Original Article

Test taking response styles and associated personality traits in aircrew during evaluation

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ABSTRACT

The medical category given to aircrew following their medical evaluation determines their future flying status. This fact has a direct bearing on the level of self disclosure that an aircrew uses in answering questions regarding themselves on personality questionnaires during the psychometric assessment. Test taking response style refers to the way in which a respondent reacts to a test and test taking atmosphere. Personality evaluation of military personnel in our laboratory using objective personality questionnaires has indicated that internal validity scales are high in over 55% of the subjects, making test results less reliable and more difficult to interpret. The aim of the study was to investigate the incidence of aircrew who score significantly higher on response style scales of the 16 PF and MMPI test questionnaires and to delineate whether these scores are associated with any specific personality traits. The 16 PF and MMPI test questionnaires were administered to 60 and 40 aircrew respectively, who were referred for psychological assessment as part of their medical evaluation. Test results were scored and percentage incidence of low, moderate and high scores on response style scales were calculated in the group and subjected to χ^2 test. Five response style indices and twenty nine personality variables scores were analyzed both within and between each other, using Pearson's product moment correlation. Results indicated that a significantly larger percentage of these aircrew scored higher on motivational distortion (MD scale on 16PF) and on the defensiveness scales (L & K), but not on the "cannot say" (? Scale) and infrequency (F scale) of the MMPI. This suggests that in referred aircrew, test taking response style is primarily influenced by their unwillingness to disclose personal information. Two groups of aircrew were differentiated. The significantly larger aircrew group scoring high on MD and K scales had personality traits which were in consonance with "core personality" traits of aircrew. However, a smaller group which scored high on F and ? scales, had personality characteristics indicative of less adaptive traits.

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Test taking attitudes influence the interpretability of objective personality tests such as self report inventories and schedules. Objective questionnaries utilized in aircrew evaluation include such tests as the 16 Personality Factor (16PF) [1] and the Minnesota Multiphasic Personality Inventory (MMPI) [2] that are self report inventories. Maximizing the validity of self report in certain settings is of concern because subjects frequently have a strong motivation to present themselves other than they

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are. Certain types of populations such as military personnel, prisoners, patients and others whose lives or professions are heavily influenced by others decisions may feel particularly vulnerable to the consequences of self- disclosure [3].

In psychological evaluation of aircrew and other military personnel in Department of Aviation Psychology at Institute of Aerospace Medicine (IAM), the internal validity scales of personality questionnaire tests were found to be elevated in over 55% of subjects, making results less reliable [4]. The medical category given to aircrew following their medical evaluation, determines their future flying status. This fact has a direct bearing on the level of self disclosure that an aircrew uses in answering questions regarding themselves on personality questionnaires during the psychometric assessment. This may lead to lack of disclosure/ faking bad or good in aircrew, depending on the motives of the subject. When asked to complete inventories, aircrew may be influenced by differing motives, depending on motivation to continue flying, change their flying stream, be grounded or get release from service on medical grounds.

In questionnaires, the transparency of items is so high that the subject may try to guess what aspect of his behaviour is being measured. Therefore, there is a need to study what factors influence response style, when aircrew come for medical evaluation. If these factors can be quantified, correction scores for personality test scales can be derived to increase reliability of responses given by aircrew to questionnaires. One important factor, which can influence response style, is personality.

The concept of the response style in test taking refers to the ways in which a respondent reacts to a test and the test-taking atmosphere. Respondents may function during the test in ways that render the scores on the test suspect. There are a number of different types of response styles usually measured using validity scales on the questionnaire. On the MMPI, there are four validity scales. The ? scale is indicated by the number of omitted items. If over thirty items are left unanswered it suggests lack of cooperation or defensiveness. The L scale measures the tendency to claim an excessive amount of virtue. High scores reflect a tendency to present an overly favourable self-image. The F scale measures the tendency to endorse rare or unusual attributes. High scores may suggest faking, confusion, disorganization or severe disturbance. The K scale measures an individual's unwillingness to disclose personal information. High scores reflect defensiveness or the individual's unrealistic view of him or herself. On the 16 PF Form D, there is a motivational distortion score, which measures the tendency to provide socially desirable answers to items. Specifically this consists of self-deception (self- denial of attributes one finds psychologically threatening) and misrepresentation of self to others.

