie

Jun 9, 2017, 4:07 PM

Samuel King, DVIDS US Air Force officials cancelled F-35 flights on Friday at Luke Air Force Base after over a month of pilots reporting that the plane caused them to suffer from hypoxia-like symptoms from a lack of oxygen



Physiology of high performance flight and effects of aircrew flight equipment

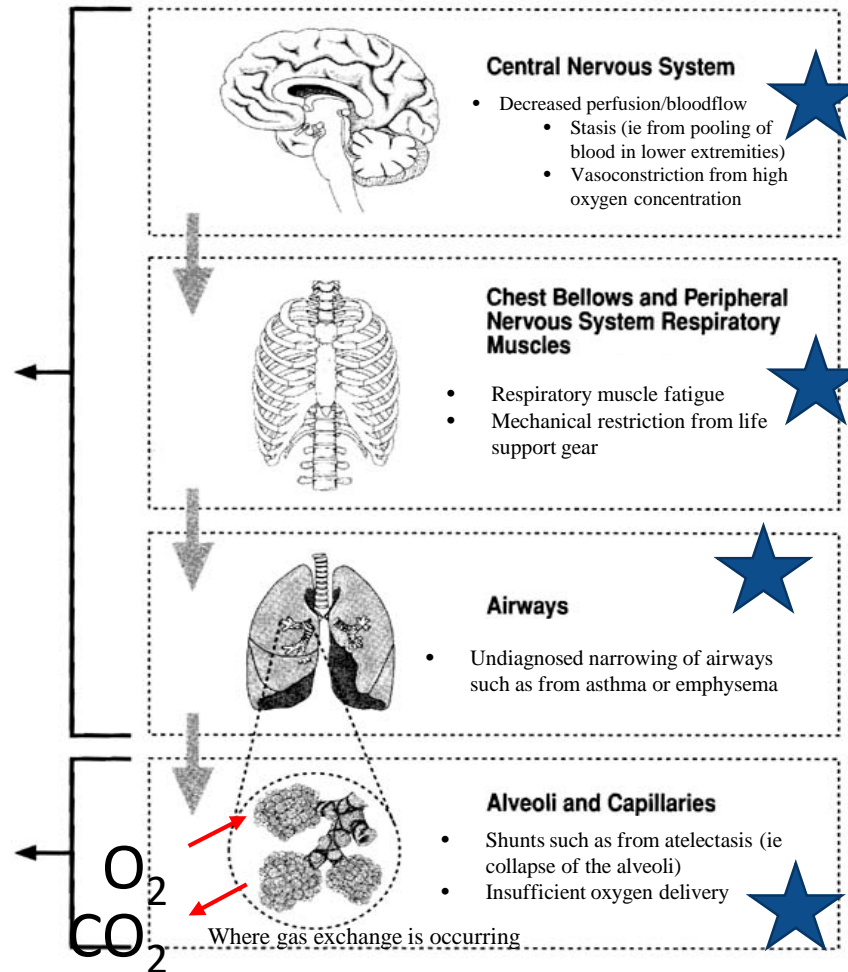


Ventilatory Failure

- \uparrow P_{aCO_2}
- \downarrow P_{aO_2}
- \downarrow Alveolar ventilation
- Normal D(A-a) O_2 gradient

Oxygenation Failure

- Normal/ \downarrow P_{aCO_2}
- Normal/ \downarrow P_{aO_2}
- Normal/ \uparrow Alveolar ventilation
- Widened D(A-a) O_2 gradient



Adapted with permission from Society of Critical Care Medicine, Fundamental Critical Care Support Manual



The 'high bar'

- **Universal paradigm that medically cleared pilot candidate can potentially fly ANY airframe in the fleet**
- **Categorical waivers limiting pilot candidates generally not given**
 - **Exception in US would be National Guard or Reserve: applicant is hired to fly specific airframe**
- **Determination of airframe assignment is based upon performance in UPT**





