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# Blood type and personality

Mary Rogers, A. Ian Glendon\*

*School of Applied Psychology, Griffith University, Gold Coast Campus, PMB 50 Gold Coast Mail Centre,  
Gold Coast, Queensland 9726, Australia*

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## Abstract

This study investigated possible relationships between blood types and personality within a normal population. Evidence from published studies claiming associations between blood type and personality is scanty, conflicting, and characterised by unequal cell sizes. This study predicted that compared to those with other blood types, blood Type B individuals would be higher on neuroticism, blood Type O individuals would be higher on extraversion and optimism, blood Type A individuals would be higher on agreeableness and blood Type AB individuals would be higher on conscientiousness. A main effect for gender on neuroticism and an interaction effect for gender and blood Type B on neuroticism were also predicted. Participants comprised a quota sample of blood donors—180 males and 180 females. Thirty males and 30 females from each of the four blood types were included in the final analysis. A version of the big-five factor personality inventory developed by Goldberg, and the Life Orientation Test Revised were administered. MANOVA results showed that the combined dependent variables were not significantly affected by blood type, nor by gender, nor were there any interaction effects. No relationship between blood type and personality is supported by this study. Methodology of previous studies is reviewed and implications of the findings considered. © 2002 Elsevier Science Ltd. All rights reserved.

*Keywords:* Agreeableness; Blood type; Conscientiousness; Extraversion; Intellect; Neuroticism; Optimism; Openness

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## 1. Introduction

Approximately 40% of the variation in personality is genetic (Costa & McCrae, 1992a; Eysenck, 1990; Plomin & Caspi, 1999). The notion that personality traits were inherited through the blood dates back to Aristotle (Hoyersten, 1997). Hippocrates sought to link personality with four bodily humors—sanguine, phlegmatic, choleric and melancholic (Furukawa, 1930; Jogawar,

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\* Corresponding author. Tel.: +61-7-5594-8964; fax: +61-7-5552-8291.

*E-mail address:* i.glendon@mailbox.gu.edu.au (A.I. Glendon).

1984). Because blood group is genetically determined, ascertaining whether certain personality traits are associated with particular blood types is one way of examining possible influence of genetic factors in personality.

### *1.1. Blood type and personality studies*

Popular books (e.g. Constantine, 1997; D'Adamo & Whitney, 2001; Nomi & Beshar, 1983) have been supplemented by scientific studies on a possible connection between blood type and personality in normal populations. Medical science has investigated the relationship between blood group and different diseases, while clinical studies have identified associations between blood type and psychological disorders. This paper considers a non-clinical population.

In his first study of blood type and personality Furukawa (1927) concluded that human blood types are one of the most important determinants of temperament. He maintained that types O and B were active (aggressive, progressive, positive) while types A and AB were passive (conservative, defensive, negative). Furukawa (1930) found that a majority of blood Type O individuals chose temperamental characteristics such as being optimistic, sociable and strong-willed (phlegmatic). Blood Type As he found to be melancholic—shy, docile, diffident, worrying, reserved and impressionable. Blood Type Bs were sanguine—frank, light-hearted, cheerful, sociable, quick and attentive. Blood Type AB persons had contradictory temperaments and could not be easily judged. Arguing that Furukawa's studies were methodologically and statistically unsound, Thompson (1936) found no relationship between blood type and intelligence, emotions, idiosyncrasies, or personality.

Using the High School Personality Questionnaire, Form A, Cattell, Boutourline, and Hundleby (1964) found that blood Type A respondents were more tender-minded than were those with blood types O, B, and AB. While participant numbers were not reported, blood type frequencies were unequal. Norton's (1971) criticism of Cattell et al.'s study was rejoindered by Cattell and Hundleby (1972). No clear relationship has been found between intelligence and blood type (Cattell et al., 1964; Gibson, Harrison, Clarke, & Hiorns, 1973; Owen, 1972).

