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METHODOLOGY IN THE ASSESSMENT OF STRESS AMONG AIR TRAFFIC CONTROL SPECIALISTS (ATCS): NORMATIVE ADULT DATA FOR THE STATE-TRAIT ANXIETY INVENTORY FROM NON-ATCS POPULATIONS

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16. Abstract

Previous FAA studies of psychological work stress among air traffic control specialists (ATCSs) have typically employed the Spielberger State-Trait Anxiety Inventory (STAI) to assess stress. Interpretation of the findings, however, has been tempered by a concern that use of the college student normative data available for this test might underestimate actual ATCS stress levels. Since ATCSs differ from college students in a number of seemingly important respects, a study was undertaken to obtain baseline STAI data from a sample of adult, non-ATCS FAA personnel. Biographical and STAI data were collected from 1,972 men and women ranging in age from the twenties into the sixties. Respondents were classified according to age, sex, education, occupational supervisory level, and degree of present work-shift difficulty. STAI scores were compared according to each method of classification. Significant age differences were found for both State and Trait anxiety scores in comparisons involving the 25-29 and the 60-69 year age groups. However, there were no differences in State or Trait anxiety scores between age groups below age 60. Comparisons of the scores of individuals within the 25-59 year age range with college undergraduate data revealed either no differences or significantly higher anxiety scores for the college undergraduate group. No significant differences in State or Trait anxiety scores were found between men and women, between different levels of occupational supervision, or between different educational levels. State anxiety scores were found to differ significantly in relation to work shift difficulty with shifts rated as "Very Difficult" having higher State scores than each of the four other shift ratings of lower difficulty; these changes, however, were not appreciably different from those previously obtained for ATCSs.

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METHODOLOGY IN THE ASSESSMENT OF STRESS AMONG AIR TRAFFIC CONTROL SPECIALISTS (ATCS): NORMATIVE ADULT DATA FOR THE STATE-TRAIT ANXIETY INVENTORY FROM NON-ATCS POPULATIONS

Introduction.

Air traffic control specialists (ATCSs) are often considered to be in an occupation which requires that they endure a high degree of work-related stress. Some popular magazine accounts have even indicated that ATCSs may be near the limits of their ability to cope with such stress.

Based on those concerns, a number of field studies was conducted by the Civil Aeromedical Institute over the past 10 years to evaluate the level of stress associated with air traffic control work. Physiological, biochemical, and psychological indices of stress and anxiety were employed and measures were obtained on ATCSs from a variety of facilities under differing workload conditions. A summary of the research findings has recently been published by Smith (4).

The principal psychological measure of anxiety used in the series of studies noted above was the State-Trait Anxiety Inventory (STAI) which is a standardized measure of both A-Trait, the propensity to experience anxiety, and A-State, the more variable current level of anxiety (8). Of the limited normative group data available for this test, the group most closely matching the ATCS sample was that of college undergraduates who had the lowest mean score of any of the available normative groups (high school students, surgical patients, and prisoners).

A recurrent finding in the studies reviewed by Smith (4) was that ATCSs typically showed A-Trait and A-State scores that were clearly within, and most often below, the average levels of the college student normative group. This would seem to suggest that ATCSs are not engaged in work that is unusually stressful to them. ATCSs, however, differ from college students in a number of seemingly important respects (e.g., age, type and level of education, nature of their work, and the fact that ATCSs are predominantly men). There is at least some evidence that reported anxiety levels may decrease with age (3) and that the nature of this decline may differ as a function of sex (2). If so, then the low scores of ATCSs compared to college students may be, at least in part, an artifact of developmental processes that might be sex-influenced as well as age-influenced.

In order to evaluate from the most accurate perspective the STAI data obtained for ATCSs, it appeared necessary to secure baseline data for the STAI from an adult population comprised of men and women covering a wide age range and engaged in a variety of occupations. The present investigation was conducted as part of a larger study to provide these and other normative data for comparison with ATCSs.

With respect to occupation, the effects of three characteristics on reported anxiety (both Trait and State) were evaluated. First, occupational level as given by Super (9) was considered at three levels of job responsibility: nonsupervisor, supervisor, and manager. The second characteristic was the educational or training level, a factor suggested by Benge, Burk, and Hay (1) in their job evaluation method. The third factor, workload difficulty was assessed using a scale developed by Smith and Melton (5) to measure perceived workload in air traffic controllers. To determine the effect of work itself upon the report of anxiety, a subsample of male respondents was asked to indicate State anxiety levels just before and just after work shifts for several shifts.

Method.

Participants. The respondents to the questionnaire in this study were volunteers from the work force of the Federal Aviation Administration's (FAA) Mike Monroney Aeronautical Center in Oklahoma City. The center employs approximately 3,500 individuals, both men and women, with a wide range of ages and occupations. Questionnaires were distributed to approximately 2,400 members of the work force, and usable questionnaires were returned by 1,972 for an approximate response rate of 82 percent. Usable questionnaires were those which had no more than three blanks on an anxiety scale and with at least one of the questions on age, sex, or occupational characteristics answered.