A number of previous studies have used both the 16 PF and the MMPI on aircrew however, the studies seldom publish their data on response styles and only few mention whether results have taken response styles into account. One study investigated the usefulness of MMPI with particular emphasis on norms, the discrimination of adjustment and the validity of the K correction [5]. The norms for 634 pilots differed significantly from the original norms for eight scales, with the pilots appearing more defensive, hysteric and hypomanic and less hypochondriacal, psychasthenic, schizophrenic and socially introverted than the original normative group. They

suggested that use of pilot norms permits more accurate comparison with pilot groups. They concluded that the K correction is inappropriate within the pilot sample and that raw scores, uncorrected for K should be used. This elevation of the K scale was replicated in a later study [6] which interpreted this finding as indicating the need in pilots to present themselves favourably.

A later study [7] analyzed MMPI data from two groups of aviators: 229 US Army helicopter pilots being screened for acceptance into US Army Special Operations and 58 helicopter pilots participating in a variety of research studies at the US Army Aeromedical Research Laboratory. The two groups differed in terms of their scores on some validity scales and several clinical scales. Using discriminant analysis, observed differences in both test-taking attitude and Masculinity-Femininity classified subjects into Special Operations applicants or more conventional aviators.

A few studies have utilized 16 PF on aircrew, of which two dealt with personality aspects of involvement in pilot -error accidents [8,9]. The first study found that three factors (M, N, Q2) were able to correctly classify 86% of the aviators as to whether or not they had been previously listed as a cause factor in a military aviation accident. The second study however could not replicate these findings. These authors used Form A of the test; hence no MD scores were mentioned. Lardent [10] compared personality constructs using 16 PF on 47 F-4 Phantom fighter pilots who had experienced Class-A accidents and 44 who had not. Data did not provide evidence for a "grand theory" or generic personality profile for accident-prone fighter pilots; however, support was found for the concept of "limited domain" theories of accident proneness. Five significant personality factor (conscientious, suspicious, shrewd, self-sufficient and tense) differences discriminated the safe from the crashed F-4 pilot subjects. 27% of the variance in crashing was explained by personality differences, and over 70% of the pilots were correctly classified. Two other studies have used 16 PF on trainee pilots. The first studied 31 male aviation majors, aged between 18 and 38 yr, who had earned their Private Pilot Licenses and were working toward more advanced ratings. The pilots varied significantly from the male college student norm on Factors E, F, G, H and Q3 of the 16 PF [11]. In the other study, 16 PF was administered to 50 first year flying trainees; results revealed that the trainees were significantly lower on self-control (Factor Q3) and higher on tough mindedness (Factor I) than the norm [12].

The personality profile of a highly rated Indian Air Force pilot using the 16 PF, was described as "above average in abstract thinking, high stress tolerance, resilient, decisive, practical, sober and dependable". No statistical differences between fighter and transport pilots were found [13]. However, in absolute scores, fighter pilots were higher on intelligence, self-sufficiency and emotional stability.

The aim of this study was to investigate the incidence of aircrew scoring significantly higher on response style indices of the 16 PF and the MMPI test questionnaires and to delineate whether these scores are associated with any specific traits of personality.

Material and Methods

A total of 60 aircrew who were referred for psychological assessment as part of their medical evaluation for various diagnoses from July 1995 to June 2003, at IAM, IAF, Bangalore constituted the sample population. They were

administered the 16PF test (N=60). All but one of these aircrew were male. The MMPI was also administered separately to 38 males and 2 females (N=40) mostly of the first group. The demographic characteristics of the sample are shown in Tables 1A and 1B, and diagnostic groups of the sample are shown in Table 2.