Using the 16PF Cattell, Brackenridge, Case, Propert, and Sheehy (1980) found some significant relationships between blood type and personality among 323 Australian residents, although with only 12 ABs in the sample. Blood Type As were significantly lower than Type Os on self-sentient integration, but not compared with other blood types. Cattell et al. (1980) also found that blood Types O and A differed significantly from each other on anxiety—A being the highest—with neither As nor Os differing significantly from the other two groups.

Proposing a possible association between blood type and genetic determination of racial and national differences Eysenck (1977) found "emotional behaviour" to be more common in Type B than in Type A blood group and Type ABs to be more introverted than other types. Seeking to explore why cultures and nations differ with respect to psychoticism, extraversion and neuroticism Eysenck (1982) reviewed studies of blood group and personality tests in over 20 countries linking personality differences with genetic factors. Eysenck (1982) found that anxiety and neuroticism levels of a country appeared to vary consistently with the proportion of Type B blood group individuals. He also found that introversion varied with the proportion of Type AB blood group individuals.

Three studies have reported an association between extraversion and blood type. Lester and Gatto (1987) found that those with blood types O and AB had significantly higher extraversion

scores, while blood type A and B individuals had significantly higher introversion scores. Angst and Maurer-Groeli (1974) found that blood Type Bs were higher on neuroticism and that blood Type ABs were introverted. Maurer-Groeli (1974) found that blood Type As were more emotionally vulnerable and that blood Type ABs were more aggressive, open and extraverted than were individuals with other blood types. Findings for blood Type AB contradicted Angst and Maurer-Groeli's results. de Mikusinski and Omar de Urteaga's (1983) first study found blood Type O females to be higher than blood Type A females on extraversion. Their second study found that blood Type A males were more extraverted and blood Type O males more introverted, while blood Type O females were more extraverted. Citing results from a self-selected sample of 20,635 respondents to the Myers–Briggs Type Indicator (MBTI) but presenting no quantitative data, D'Adamo and Whitney (2001) summarised the blood types as: O extraverted, A introverted, B independent, AB intuitive.

Three studies have reported associations between neuroticism and blood type. Rinieris, Christodoulous, and Stefanis (1980) found that irrespective of blood type, females had a higher mean neuroticism score than males did. Their results suggested that gender may be an intervening variable in the relationship between blood type and personality. Jogawar (1984) found those with Type B blood to be more neurotic than individuals of other blood types. Marutham and Indira (1990) initially found no difference between blood groups and extraversion, neuroticism and "Type A" behaviour, but after dividing the groups on the basis of EPI norms, found that blood Type Bs had higher scores on neuroticism than did any other group.

Summarising findings from blood type and personality studies Table 1 reveals some conflicting results. Findings are fairly consistent for blood Type As who have been found to be passive, shy, docile, tender-minded, introverted and emotionally vulnerable. However, de Mikusinski and

Table 1  
Summary of findings from blood type and personality studies

Blood type	Findings (Author, Date)
A	Passive—i.e. conservative, defensive, negative (Furukawa, 1927); shy, docile, worrying (Furukawa, 1930); tender-minded (Cattell et al., 1964); introverted (D'Adamo & Whitney, 2001; Lester & Gatto, 1987); emotionally vulnerable (Maurer-Groeli, 1974); anxious, low self-sentient integration (Cattell et al., 1980); extraverted (males only), (de Mikusinski & Omar de Urteager, 1983)
B	Active—i.e. aggressive, progressive, positive (Furukawa, 1927); cheerful, sociable, frank, light-hearted, attentive, quick (Furukawa, 1930); independent (D'Adamo & Whitney, 2001); introverted (Lester & Gatto, 1987); anxious, neurotic (Eysenck, 1982); neurotic (Angst & Maurer-Groeli, 1974; Jogawar, 1984; Marutham & Indira, 1990)
O	Active—i.e. aggressive, progressive, positive (Furukawa, 1927); optimistic, sociable (Furukawa, 1930); non-anxious (Cattell et al., 1980); extraverted (D'Adamo & Whitney, 2001; Lester & Gatto, 1987); extraverted (females only), introverted (males only), (de Mikusinski & Omar de Urteager, 1983)
AB	Passive—i.e. conservative, defensive, negative (Furukawa, 1927); contradictory traits (Furukawa, 1930); introverted (Angst & Maurer-Groeli, 1974); extraverted (Lester & Gatto, 1987); aggressive, open, extraverted (Maurer-Groeli, 1974); intuitive (D'Adamo & Whitney, 2001); self-sufficient (Cattell et al., 1980)