Table 1 presents the demographic characteristics, age, ethnic origin, and educational level of the respondent sample. Note in this table that the "N's" for the groups differ from one characteristic to another because not all respondents answered all of the relevant questions. The total sample was composed of 75.5 percent men and 24.4 percent women. The women respondents averaged somewhat younger than the men (41.2 vs. 44.2 years) and the mean age of the men in the before/after shift (43.6 years) was only slightly below that of the entire group of respondent men. However, the range of ages represented was similar for the two sexes. In Table 2, the age distribution of the survey sample is compared to the distribution of the general population as given in the 1978 Statistical Abstract of the United States (10). The proportions of the survey sample in the younger age groups (22-24 and 25-34) and in the oldest group (55-64) were somewhat lower than in the general population, while the members surveyed in the middle age groups (35-44 and 45-54) were somewhat higher proportionately than in the general population figures.

The second section of Table 1, ethnic origin, shows that the men and women respondents were very similar in the proportions in each ethnic group. The groups were represented approximately as expected according to their distribution in the national population (Table 2) with one exception, viz the Native American category which was represented by 9.9 percent of the men and 11.0 percent of the women. Since Oklahoma has the largest population of Native American Indians in the United States (10), it would be expected that the proportion would be somewhat higher than the proportion in the total population of the United States, but not 25 times higher. Figures obtained from

Table 1. Percentage of Respondents in Each Age, Ethnic, and Educational Group

	Men	Women	Before/After Shift
	N=1,439	N=460	N=66
Age in Years	Percent		
20 to 24	1.0	4.6	--
25 to 29	4.2	10.9	6.1
30 to 34	10.6	13.9	7.6
35 to 39	14.0	16.1	15.2
40 to 44	19.2	17.4	28.8
45 to 49	22.7	12.4	22.7
50 to 54	14.5	11.3	4.5
55 to 59	9.7	8.3	9.1
60 to 69	4.0	5.2	6.1
Ethnic Origin	N=1,454	N=472	N=52
Asian	0.3	0.4	--
Black	7.8	9.5	9.6
Caucasian	80.5	78.0	78.8
Hispanic	1.2	0.6	--
Native American	9.9	11.0	9.6
Other	0.2	0.4	1.9
Education	N=1,399	N=455	N=52
Less than 12 years	3.0	0.9	9.6
High school through 3 years of college	38.5	60.9	30.8
College graduate or higher degree	31.0	10.8	25.0
Business or trade school	27.5	27.5	34.7

NOTE: The N's for the groups differ from one section of the table to another because not all respondents answered all of the relevant questions.

the center's personnel office showed that American Indians constituted 4.8 percent of the work force at the time of the survey. The much higher than expected proportion selecting this category suggests that a number of native-born non-Indians misunderstood the meaning of the Native American designation.

Table 2. Percentages of Respondents in the Survey Sample According to Age, Ethnic Group, and Education Compared with Percentages in the General Population of the United States (ref. 10)

	Survey Sample		General Population	
	Men	Women	Men	Women
Age in Years	Percent			
22 to 24[a]	1.0	4.6	10.1	10.5
25 to 34	14.8	24.8	30.0	29.1
35 to 44	33.2	33.5	21.0	21.0
45 to 54	37.2	23.7	20.8	21.0
55 to 64[a]	13.7	13.5	17.7	18.7
Ethnic Groups[b]				
Caucasian	80.5	78.0	86.9	86.4
Black	7.8	9.5	11.4	11.8
Hispanic	1.2	0.6	----	----
Asian	0.3	0.4	1.1	1.0
Native American	9.9	11.0	0.4	0.4
Education				
Less than 12 years	3.0	0.9	34.4	35.7
High school through 3 years of college[c]	66.0	88.4	46.3	52.3
College graduate or higher degree	31.0	10.8	19.2	12.0

[a]The survey sample ranges for these groupings were from 20 to 24 and 55 to 69, respectively.

[b]The five choices were mutually exclusive for the survey sample. However, for the general population percentages, the Hispanic figures were included in either the Caucasian or Black figures.

[c]The survey sample percentages for this category include post high school business or trade school attendees.

The information provided by respondents on educational achievement (Table 1) indicates a well-educated sample with 58.5 percent of the men and 38.8 percent of the women either having graduated from college or having attended a business or trade school. As this percentage suggests, the women were less highly educated on the average than the men, $X^2(3) = 99.6$ $p < .001$. While the percentage graduating from high school was about the same, three times as large a percentage of men as women earned college degrees. There were significant differences for both men, X^2 (3) = 619.1, $p < .001$, and women, X^2 (3) = 268.2, $p < .001$, in comparison to the educational achievement of the general population (Table 2), with a substantially larger proportion of men and women in the survey sample having finished high school through 3 years of college, and a larger proportion of the surveyed men having graduated from college.

The subsample of men who had A-State assessments taken before and after several work shifts was similar in most respects to the total sample of men (Table 1). The mean ages were almost identical and the age distributions did not differ significantly. The ethnic composition of the subsample was also very close to that of the main sample. In the area of educational achievement, the before/after sample differed from the main sample of men, X^2 (3) = 10.3, $p < .05$, with generally less education across the various educational categories.

The occupations represented by the before/after subsample were: accountants, aircraft mechanics, boiler operators, clerks, computer programmers, electronic engineers, electronic technicians, and warehousemen. Additional occupations were represented in the total sample.

