

Health History and Performance Testing of Sailplane Pilots

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Abstract

A study of the health status and performance capability of pilots attending the 2005 Soaring Society of America (SSA) Conference was undertaken as part of an effort to develop a means of individual self-assessment of the effects of aging and to determine whether those who self-certify their medical fitness to fly sailplanes (permitted in the USA) are less fit than those who are required to undergo medical certification. One-hundred and eighty-three out of two thousand and seven conference attendees volunteered to complete a questionnaire on flight hours, ratings and health history and status and undergo simple (SRT) and two-choice visual reaction-time (CRT) testing. Pilots had a lower prevalence of hypertension, heart disease, and diabetes than the comparison population. SRT was statistically significantly better than predicted (239.6 ms vs. 276 ms) as was CRT (466.7 ms vs. 510.5 ms). When compared by possession of a medical certificate there were no significant differences for age, SRT, CRT, hypertension, heart disease or diabetes. Further studies are needed to determine whether CRT and other age-sensitive tests could be adapted to permit sailplane pilots to self-certify their fitness to fly.

Nomenclature

SRT	Simple reaction time
CRT	Two-choice visual reaction time
ms	Milliseconds
% pred.	Percent of predicted value
HIPA	Health Insurance Portability Act
FMCSA	Federal Motor Carrier Safety Administration

Introduction

In order to evaluate health status and provide a means of individual self-assessment of the effects of aging, pilots attending the 2005 Soaring Society of America (SSA) Conference volunteered to complete a questionnaire on self-reported pilot history, ratings, health history and symptoms and underwent simple and Two Choice Visual reaction-time testing. American sailplane pilots are permitted to self-certify their medical fitness to fly. Because some of these pilots also hold other ratings, many of them reported possessing current aviation medical certificates, allowing us to assess whether this made any difference to health status or performance.

Methods

Soaring pilots, attending the 2005 SSA Convention in Ontario, CA were invited to complete a limited questionnaire on occupation, health status, toxic exposure and pilot history and undergo SRT and CRT testing. In order to provide an incentive to participate, we structured the testing as a contest and awarded one-hundred dollar gift certificates for soaring merchandise in two categories, normal (<50 years of age) and senior (50 years of age or greater).

Although SRT and CRT are considered performance, rather than medical tests, informed, HIPA (*Health Information Protection Act*) compliant consent was obtained because the questionnaire contained medical history and status inquiries for which we have a general population comparison in the cohort from which the reference values for SRT and CRT are

derived¹. The questionnaire is a subset of a standardized instrument used in the evaluation of subjects exposed to toxic substances for which reference values are available² with aviation-specific additions. SRT and CRT were performed according to previously published methods³.

A separate room for testing was provided by the conference organizers and a quiet environment was maintained. Test stations were isolated by dividers on three sides. The CRT testing device (Neuro-Test, Inc.) consists of a keypad with side-by-side touch-sensitive areas containing the letters "A" and "S". When performing the test, the subject is instructed to press the key corresponding to the letter which appears on a computer screen as quickly as possible but without error, (tests with errors are repeated). The subject completes at least three sessions, each of which consists of twenty random letter presentations. The results of the first six presentations from each session are discarded as practice. The device incorporates a test of vigilance obtained by varying the time between each letter presentation randomly between three and nine seconds. Subjects first perform SRT with the same protocol using only the letter "A" as a training exercise to accustom them to the keypad prior to performing CRT. The SRT data is preserved and is reported.

Completed questionnaires were machine-read and reviewed in the presence of the subject to insure completeness and accuracy. Statistical analysis was performed using STATATM statistical software.

Results

The SSA had at the time of the study approximately 12,000 members. The society estimated that it represented about 1/3 of US pilots with a glider rating. One-hundred and eighty-three of 2,007 conference attendees, mean age 53.6 years, participated in the study. Of these, 88 (46.6 %) had a current FAA medical certification.