Omar de Urteager (1983) found blood Type A males to be extraverted. While Rinieris et al. (1980) found no relationship between blood type and neuroticism, four other studies revealed blood Type B to be related to neuroticism. Furukawa (1927) found blood Type Bs to be active, while Furukawa (1930) found blood Type Bs to be cheerful, sociable, frank, light-hearted, attentive and quick. Lester and Gatto (1987) found blood Type Bs to be introverted. Findings for blood Type Os were fairly consistent, suggesting that they are active, optimistic, sociable and extraverted. However, de Mikusinski and Omar de Urteager (1983) maintained that only blood Type O females were extraverted while blood Type O males were introverted. Findings for blood Type ABs were inconsistent. One study revealed them to be passive; two studies revealed them to be introverted; while another considered them aggressive, open and extraverted. Furukawa (1930) reported blood Type ABs as showing contradictory traits. Two studies reported significant gender differences. de Mikusinski and Omar de Urteager (1983) found that blood Type A males and blood Type O females were extraverted and blood Type O males to be introverted.

Of the studies for which results are summarised in Table 1, only two provide data from which estimates of effect size can be calculated. Maruthram and Indira (1990) cite means and standard deviations, from which *t*-tests were derived. An apparent contradiction between the text description of findings and tabulated data may be of lesser importance than the calculated estimation of effect sizes, performed according to Cohen's (1992) formula. These were small ( $d=0.20$ ) for differences between O and B blood types on the neuroticism scale and very small ( $d=0.07$ ) for differences between A and B blood types on the neuroticism scale. Effect size calculations assume that sample sizes are equal, which in the case of the Maruthram and Indira study, they were not. From the data provided by Cattell et al. (1964) it was possible to calculate  $\omega^2$  using Howell's (1997, p. 333) formula, which gave a value of 0.029, indicating a small to medium effect size for blood Type A to be tender-minded. This was for an *F* value and significance level ( $F=6.64$ ,  $P<0.01$ ) that were high compared with others in the found literature. Indications from these limited calculations suggest that any effect size for an association between blood type and personality is likely to be small. This was confirmed by Cramer and Imaike (2002).

The small number of studies on blood type and personality found in the scientific literature generally present a tenuous conceptual basis. Most are poorly designed, have inconsistent methodology, conflicting results, and interpretation is problematic. While some used large sample sizes (Cattell et al., 1964, 1980; Cramer & Imaike, 2002; D'Adamo & Whitney, 2001; de Mikusinski & Omar de Urteager, 1983; Furakawa, 1927, 1930; Jogawar, 1984; Maurer-Groeli, 1974; Rinieris et al., 1980), others (Lester & Gatto, 1987; Marutham & Indira, 1990) had small sample sizes. All had unequal cell sizes. Most previous studies included all four blood types, but some had markedly lower proportions of participants with blood Type B and blood Type AB. Marutham and Indira did not include blood Type AB, and de Mikusinski and Omar de Urteager included only blood types A and O. Jogawar had the highest proportion of blood Type B participants. The poor and very variable methodology of published studies makes a formal meta-analysis impossible.