Questionnaire. The items on which this study is based were included in a longer questionnaire used for a more extensive survey on the effects of shift work. The pages of the questionnaire used are included as Appendix II. However, only the items marked by an asterisk were used for this study. These included the demographic items covering age, sex, formal education or training, and occupational level, as well as items measuring the difficulty of present work shift. The A-State (Y-1) and A-Trait (Y-2) scales of the revised STAI (7) were included as part of the questionnaire, but are not shown in the appendix.

Except for the subsample dealing with work shifts, the form of the STAI used in this study was the recently revised version (7) of the original form first published in 1968 (6). The revised A-State scale has six new or reworded items, and the A-Trait scale has seven new items. Even so, the correlations between the two versions are .96-.97 for the A-Trait scale and .96-.98 for the A-State scale indicating that the versions are generally interchangeable (7).

Both versions of the STAI were used in the subsample which assessed change in anxiety level from before to after work. Since the earlier version was used in all of the previous studies involving similar assessments of ATCSs (4), this procedure allowed direct comparisons to be made of the two versions on the adult population sampled in this study.

Procedure. Volunteers were given a packet containing an instruction sheet (Appendix I) and the questionnaire (Appendix II). The questionnaire was retrieved in the original envelope within 1 hour if possible (i) to insure that it was answered in the work environment and not at home, and (ii) to vary the time the questionnaire was answered throughout the day so that no one particular work time was sampled excessively. The latter was accomplished by varying the initial distribution time throughout the work day as different work units were visited.

The participants who volunteered for the before and after work assessment were each assigned a number which was to be recorded on the main questionnaire as well as on each "before and after" A-State scale. The purpose of assigning the numbers was to provide anonymity and at the same time allow collation of the main questionnaire and the several A-State scales from the "before and after" assessments. Arrangements were made to distribute a "before" A-State scale to each volunteer at the beginning of each assessment period and an "after" A-State scale plus a shift-difficulty questionnaire in the last hour of each assessment (the shift-difficulty questionnaire was part of the larger study and is not considered here). An effort was made to have all volunteers complete an A-State scale before and after work for three consecutive work shifts. Of the 88 participants, 53.4 percent finished all 3 days, 31.8 percent completed 2 days, and 14.8 percent completed 1 day of this part of the survey. All of the before and after A-State scales were collected within 1 hour of their distribution.

Results.

Age. For both A-Trait and A-State the mean scores were highest for the 25- to 29-year age group and then generally declined through the successive age groups until reaching the lowest value in the 60- to 69-year age group. Figure 1 presents a plot of the mean A-Trait scores for the eight age groups while Figure 2 presents the same information for the A-State scores.

The trend of declining STAI scores for increases in age was confirmed by performing age-by-sex ANOVAs for both the A-Trait and the A-State scores. The outcomes were almost identical in that the main effect for the age factor was significant in both ANOVAs ($F(7/1745) = 5.44$, $p < .01$ and $F(7/1745) = 4.58$, $p < .01$ for A-Trait and A-State, respectively). The effect of sex was not significant, nor was the interaction between the age and sex factors significant in either analysis. Subsequent Newman-Keuls (11) comparisons of the mean scores for the eight age groups indicated that the 25- to 29-year age group differed significantly ($p < .05$) from the 60- to 69-year age group on both A-Trait and A-State scores. None of the other comparisons was significant.

On the basis of the above ANOVAs and comparisons, the sample was divided along the lines of significant differences. Thus, three functional age categories were formed: The 25 through 29 group, the collapsed groups from 30 through 59, and the 60 through 69 group. The groups between 30 and 59 were combined because of the lack of significant differences among them, and