Psychological Questionnaires

A good rapport was first established with the pilot, informed consent was obtained and a detailed clinical interview was carried out. The interview pertained to the present and past medical and/or psychological history, flying, occupational, family, personal and treatment history. Depending on the clinical presentation, one or both questionnaires were administered individually to aircrew under structured conditions as outlined in the test manuals. These were:-

(a) The 16 PF test, Form D [1]. This is a 105-item questionnaire, which measures the sixteen

Table 1A: Demographic characteristics of the aircrew population

Characteristic		16 PF	%	MMPI	%
Sex	Male	59	98	38	95
	Female	1	2	2	5
Marital status	Single	23	38	15	38
	Married	36	60	25	62
	Divorced	1	2	0	0
Present aircraft stream	Fighter	33	55	19	48
	Transport	19	32	17	42
	Helicopter	8	13	4	10

Table 1B: Demographic characteristics of the aircrew population

Characteristic	16 PF group mean (SD)	MMPI group mean (SD)
Age (yr)	28.93 (5.74)	28.47 (4.72)
Education (yr)	15.03 (0.25)	15.00 (0.00)
Service (yr)	6.87 (4.78)	6.45 (4.49)
Flying hours	882 (744)	860 (699)

Table 2: Diagnostic categories of aircrew sample

Diagnostic category	16 PF	%	MMPI	%
Head injury / Spinal disease	18	30	8	20
Low motivation / Fear of flying	14	23	12	30
Psychiatric illness	10	17	8	20
Air Sickness	3	5	1	2
Medical illness	15	25	11	28

first order and four second order factors of personality by factor assay. It has been standardized on Indian general population. The consistencies of the test have been provided in a number of ways by Institute of Personality and Ability Testing. Short interval test-retest reliability coefficients for individual source traits, varied from 0.67-0.86 and for second order factors varied from 0.83-0.93. Validity coefficients varied from 0.63-0.90 [1].

(b) The MMPI [2]. This is a 566-item inventory, which is a forced choice test with 'yes' or 'no' answers. There are ten clinical scales: Hypochondriasis, Depression, Hysteria, Psychopathic Deviance, Masculinity-Feminity, Paranoia, Psychasthenia, Schizophrenia, Hypomania and Social Introversion. There are four validity scales to detect whether the subject has answered in a straightforward, honest manner. Extreme endorsements of the items on any of these scales may invalidate the test, while lesser endorsements frequently contribute important interpretative insights. Test reliability and validity are "quite satisfactory" [2], with reliability coefficients for individual scales, varying from 0.46-0.93 in different studies.

Procedure

(a) Test Administration and Instructions. The subjects were asked to complete the questionnaire as part of the psychodiagnostic testing. Instructions to the subjects followed the test manual. They were instructed to give their first and natural response to the questions and to answer them carefully and truthfully. The examiner read out the instructions to the subject who then worked through the examples. The subject was then told that if he did not understand any questions, he could note down the numbers and the examiner would clarify the unanswered questions at the end of the test, since as far as possible no questions should be left unanswered. The test was then begun; questions were read from the test booklets and answered on separate answer sheets. The responses were computer scored. Raw and sten scores were then plotted on test profiles.

(b) Data Reduction. Data of thirty-nine variables, for 60 subjects, were entered into the Statistical Package for Social Sciences (SPSS) worksheet on computer. Eight of these variables were demographic characteristics including personal, flying and medical history. Seventeen were 16 PF variables and fourteen were MMPI variables.

(c) Statistical Analysis. The test results were analyzed and the percentage incidence of below and above cut off scores on response style indices were calculated in the group and subjected to c 2 testing. Five response style indices and the twenty nine personality variables were analyzed both within and between each other using Pearson's product moment correlation.

Results

(a) Aircrew scoring high on Response Style Indices. A significantly higher percentage of aircrew scored higher on Motivational Distortion (MD) score on 16 PF test and on the Defensiveness scales (L&K scales), but not on the "cannot say" (? scale) and the Infrequency scale (F scale) of the MMPI, as shown in Table 3.

(b) Correlation between different Response Style Indices. Correlation analysis between the response style indices of the 16PF and the MMPI tests showed that MD scores had a significant positive correlation with the defensiveness (K) scale (r =0.40, p< 0.016) and a negative correlation with the infrequency (F) scale (r = -0.45, p<0.006).

Table 3: $\chi 2$ analysis of percentage of aircrew scoring above and below Response Style Indices cut off scores

Response Style Indice	% below cut off score	% above cut off score	$\chi 2$ value
MD	21.3	78.7	6.80**
?	97.7	2.3	3.90**
L	32.6	67.4	9.19**
F	74.4	25.6	10.90**
K	18.6	81.4	12.67**

(** p <0.01)

(c) Correlations between 16 PF Scales and Response Style Indices. Results in Table 4 show that the scores on Defensiveness (K) scale of MMPI correlated positively with Factor C (Emotional stability), Factor F (Expressivity), Factor H (Boldness), Factor Q3 (Control of emotions) and second order factors of Extraversion and Alert Poise on the 16 PF. K was negatively correlated with Factor Q2 (Group-dependency), Factor Q4 (Frustration) and the second order factor of Anxiety.