### 1.2. Personality measures

Dimensions of the five-factor model of personality have been found in many different cultures, suggesting a biological foundation for these traits (Costa & McCrae, 1992a). The five-factor approach has emerged as possibly the most widely accepted model of personality structure

(Goldberg, 1993) providing probably the best account of personality ratings (Costa & McCrae, 1992a). The genetic influence on neuroticism has been estimated at 41%, extraversion at 53%, openness to experience at 61%, agreeableness at 41% and conscientiousness at 44% (Jang, Livesley, & Vernon, 1996). The genetic foundation to personality suggests that traits are enduring dispositions. A longitudinal study revealed stability coefficients of 0.67 for Neuroticism, 0.81 for Extraversion, 0.84 for Openness to Experience, 0.63 for Agreeableness and 0.78 for Conscientiousness (Costa & McCrae, 1992a).

Gender differences in personality are constant cross-nationally with females scoring higher than males on neuroticism and openness to experience to a medium degree, and on agreeableness to a small degree (Costa & McCrae, 1992b; Feingold, 1994; Marusic & Bratko, 1998).

The big-five personality factor model can assimilate other structures and is appropriate for organising a range of traits that are useful as a description of normal personality and in clinical psychology (Costa & McCrae, 1992a). A personality factor emerging from the literature on blood type and personality that is less well catered for in the big-five factor model is optimism.

### *1.3. Purpose and aims*

This is the second published study to explore a possible relationship between blood type and gender, and the big-five factors of personality—extraversion, neuroticism, agreeableness, conscientiousness and intellect (or openness), but the first to include a measure of optimism. Measures that have been used in previous studies of blood type and personality include Cattell's Sixteen Personality Factors (16PF) Inventory, Eysenck Personality Inventory (EPI), High School Personality Questionnaire (HSPQ), Maudsley Personality Inventory (MPI), Minnesota Multi-phasic Personality Inventory (MMPI), Myers-Briggs Type Indicator (MBTI) and Type A Self-Rating Inventory (TARI).

The relationship between optimism and blood type will be investigated using the Life Orientation Test Revised (LOT-R). Evidence from a variety of sources suggests that dispositional optimism is beneficial for physical and psychological well-being. Optimists exhibit more stable coping tendencies and adjust more favourably to important life transitions than do pessimists (Scheier, Carver, & Bridges, 1994).

### *1.4. Hypotheses*

To establish some order out of the confusion from scientific findings and the many suggestions made within the popular blood type and personality books, these hypotheses were proposed.

**Hypothesis 1.** Blood Type B individuals will score higher on neuroticism than will individuals with blood types A, O and AB.

**Hypothesis 2.** Blood Type O individuals will score higher on extraversion than will individuals with blood types A, B and AB.

**Hypothesis 3.** Blood Type A individuals will score higher on agreeableness than will individuals with blood types B, O and AB.

**Hypothesis 4.** Blood Type AB individuals will score higher on conscientiousness than will individuals with blood types A, B and O.

**Hypothesis 5.** There will be a main effect for gender on neuroticism.

**Hypothesis 6.** There will be an interaction effect for gender and blood Type B on neuroticism.

**Hypothesis 7.** Blood Type O individuals will be higher on optimism than will individuals with blood types A, B and AB.

The first three of these hypotheses are similar to those proposed by Cramer and Imai (2002). A further research aim was to determine whether there is any relationship between blood type, gender and intellect.

## 2. Method

A pilot study indicated that participants had no difficulty understanding and completing the personality inventory. Being a widely used scale the LOT-R was not piloted.

### 2.1. Participants

Participants were a quota sample of 360 Gold Coast blood donors—180 males and 180 females (aged 17–70 years; mean 44 years). Mean participant ages by group are shown in Table 2. That blood donors have proof of their blood type and are required to rest for up to 15 min after donating blood provided the rationale for using this population. Blood donors have been found not to differ from a broad population cross-section on neuroticism (Mai & Beal, 1967).