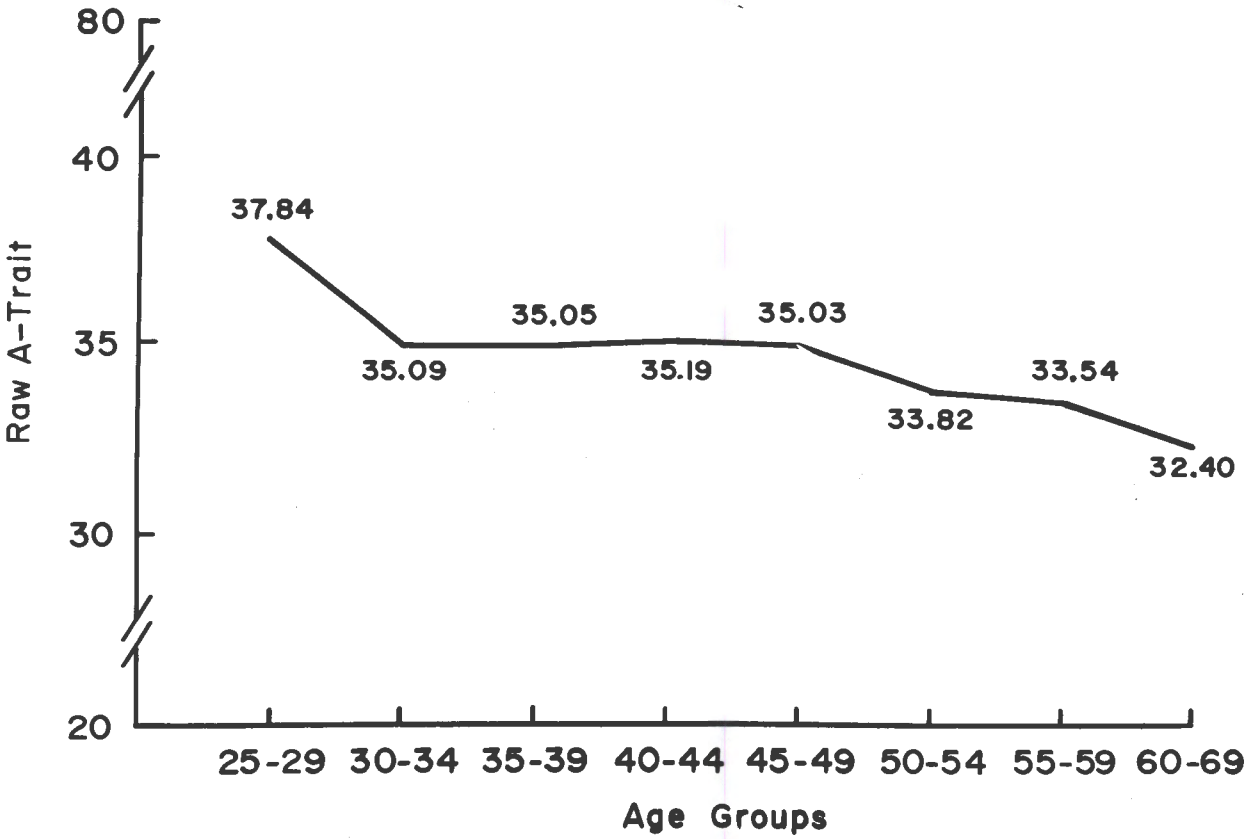

Figure 1. Mean A-Trait scores for the eight age groups.

because they occupied an intermediate position between the extreme groups, which did differ significantly. The scores of these three groups were compared to the scores reported for the original STAI form by Spielberger et al. (8) for high school juniors, college freshmen, and college undergraduates. Table 3 gives the results of the t tests for these comparisions. The comparisions of A-Trait scores indicated that the high school, college freshmen, and college undergraduate samples all scored significantly higher than FAA respondents in the 30- to 59- and 60- to 69-year age groups for both men and women.

The significant differences for the men on the A-State scores were that the high school students and college undergraduates both scored higher than the FAA men in the 60 to 69 age group, and the college freshmen scored higher than the FAA men in all three age categories. The A-State scores of the women in the high school and college freshmen groups were significantly higher than the FAA women in both the 30- to 59- and the 60- to 69-year age groups, while the college undergraduate women scored lower than FAA women in the 25 to 29 age group.

To determine the strength of the relationship between age and A-Trait and A-State scores in the present study, Pearson product-amount correlation coefficients were computed between age and scores on the A-Trait and A-State