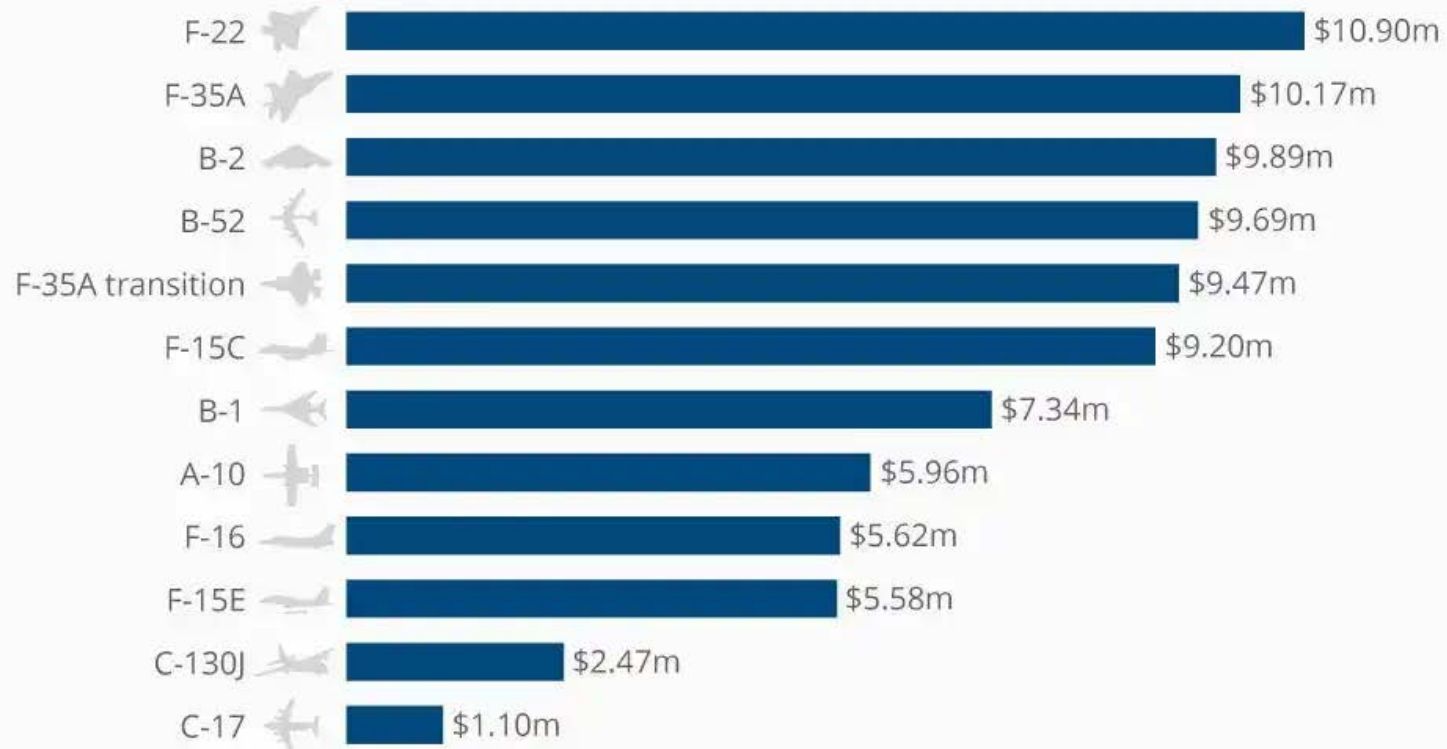
The high cost of training a pilot



The high cost of training a pilot

The Cost Of Training U.S. Air Force Pilots

Estimated total cost of training a basic qualified pilot by platform in 2018*



@StatistaCharts

* Fiscal year 2018 dollars
Source: Rand Corporation

Forbes **statista**



Conclusion

- With higher prevalence of respiratory diseases in NATO countries and physiologic events, standardized pulmonary screening is necessary
- Important to optimize pilot's pulmonary function to mitigate physiologic events