Measured SRT and CRT were compared to reference values⁴ and expressed as percent predicted (% pred.). The reference value for SRT does not vary with age while that for CRT increases significantly with age and decreases significantly by years of achieved education level⁵. SRT was statistically significantly better than predicted (239.6 ms vs. 276 ms) in this volunteer population as was CRT (466.7 ms vs. 510.5 ms). SRT percentage pred. was 86.9%. CRT percentage pred. was 91.3%. For SRT, regression by age, years of school completed, total flight hours and possession of a medical certificate revealed no significant effects. For CRT, the effect of age was significant (p<0.000). Years of school completed revealed a trend (p<0.12). Mean CRT increased linearly by 2.02 ms per year in this pilot population. Regression of SRT by age is presented in Fig. 1 and CRT by age in Fig. 2.

Pilots had a lower prevalence of hypertension, heart disease, and diabetes than the comparison population. When compared by possession of a medical certificate there were no significant differences for age, SRT, CRT, hypertension, heart disease or diabetes (Table 1).

Discussion

Sailplane pilots in this limited sample were faster (better) than predicted for both simple and choice reaction time. No significant difference was detected between those who self-certify and those with a current medical certificate in either performance or history of hypertension, heart disease or diabetes. This data is encouraging for the efficacy, or, perhaps, neutrality of self-certification. Commercial driver studies¹ suggest that CRT is strongly correlated with frequency of accidents. It has been estimated that a 7-12% decrease (~ 100 ms) in CRT would reduce vehicle accidents in the US by 50-70,000 incidents per year^{6,7}. The authors of that study do not, however, suggest an upper CRT bound for licensing.

Mean CRT increases linearly by 2.02 ms per year in this population. The 40 year difference from age 20 to age 60 equates to a slowing of 80.8 ms. The change from 20 to 65 is 90.9 ms. This suggests that, on the basis of CRT, the difference between function at age 60 and 65 is relatively small. While CRT appears to be an appropriate age-sensitive measure of pilot performance, other age-dependent measures could be employed. Accurate, rapid techniques for measuring visual field intactness, contrast sensitivity, intra-ocular pressure, vestibular function and dexterity, all of which have significant age coefficients are available^{8,9,10,11}.

Although performance testing has been used (famously in the movie "The Right Stuff") to select astronauts and fighter pilots¹², we have not found instances in which it is or has been employed to restrict or deny driving or pilot privileges. The current study is too small to illuminate this issue.

Limitations of the present study include a volunteer population which may not be fully representative of the sailplane pilot population or the pilot population in general,

self-reported health and flight status, small numbers and a limited battery of tests (CRT and SRT).

Interestingly, there are no studies which relate the results of performance testing prospectively to actual outcomes, i.e. accidents. This is also true of the predictive value of blood levels of alcohol or illicit drugs. We hypothesize the association, but lack actual data.

Studying sailplane pilots provided an opportunity to evaluate whether outcomes differed on the basis of a current medical certification. The results suggest that they do not. A new group, sport pilots, is permitted to fly without a current medical certificate if they possess a valid driver's license, providing a ground-floor opportunity to expand the present inquiry if funding can be obtained.

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Table 1

Comparison of sailplane pilot results with and without a current aviation medical certificate.

	Mean (all n=183)	sd	Mean (No Medical) n=95	sd	Mean (Current Medical) n=88	sd	P<0.05*
Age (yrs)	53.6	13.91	54.06	14.11	53.09	13.73	ns
Hypertension (%)	20.6	40.6	22.8	42.4	18.2	39.3	ns
Heart attack (%)	2.1	14.5	3.0	17.5	1.1	10.8	ns
All heart dis. (%)	4.8	21.5	4.0	20.2	5.7	23.5	ns
Diabetes (%)	4.2	20.2	5.9	24.2	2.2	15.2	ns
SRTmin (ms)	239.7	28.9	239.6	28.4	239.8	28.7	ns
SRT % pred.	84.7	10.5	82.7	10.2	86.9	10.4	ns
CRTmin (ms)	466.7	67.9	470.7	78.4	462.0	54.1	ns
CRT % pred.	90.5	12.0	90.3	13.6	90.7	9.9	ns