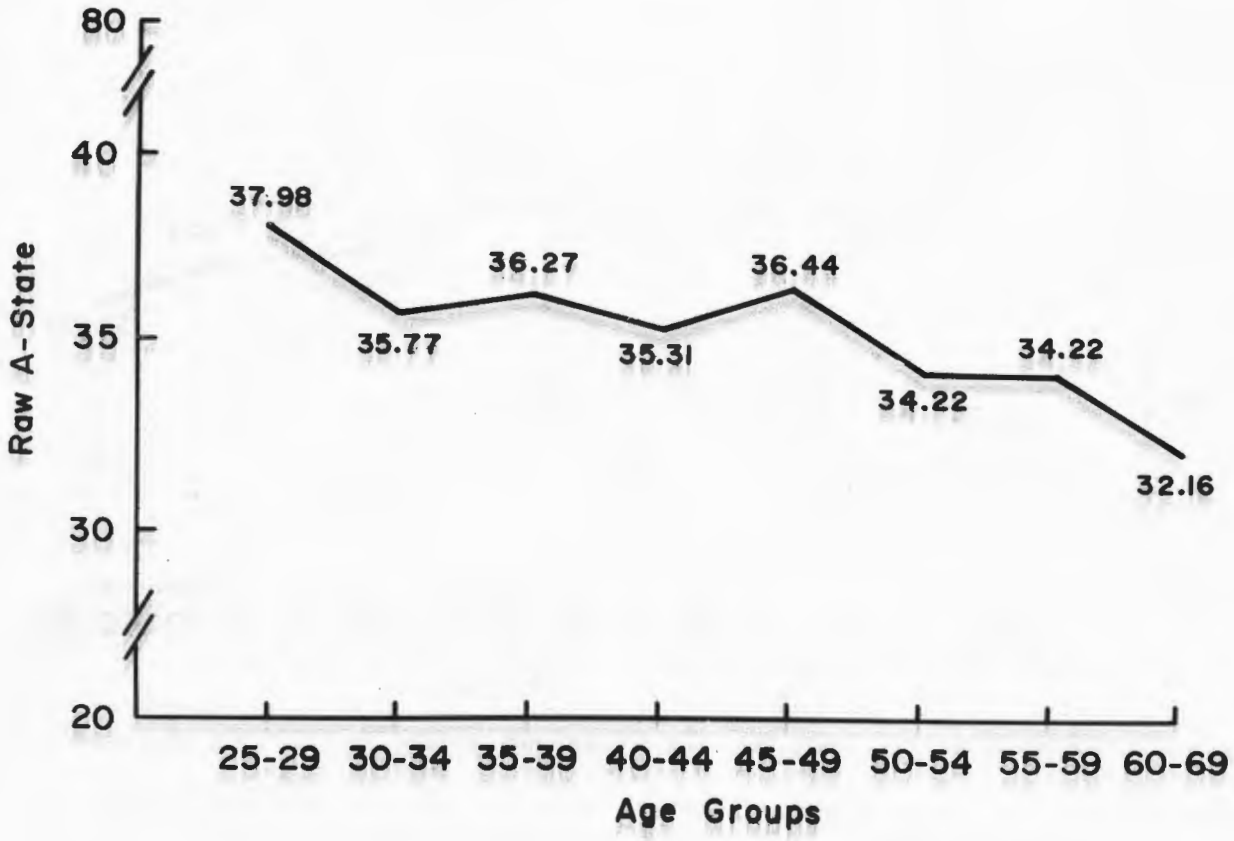

Figure 2. Mean A-State scores for the eight age groups.

scales for both men and women. The coefficients for men were -.08 for A-Trait ($p < .01$) and -.08 for A-State ($p < .01$), while for women they were -.20 for A-Trait ($p < .001$) and -.16 for A-State ($p < .001$). Although each of these correlations is significant and consistently in the direction of decreased scores with increased age, they are all low and account for only 0.6 to 4.1 percent of the variance in the age and STAI measures.

Sex. The mean A-State scores for men (35.68) and women (35.43) did not differ significantly by t test, nor did the mean A-Trait scores for men (34.93) and women (34.85) differ significantly. This equivalence of men's and women's STAI scores extended across the various levels of the other major variables of this study, viz, supervisory level, educational level, and shift

Table 3. Mean STAI Scores of the Present Sample by Age and Sex Groupings and t Tests Between Scores of Normative Subjects on Original Form X (ref. 8) and Scores of Present Sample by Age and Sex Groupings on Form Y

				Normative Groups					
	Present Sample			High School Juniors		College Freshmen		College Undergraduates	
	Men	Women		Men	Women	Men	Women	Men	Women
Age in Years	A-Trait								
25 to 29	36.61	39.37		39.37	41.61	38.07	38.22	37.68	38.25
			t	1.90	1.20	1.19	-0.89	0.74	-0.73
30 to 59	34.82	34.41							
			t	6.41***	8.13***	5.92***	6.81***	4.52***	5.05***
60 to 69	33.00	30.74							
			t	4.45***	4.10***	4.16***	3.93***	3.26***	3.48***
	A-State								
25 to 29	36.75	39.50		36.99	37.57	40.01	39.39	36.35	35.12
			t	0.17	-0.99	2.80**	-0.08	-0.28	-2.77**
30 to 59	35.64	35.00							
			t	1.69	2.60**	7.15***	7.12***	1.00	0.14
60 to 69	32.06	32.41							
			t	3.51***	1.97*	6.72***	3.71***	2.98**	1.30

*p < .05 **p < .01 ***p < .001

difficulty. STAI scores for each of these variables are shown in Tables 4 and 5 and Figure 3, respectively. In none of the ANOVAs performed on the data shown in these tables, was the main effect for the sex factor or the interaction effect of sex with any other factor significant.

Supervisory Level. Three groups of respondents, nonsupervisors, supervisors, and managers, were identified by their responses to Items 8 and 9 under the job information section of the questionnaire. For those groups the mean A-State scores were 35.74, 35.15, and 35.64 and the A-Trait scores were 35.27, 34.43, and 33.55, respectively. There were no significant differences in mean A-State or A-Trait scores among these three groups of respondents (see Table 4).

Table 4. Mean A-Trait and A-State Scores for Nonsupervisors, Supervisors, and Managers

		Nonsupervisors	Supervisors	Managers
A-Trait	Men	35.33	34.13	33.75
	Women	35.13	36.94	32.37
A-State	Men	35.79	35.01	34.90
	Women	35.64	36.47	33.17

Educational Level. The information given by respondents about education in the General Information section of the questionnaire was used to classify the following three groups: (1) completion of 1 or more years of business or trade school, (2) education up to 3 years of college, and (3) completion of a bachelor's or higher degree. The respective A-State scores for these groups were 33.57, 35.61, and 35.45 and the respective A-Trait scores were 35.09, 35.05, 34.43. Neither the A-State nor the A-Trait scores differed significantly among groups (see Table 5).

Difficulty of Shift. The five response alternatives for question 11 on shift difficulty in the job information section of the questionnaire provided five categories of shift difficulty and the corresponding groups of respondents. Figure 3 shows the mean A-State scores for workers in shifts rated "very difficult," "difficult," "neither difficult nor easy," "easy," and "very easy"; Figure 4 shows the mean A-Trait scores for the same groups of respondents. The mean A-State scores for groups who rated their shifts as "very difficult" and, to a lesser extent, as "difficult" were noticeably elevated above the scores of the other three groups. The ANOVA conducted on these scores yielded a significant effect for shift difficulty.

Table 5. Mean A-Trait and A-State Scores for Three Educational Levels

		One Year or More of Trade School	≤13 Years of School	College Graduate
A-Trait	Men	34.47	34.97	35.22
	Women	34.33	35.23	33.89
A-State	Men	35.46	35.71	35.69
	Women	35.42	35.40	34.45

($F(4/1782) = 18.47$, $p < .01$). A Newman-Keuls (11) comparison between the means of the five groups indicated that the "very difficult" shift group had significantly ($p < .01$) higher A-State scores than the other four groups, but that there were no significant differences among the remaining groups.