### 2.2. Design

The study was a 2×4 (gender, blood type) multivariate analysis of variance (MANOVA) between-subjects design. The six continuous dependent variables were the big-five personality factors: extraversion, neuroticism, intellect (openness), agreeableness and conscientiousness, plus optimism. Independent categorical variables were gender (male, female), and blood type (A, B, O, AB).

Table 2  
Mean ages for samples of males and females with blood Types A, B, O and AB ( $N = 360$ )

Blood type	Males	Females	Totals
A	44.77	39.98	42.38
B	50.53	41.97	46.25
O	43.92	45.03	44.48
AB	43.53	44.80	44.17

### 2.3. Materials

(1) A consent form, appropriately signed; (2) a version of the big-five factor personality inventory (Goldberg, 1992); (3) the Life Orientation Test Revised (LOT-R). The LOT-R is a six-item self-report measure (plus four filler items). Responses are 0 “Strongly Disagree”, 1 “Disagree”, 2 “Neutral”, 3 “Agree” and 4 “Strongly Agree”. Cronbach’s alpha for the six items was 0.78. The test–retest reliability of the LOT-R is fairly stable across time and it appears to possess adequate discriminant validity (Scheier et al., 1994).

Goldberg’s (1992) instrument can be used as an alternative to the NEO Personality Inventory (NEO-PI) developed by Costa and McCrae (1985) and the Hogan (1986) personality inventory. Designed to access an alternative set of big-five markers when participants’ time was limited, it is a self-report inventory of 50 bipolar items. The nine-point response scale is ordered quasi-randomly with the direction of the scales counterbalanced with one half of the desirable poles on the same side of the page to control for response bias. Goldberg (1992) estimated coefficient alpha reliabilities to be: Extraversion 0.81, Agreeableness 0.72, Conscientiousness 0.78, Neuroticism 0.85, and Intellect 0.79, averaging 0.79 for the five factors in the quasi-random bipolar scale format, with the inter-domain correlation averaging 0.20.

### 2.4. Procedure

Data were collected from 360 Gold Coast blood donors (response rate 98.6%). Participants’ declared blood type was confirmed by sighting their blood donor card or by checking with a staff member. Participants completed an informed consent form, the big-five personality inventory and the LOT-R, instructions being read verbatim.

### 2.5. Data analysis

Percentages of blood groups in the Australian population are: Type O 49%, Type A 38%, Type B 10%, Type AB 3% (Keller, 1992). Because of practical limitations in obtaining sufficient numbers of blood type B and AB participants (the last few participants being recruited via a newspaper article and by telephoning donors) to complete the original quota sample of 60 participants per cell, to maintain a balanced design for analysis participant numbers were reduced to 30 participants per cell. This was done by retaining all blood type B and AB participants and using SPSS to take random samples of 30 from each of the A and O blood type/gender sub-samples. The sub-samples did not differ significantly from the original samples in respect of age and personality measures.

## 3. Results

A 2×4 (gender, blood type) MANOVA was performed on six dependent variables: extraversion, neuroticism, agreeableness, conscientiousness, intellect and optimism. Independent variables were gender (male and female) and blood type (A, B, O, AB).

Sample means, standard deviations, 95% confidence intervals, and power values for the dependent variables are shown in Table 3. Table 4, which also indicates acceptable reliability

analyses for the six dependent variables, shows that correlations between dependent variables ranged from 0.04 (conscientiousness and optimism), to 0.50 (intellect and extraversion). A linear pattern was found among all dependent variables except for the bivariate relationship between conscientiousness and optimism. Bartlett's test of sphericity was significant ( $\chi^2 = 549.55$ , d.f. 20,  $P < 0.001$ ). Levene's test of equality of error variances was non-significant for all variables. These tests also gave acceptable results for the complete sample of 360.