* difference by possession of a medical certificate

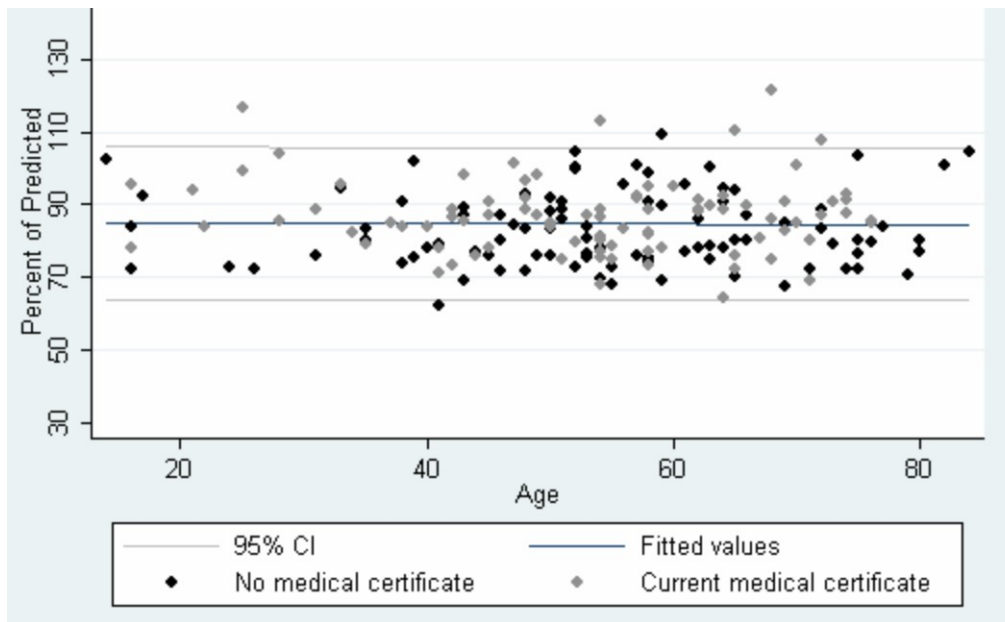


Figure 1 Simple reaction-time (SRT) percent of predicted by age with and without current medical certificate.

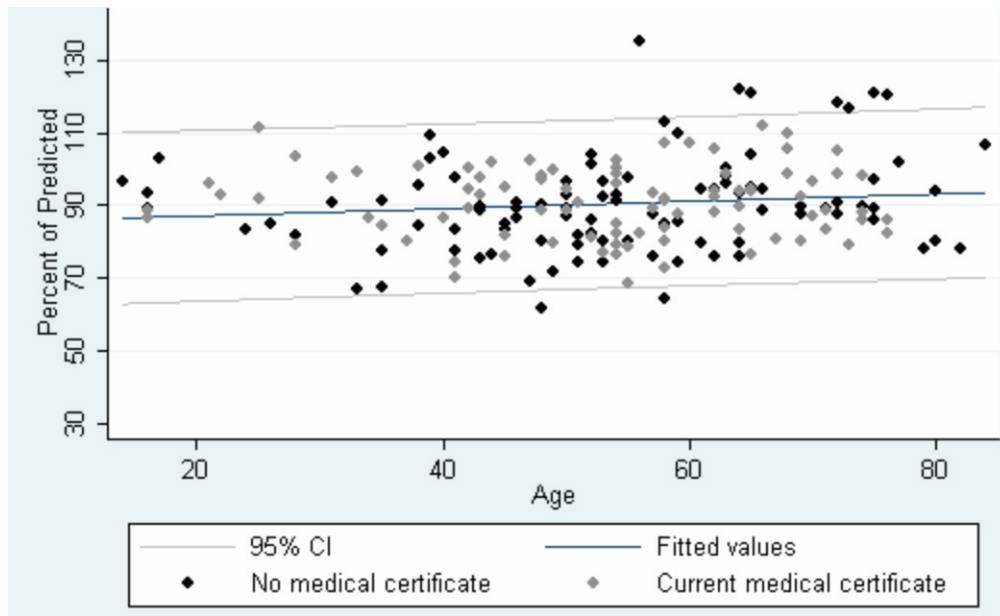


Figure 2 Two-choice visual reaction-time (CRT) by percent of predicted by age with and without current medical certificate.