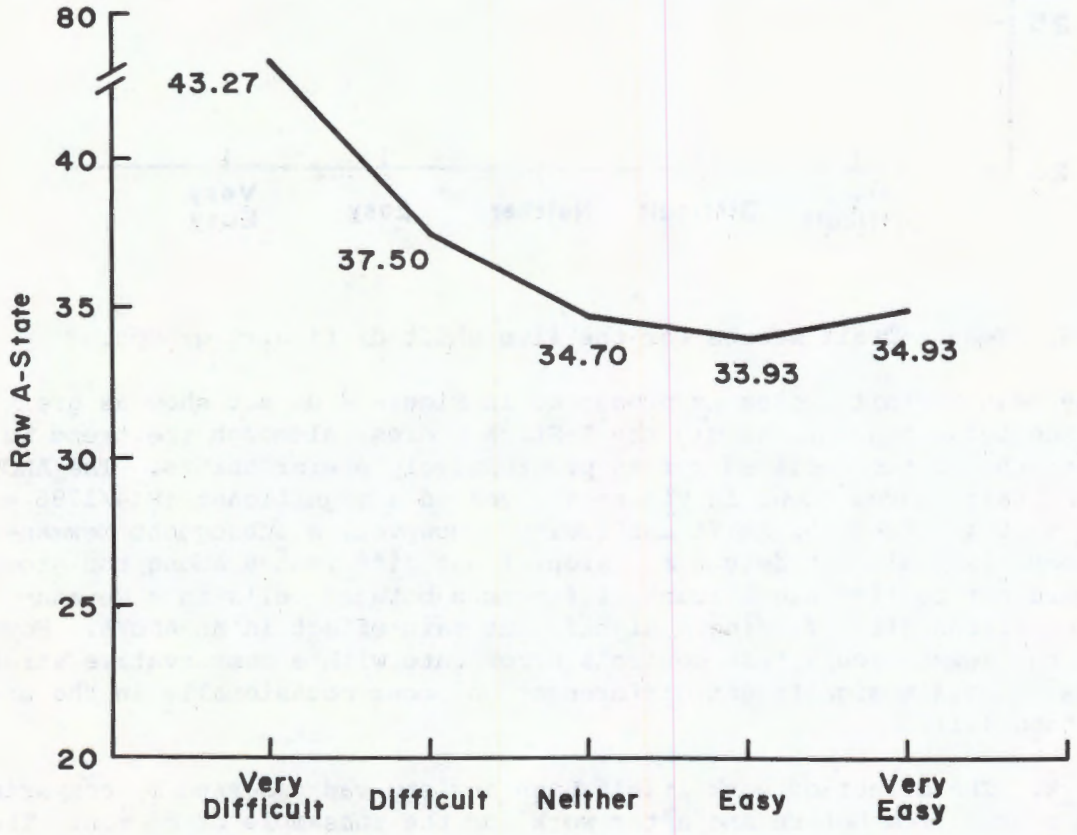

Figure 3. Mean A-State scores for the five shift difficulty groups.

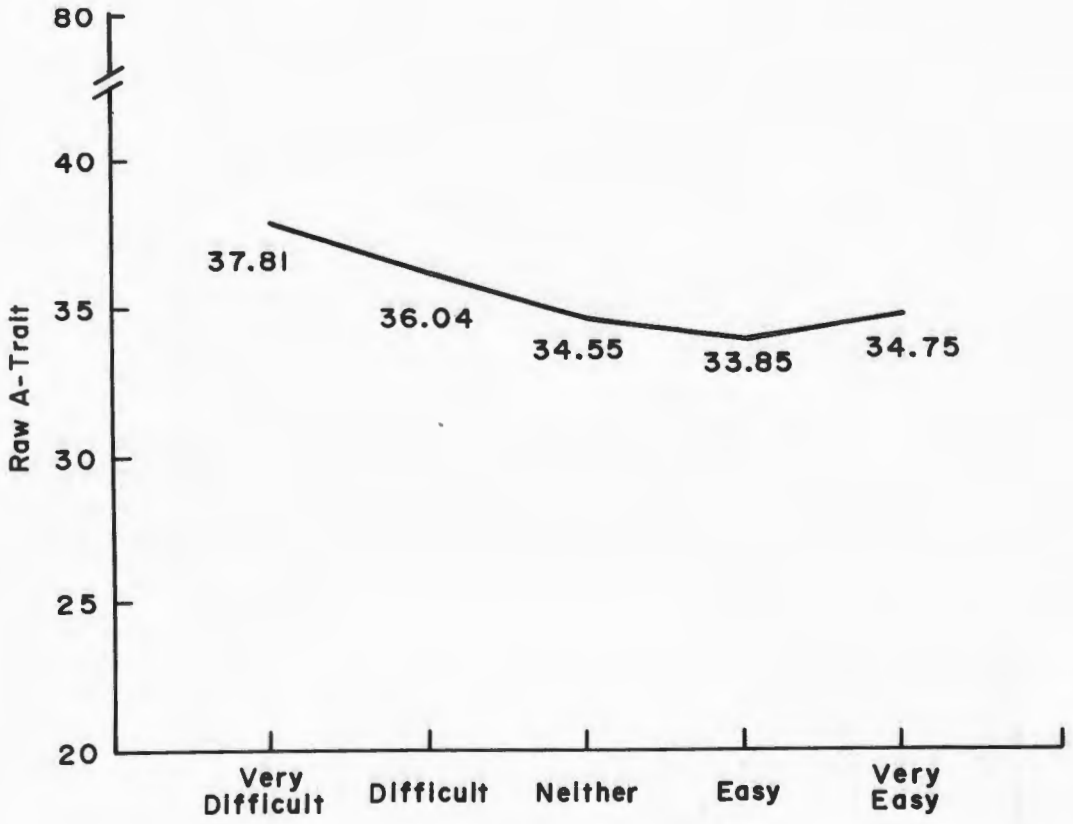

Figure 4. Mean A-Trait scores for the five shift difficulty groups.