Therefore, it suggests that the aircrews' unwillingness to disclose personal information (K) is associated with higher self-perceived emotional stability, enthusiasm, boldness, extraversion and alert poise. It is negatively associated with being self sufficient and anxious.

The F scale; the tendency to endorse rare or unusual attributes is positively correlated with Factor N (Shrewdness) and negatively correlated with emotional stability and high self concept control (Factors C and Q3) and alert poise. The ? scale which indicates uncooperativeness was associated positively with dependency and negatively with alert poise. Alert poise also correlated with the tendency to provide socially desirable answers (MD).

Table 4: Significant correlations between 16 PF scores and Response Style Indices in aircrew

	16 PF Primary Factors								16PF 2nd Order Factors		
RSI	C	F	H	I	N	Q2	Q3	Q4	A	E	AP
MD											0.25 *
?				0.44 ***							-0.28 **
F	-0.56 ***				0.36 *		-0.47 ***				-0.46 *
K	0.58 ***	0.48 ***	0.48 ***			-0.40 **	0.48 ***	0.40 **	-.29 **	0.47 *	0.26 *

(* p< .05, ** p< .01, ***p< .001, ****p< .0001) (For correlation with MD, N=60 and for MMPI scales N=35)

Table 5: Significant correlations between MMPI scales and Response Style Indices in aircrew

RSI	MMPI Scales				
	D	Pa	Sc	Si	Pd
MD		-0.39 **			-0.36 *
F	0.33 *	0.51 ***	0.40 **	0.39 **	
K				-0.54 ****	

(* p< .05, ** p< .01, ***p< .001, ****p< .0001) (N=35)

(d) Correlations between MMPI Scales and Response Style Indices. Table 5 indicates the significant correlations found between MMPI scales and response style indices in aircrew. The tendency to endorse rare or unusual attributes (F scale) is associated with higher scores on Depression (D), Paranoia (Pa), Schizophrenia (Sc) and Social introversion (Si) scales.

Scores on the Defensiveness (K) scale of MMPI correlated negatively with Social introversion (Si) scale. The higher the tendency to provide socially desirable answers (MD), the lower were the scores on the Paranoia (Pa) and Psychopathic deviance (Pd) scales.

(e) Correlations between Demographic variables and Response Style Indices in aircrew. Younger aircrew tended to endorse socially desirable answers and were unwilling to disclose personal information; results shown in Table 6 indicate that aircrew with lesser service and fewer flying hours were more liable to endorse socially desirable answers (MD). Aircrew with higher scores on Defensiveness (K) scale were younger and had fewer number of flying hours. Older aircrew showed higher tendency to endorse rare or unusual attributes; higher F scale scores were related to being older and having higher number of flying hours.

Discussion

The results of this study indicate that a significantly higher percentage of aircrew scored higher on Motivational Distortion (MD) score on 16 PF test and on the Defensive scales (L and K scales) of the MMPI. A significantly higher percentage of aircrew scored lower on the "Cannot say" (? Scale) and the Infrequency scale (F scale) of the MMPI. This suggests that aircrew test-taking attitude is more influenced by their tendency to provide socially desirable answers and

Table 6: Significant Correlations between Demographic variables and Response Style Indices in aircrew

RSI	Demographic Variable		
	Age	Service (yrs)	No. of flying hours
MD		-0.31*	-0.31*
F	0.34*		0.52**
K	-0.35*		-0.34*

(* p< .05, ** p< .01) ((For correlation with MD, N=60 and for MMPI scales N=40)

their unwillingness to disclose personal information and less influenced by uncooperativeness and the tendency to endorse rare or unusual attributes.

This is the reason why the tendency to provide socially desirable answers to items correlates positively with aircrews' unwillingness to disclose personal information and why the tendency to endorse rare or unusual attributes is negatively correlated with the tendency to provide socially desirable answers (MD) in this sample. These findings are partly in line with previous studies [5,6], which indicated that in their pilot sample the F scale score was lower and K scale higher than in the original norms. However contrary to our findings, L scale scores were lower and ? scale was higher than the original norms. This could be possibly because their sample did not consist of clinical cases, like the sample in the present study. Test-taking attitude of aircrew during medical evaluation may be the reason for the differing results of the present study.