Please hold questions until
the end for panel discussion





Conclusions/HFM 299 Recommendations

- With rise in global prevalence of respiratory diseases, standardized pulmonary screening is necessary
 - Need for continued/enhanced surveillance of aircrew candidates for asthma
 - Pulmonary function testing of all candidates
 - Specific enhanced screening for candidates with a history of asthma
- With screening, pulmonary function in our pilot candidates remains superior to general population
- Important to optimize pilot's pulmonary function to mitigate physiologic events
 - Increased aeromedical risk if underlying conditions such as asthma not properly treated.
 - For example, given the potential for aggravating G-induced impairment of gas exchange which may contribute to reduced G-tolerance and possibly contribute to UPEs



Discussion Points

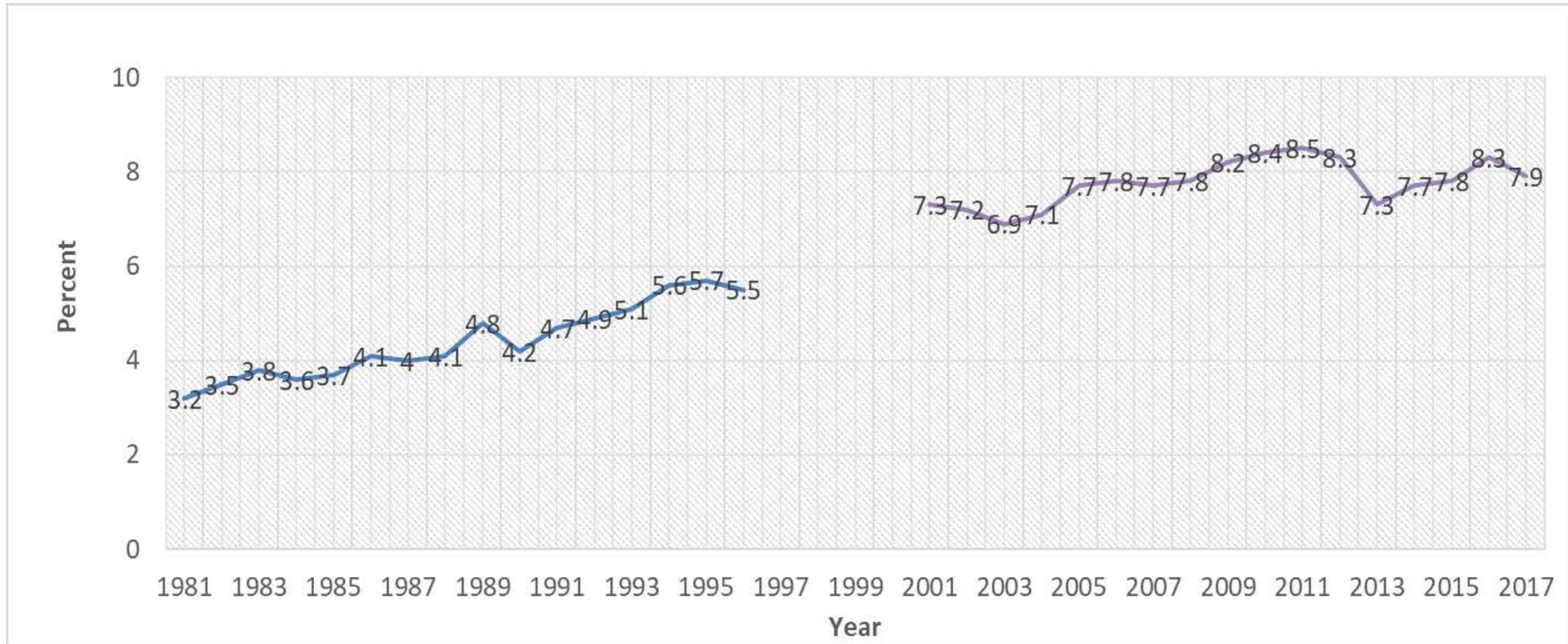
- High performance asthmatics
- Rise of atopy prevalence
 - Where does screening and treatment come in?
- Types of asthma and lung function decline