The mean A-Trait scores as presented in Figure 4 do not show as great a difference between groups as did the A-State scores, although the trend is the same; the scores declined across progressively easier shifts. The ANOVA on the A-Trait scores shown in Figure 4 revealed a significant ($F(4/1786 = 4.72$, $p < .01$) effect for shift difficulty. However, a subsequent Newman-Keuls comparison did not detect any significant differences among the groups. It is rare not to find significant differences between cells in a Newman-Keuls comparison after finding a significant main effect in an ANOVA. However, because the Newman-Keuls test controls error rate with a conservative strategy, failures to obtain significant differences do occur occasionally in the use of this method (11).

Work. The effect of work itself upon anxiety was assessed by comparing A-State scores from before and after work for the subsample of 88 men. The mean "before" score was 33.12 and the mean "after" score was higher at 37.01. This 3.89 mean difference was statistically significant, t (87) = -6.49, $p < .001$.

Correlations between the scores obtained on the revised and the original version of the A-State scale for these subjects were +.54 for the before-work and +.64 for the after-work assessments. The correlation between the two forms on the A-Trait scale was +.86. Since the STAI assessments were completed on consecutive days, these values are essentially test-retest correlations and are similar to test-retest outcomes reported for the original version of the STAI (+.33 to +.54 for A-State and +.84 for A-Trait) (8). As expected, the A-Trait scale is the more constant of the two, since it is designed to measure a fairly stable personality characteristic, while the A-State scale is intended to measure periodic fluctuations in anxiety.

Discussion.

STAI scores for both A-Trait and A-State decreased significantly with age. However, this decrease was found to be attributable to the difference in scores of the youngest (25-29 years) and oldest (60-69 years) age groups studied. Since A-Trait and A-State scores of individuals aged 30 through 59 did not differ from those of the youngest group, the scores of adults falling within the age range of 25 to 59 were compared with scores of the normative data for college undergraduates. These comparisons revealed either no differences or significantly higher mean values for college undergraduates. The only exception was the finding of significantly lower A-State scores in college undergraduate women relative to the 25- to 29-year age group of women sampled in the present study. Since the age range of active ATCSs easily falls within the 25-59 year age range, the undergraduate normative data used in previous studies (4) to assess anxiety levels among ATCSs appears to adequately represent anxiety levels typical of an adult population of non-air-traffic-control specialists.

Neither level of supervisory responsibility nor educational level was found to be related to STAI scores. Nor were there any differences between men and women in either A-Trait and A-State. This latter finding is in agreement with the general lack of significant sex differences in STAI scores reported by Spielberger et al. (8) where only in a sample of high school juniors did A-Trait scores of men and women differ.

The perceived degree of difficulty of a work shift has been previously shown to be related to STAI scores when measured in a high-stress occupation (5). That relationship was also found to exist in the present sample which was drawn from a spectrum of occupations. Thus, it appears that for a wide range of occupational activities, there is a distinction between very difficult work periods which are perceived as more anxiety arousing than usual, and all work periods of lesser or no difficulty that are not remarkably anxiety arousing.

There are important implications from this finding in situations where the aroused anxiety is detrimental to performance of required tasks. Where possible, assessments of shift difficulty and anxiety might serve as valuable indications that alternative work situations are needed. The findings of the present study suggest that the STAI might be useful in making assessments not only of anxiety, but possibly of shift difficulty as well.

The increase in A-State scores from before work to after work found in this study is similar to the findings reported by Smith and Melton (5) for ATCSs. However, Smith and Melton reported two sets of "before" and "after" work scores: One set for shifts rated as easy and the other set for shifts rated as difficult. The difference in ratings between the easy (30.17) and difficult (29.07) shifts was not significant and these scores from ATCSs were approximately three and four points lower than the "before" work mean score (33.12) found in the present study for a variety of occupations.

In the Smith and Melton study, mean scores obtained after the easy (33.10) and difficult (37.55) shifts differed significantly from each other and both were significantly higher than their respective scores "before" work. The mean non-ATCS "after" work score (37.01) for the present study was approximately the same as the mean ATCS "after" work score (37.55) reported by Smith and Melton for difficult shifts.

These comparisons suggest that the sample used in the present study, which included accountants, aircraft mechanics, boiler operators, clerks, computer programmers, electronic engineers, electronic technicians, and warehousemen, had a higher before-work level of A-State than the air traffic controllers of the Smith and Melton study. Also, the indications are that the worker sample of the present study had an after-work A-State level almost as high as the ATCSs who rated their shift as difficult. In making these comparisons, it should be noted that even the ATCSs of the relatively high A-Trait group in the Smith and Melton study averaged below the fiftieth percentile in the college normative data given by Spielberger et al. (8).