Differences in test-taking attitude classified subjects into Special Operations applicants or more conventional aviators [7]. Aircrew test-taking attitude is likely to differ during different situations depending on how the test results are likely to influence their occupational lives.

The second aim of the study was to delineate whether the response style indices were associated with any specific traits of personality. The scores on Defensiveness (K) scale of MMPI correlated positively with the Factors C, F, H, Q3 and second order factors of Extraversion and Alert Poise on the 16 PF. K was negatively correlated with Factor Q2, Q4 and the second order factor of anxiety. Therefore it suggests that the aircrews' unwillingness to disclose personal information (K) is associated with higher self-perceived emotional stability, enthusiasm, boldness, extraversion and alert poise. It is negatively associated with being self sufficient and anxious. It appears that these personality traits are those already established by other studies [13] as being distinctive of aircrew. Therefore this personality constellation may give rise to the test-taking attitude of defensiveness.

The K score correlated with the maximum number of personality variables. The normative value of the K score was higher than in the original group in one study [5]. The investigators contended that it is likely that, because military careers can be adversely affected by test results, K scores could be expected to indicate motivation to fly. The K score was also negatively correlated to the Si score; a similar finding to the above study, indicating lower Si scores in aircrew. However, the fact that other personality characteristics distinctive of aircrew from the same study do not show significant correlations may be due to the present study sample being one of only medically evaluated aircrew.

In summary, a significantly larger percentage of aircrew scored above the cut-off scores on three validity scales. These were the MD scale on the 16 PF and the K and L scales on MMPI. Certain personality factors were associated with response to K scale and MD scales. It was found that MD correlated with alert poise and was negatively correlated with MMPI scores of Paranoia and Pd scales. The K scale was positively associated with certain core traits and negatively associated with self sufficiency and anxiety.

A significantly fewer number of aircrew scored higher on the F and ? validity scales of MMPI. Some relationships with personality were also found in these aircrew, in that F scale positively correlated with shrewdness and negatively

correlated with emotional stability, high self concept control and alert poise. On MMPI it was also associated with higher scores on depression, paranoia, schizophrenia, and social introversion. The ? scale was associated with dependency and negatively with alert poise.

Therefore in this study two groups of aircrew were differentiated. The significantly larger aircrew group scoring high on MD and K scales had personality traits which were in consonance with "core personality" traits of aircrew as such. However a smaller group who scored high on F and ? scales had characteristics which were indicative of less adaptive personality traits.

Aircrew who scored higher on K and F, were relatively younger. The results indicate that both the K and F scores of the MMPI and the MD score of the 16 PF were higher, in younger and less experienced pilots. Age appears to be an important factor influencing test-taking attitude.

Conclusion

When psychological testing is likely to have more bearing on occupational role, test-taking attitudes of aircrew are likely to differ. Age and experience of aircrew was found to be an important variable, which influences test-taking attitude.

Test-taking attitude is defensive in the majority of aircrew undergoing medical evaluation. It is more influenced by their tendency to provide socially desirable answers and their unwillingness to disclose personal information and less influenced by uncooperativeness and the tendency to endorse rare or unusual attributes. In this group, the test-taking attitude is strongly associated with certain personality traits; these are higher self-perceived emotional stability, enthusiasm, boldness, extraversion and alert poise. It is negatively associated with being self sufficient and anxious. This attitude may be more influenced by "core" personality characteristics of pilots per se and less due to situational determinants.

However in a different and much smaller subset of aircrew, test-taking attitude is one of a tendency to endorse rare or unusual attributes. This type of test-taking attitude is positively correlated with the personality trait of shrewdness and negatively correlated with emotional stability and high self-concept control and alert poise. It is also associated with higher scores on depression, paranoia, schizophrenia and social introversion scales. Therefore the lack of adaptive personality characteristics in this group may give rise to this type of test-taking attitude during medical evaluation.

Future directions for more accurate testing and interpretation of 16PF and MMPI should include the development of separate norms which are more applicable to IAF aircrew, which should consider age and flying experience of the population among other important factors.

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