Back up Slides

Components of Severity		Classification of Asthma Severity ≥12 years of age			
		Intermittent	Persistent		
			Mild	Moderate	Severe
Impairment Normal FEV ₁ /FVC: 8–19 yr 85% 20–39 yr 80% 40–59 yr 75% 60–80 yr 70%	Symptoms	≤2 days/week	>2 days/week but not daily	Daily	Throughout the day
	Nighttime awakenings	≤2x/month	3–4x/month	>1x/week but not nightly	Often 7x/week
	Short-acting beta ₂ -agonist use for symptom control (not prevention of EIB)	≤2 days/week	>2 days/week but not daily, and not more than 1x on any day	Daily	Several times per day
	Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited
	Lung function	<ul style="list-style-type: none"> • Normal FEV₁ between exacerbations • FEV₁ >80% predicted • FEV₁/FVC normal 	<ul style="list-style-type: none"> • FEV₁ >80% predicted • FEV₁/FVC normal 	<ul style="list-style-type: none"> • FEV₁ >60% but <80% predicted • FEV₁/FVC reduced 5% 	<ul style="list-style-type: none"> • FEV₁ <60% predicted • FEV₁/FVC reduced >5%
Risk	Exacerbations requiring oral systemic corticosteroids	0–1/year (see note)	≥2/year (see note) →		
		← Consider severity and interval since last exacerbation. Frequency and severity may fluctuate over time for patients in any severity category. → Relative annual risk of exacerbations may be related to FEV ₁ .			
Recommended Step for Initiating Treatment (See figure 4–5 for treatment steps.)		Step 1	Step 2	Step 3 and consider short course of oral systemic corticosteroids	Step 4 or 5
		In 2–6 weeks, evaluate level of asthma control that is achieved and adjust therapy accordingly.			