Finally, it is important to note that although A-Trait and before-work A-State levels may vary across different occupations, there is usually an increase of A-State levels during a work shift which must be considered against the baseline for the specific group of interest.

Conclusions.

STAI scores of adult men and women within the age range of 25 through 59 years were generally equal to or slightly less than scores of the college undergraduate normative group. This suggests that the previous use of undergraduate norms to evaluate A-Trait and A-State scores of ATCSs did not underestimate the levels of work-related stress associated with their work. Smith's (4) conclusion that "there is little evidence to support the notion that ATCSs are engaged in an unusually stressful occupation" is not changed by the findings of this study. Although A-State scores increased from before work to after work in the subsample of FAA employees surveyed in the present study, neither the absolute levels of work stress nor the change in stress induced by work were noticeably different from those levels and changes reported by ATCSs who rated their work shifts as difficult.

Appendix I

INSTRUCTION SHEET FOR PARTICIPANTS

This questionnaire is part of a survey on the effects of work on FAA employees being conducted by the Civil Aeromedical Institute. Your voluntary participation is requested and will be greatly appreciated. Your responses to the questions will be anonymous so do not put your name on the questionnaire.

The questionnaire is brief and should take only approximately 15 minutes to complete. You should answer the questions with your first impression and not take too long on any one item. Please try to respond to all items, however, if you do not wish to answer an item you may leave it blank.

In responding to the Self-Evaluation Questionnaire (pages 2 and 3 of this survey) please notice that the directions ask you to answer as "you feel right now" for questions 1 through 20 and to answer as "you generally feel" for questions 21 through 40.

When you have completed the questionnaire, return the form to the original envelope and seal the envelope. The survey form will be collected as indicated by the person who distributed it.

Appendix II

BIOGRAPHICAL QUESTIONNAIRE

General Information

*Age_____

*Sex M_____ F_____

*I consider myself:

Asian_____ Hispanic_____

Black_____ Native American_____

Caucasian_____ Other (Please specify)_____

*Education (Check highest level completed):

Grades	1____ 7____	College	1____	Trade or Business School	1____
	2____ 8____		2____		2____
	3____ 9____		3____		3____
	4____10____		4____		4____
	5____11____		5____		5 or more____
	6____12____		6____		
			7 or more____		

Appendix II (Continued)

Job Information

1. Present government grade: GS_____ WG_____

2. Current FAA position title (For example, clerk-stenographer, aviation safety inspector, training instructor):_____

3. How long have you worked in this position?_____

4. How many years have you worked for the FAA/CAA?_____

5. How would you describe your present occupation/profession? (For example, engineer, secretary, machinist, pilot, etc.)

_____

6. How many years have you been in this occupation?_____

7. If you have changed occupations in the last five years, what was your previous occupation?_____

*8. Are you presently a supervisor; that is, does your official job description include the responsibility for directly supervising the work of others? Yes_____ No_____

*9. Are you presently a manager; that is, does your official job description include the responsibility for managing a program, budget development, policy making, management by objectives requirements, etc.? (Check if this applies no matter what your answer to Item 8 was.) Yes___ No___

10. In general, how difficult is your job?

Very Difficult	Difficult	Neither	Easy	Very Easy

*11. Up to now, how difficult has today's shift been; or, if you are just starting the shift, how difficult do you expect it to be?

(Check one) Up to now_____ Expect to be_____

Very Difficult	Difficult	Neither	Easy	Very Easy

References

1. Benge, E. J., S. L. Burk, and E. N. Hay: Manual of Job Evaluation. New York: Harper and Row, 1941.

2. Cattel, R. B., H. W. Eber, and M. M. Tatsuoka: Handbook for the Sixteen Personality Factor Questionnaire (16PF): Champaign, Illinois: The Institute for Personality and Ability Testing, 1970.

3. Cattell, R. B., and I. H. Scheier: The Meaning and Measurement of Neuroticism and Anxiety. New York: Ronald, 1961.

4. Smith, R. C.: Stress, Anxiety, and the Air Traffic Control Specialist: Some Conclusions From a Decade of Research. FAA Office of Aviation Medicine Report No. AM-80-14, 1980.

5. Smith, R. C. and C. E. Melton: Susceptibility to Anxiety and Shift Difficulty as Determinants of State Anxiety in Air Traffic Controllers. AEROSPACE MEDICINE, 45:599-601, 1975.

6. Spielberger, C. D.: Self-Evaluation Questionnaire, STAI Form X-1 and X-2. Palo Alto: Consulting Psychologists Press, 1968.

7. Spielberger, C. D: Self-Evaluation Questionnaire, STAI Form Y-1 and Y-2. Palo Alto: Consulting Psychologists Press, 1977.

8. Spielberger, C. D., R. L. Gorsuch, and R. E. Lushene: Manual for the State-Trait Anxiety Inventory. Palto Alto: Consulting Psychologists Press, 1970.

9. Super, D. E: The Psychology of Careers. New York: Harper and Brothers, 1957.

10. U. S. Department of Commerce. Statistical Abstract of the United States 1978.

11. Winer, B. J.: Statistical Principles in Experimental Design. New York: McGraw-Hill, 1962.

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