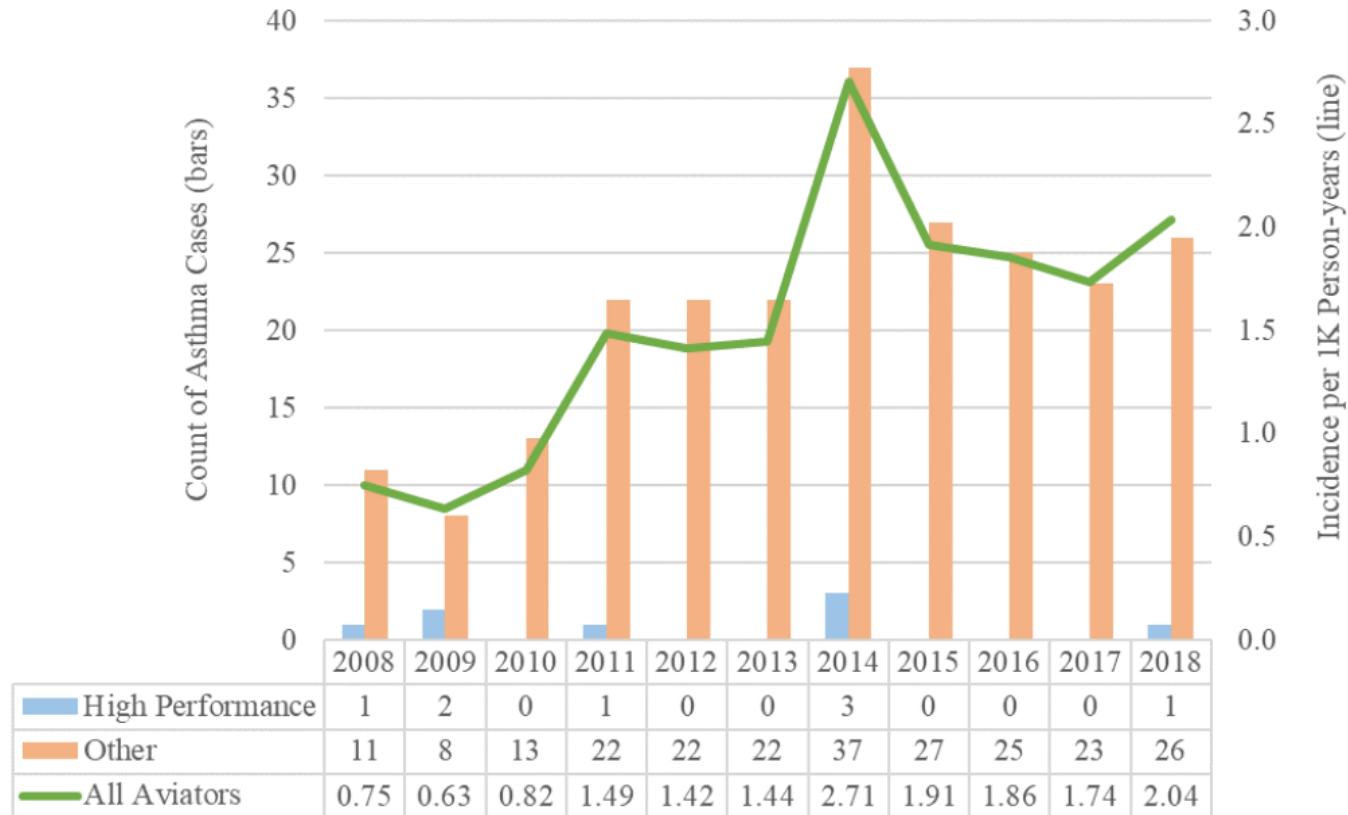
Asthma Period Prevalence and Current Asthma Prevalence: United States, 1980-2017





Asthma prevalence in USAF pilots

Figure. Count and Incidence of Asthma, Active Duty U.S. Air Force Aviators, 2008–2018



Count (bars) and incidence per 1,000 person-years (green line) of asthma diagnoses by calendar year. Counts are stratified by high performance (blue) and other (orange) aviators. Rate reflects all aviators.



Pulmonary screening policies in NATO



Pulmonary Screening and Care in Air Crew
NATO Working Group HFM-299



Dear colleague,
Thank you for participating in this questionnaire!
Please answer the questions as complete as possible:

Date
MM DD YY

Which regulations do you use for air crew medical exams? (e.g. FAA, EASA, Military Aviation Regulations)	<input type="text"/>
How often do your pilots get an Aeromedical Exam?	Choose an Item <input type="text"/>
Do you do Screening for Pulmonary Conditions in pilot applicants ?	Choose an Item <input type="text"/>
How often do you repeat Pulmonary Testing in pilots ? (Tick all boxes that apply)	<input type="checkbox"/> It is only done on initial application <input type="checkbox"/> It is done every medical exam <input type="checkbox"/> It is repeated on clinical indication <input type="checkbox"/> Other (please specify): <input type="text"/>
What form of <u>Pulmonary Screening</u> do you use? (Leave blank if not applicable) (Tick all boxes that apply)	<input type="checkbox"/> Pulmonary Function Testing <input type="checkbox"/> Standard Questionnaire (if so, can you send it?) <input type="checkbox"/> Medical History <input type="checkbox"/> Obtain Medical Records from General Practitioner <input type="checkbox"/> Other (please specify): <input type="text"/>



Pulmonary Screening policies in NATO

- Who is screened?
- What does a pulmonary screening exam entail?
- How often are screenings performed?
- How has COVID changed these policies?



Asthma prevalence in NATO pilots 2008-2018

- Asthma prevalence has been going up globally
- However, lower prevalence of asthma in NATO pilots
- May be attributed to proper screening



Pulmonary function in NATO pilot candidates