The multivariate analysis was interpreted using Pillai's trace multivariate test as it is the most robust to violation of assumptions. The combined dependent variables were significantly affected by gender, [ $F(6, 227) = 4.259$ ,  $P < 0.001$ ], but not by blood type, [ $F(18, 687) = 0.669$ ,  $P > 0.05$ ], nor by their interaction [ $F(18, 687) = 1.238$ ,  $P > 0.05$ ]. A Bonferroni correction for Type I errors would have given an alpha level of 0.008. This would have resulted in no significant univariate

Table 3

Means, standard deviations, 95% confidence intervals, and power for dependent variables ( $N = 240$ )

Dependent variable <sup>a</sup>	Blood type	Male		Female		Totals	
		Mean (S.D.)	95% CIs	Mean (S.D.)	95% CIs	Mean (S.D.)	95% CIs
Extraversion (0.29)	A	67.00 (10.09)	62.91 71.09	63.53 (13.72)	59.45 67.62	65.27 (12.06)	62.38 68.16
	B	68.87 (10.68)	64.78 72.96	68.57 (11.28)	64.48 72.66	68.72 (10.89)	65.83 71.61
	O	66.37 (9.44)	62.28 70.46	65.67 (12.47)	61.58 69.76	66.02 (10.97)	63.13 68.91
	AB	64.33 (10.88)	60.25 68.42	70.30 (11.80)	66.21 74.39	67.32 (11.65)	64.43 70.21
Neuroticism (0.09)	A	37.07 (11.71)	32.84 41.29	40.60 (12.65)	36.38 44.82	38.83 (12.22)	35.85 41.82
	B	32.70 (10.84)	28.48 36.92	41.67 (10.71)	37.44 45.89	37.18 (11.60)	34.20 40.17
	O	37.17 (9.08)	32.94 41.39	38.23 (12.71)	34.01 42.46	37.70 (10.96)	34.71 40.69
	AB	38.23 (13.22)	34.01 42.46	37.00 (12.45)	32.78 41.22	37.62 (12.75)	34.63 40.60
Agreeableness (0.21)	A	70.43 (10.84)	67.12 73.75	75.40 (7.83)	72.08 78.72	72.92 (9.71)	70.57 75.26
	B	75.00 (9.45)	71.68 78.32	75.03 (7.13)	71.72 78.35	75.02 (8.30)	72.67 77.36
	O	71.67 (10.75)	68.35 74.98	75.17 (10.09)	71.85 78.48	73.42 (10.49)	71.07 75.76
	AB	74.20 (7.48)	70.88 77.52	75.30 (9.36)	71.98 78.62	74.75 (8.41)	72.41 77.10
Intellect (0.27)	A	66.77 (7.65)	63.52 70.02	65.47 (8.09)	62.22 68.72	66.12 (7.84)	63.82 68.42
	B	69.80 (9.35)	66.55 73.05	67.17 (6.36)	63.92 70.42	68.48 (8.04)	66.18 70.78
	O	66.03 (10.67)	62.78 69.29	66.73 (9.83)	63.48 69.99	66.38 (10.17)	64.08 68.68
	AB	67.70 (8.71)	64.45 70.95	68.23 (10.76)	64.98 71.49	67.97 (9.71)	65.67 70.27
Conscientiousness (0.50)	A	68.27 (9.79)	64.96 71.58	70.20 (8.45)	66.89 73.51	69.23 (9.12)	66.89 71.57
	B	71.07 (11.68)	67.76 74.38	72.20 (6.85)	68.89 75.51	71.63 (9.51)	69.29 73.97
	O	69.87 (9.06)	66.56 73.18	74.57 (9.01)	71.26 77.88	72.22 (9.26)	69.88 74.56
	AB	70.77 (9.59)	67.46 74.08	75.40 (8.45)	72.09 78.71	73.08 (9.26)	70.74 75.42
Optimism (0.11)	A	16.30 (4.96)	14.78 17.82	16.10 (3.59)	14.58 17.62	16.20 (4.30)	15.12 17.28
	B	16.43 (3.43)	14.91 17.96	14.93 (3.91)	13.41 16.46	15.68 (3.73)	14.61 16.76
	O	15.10 (4.51)	13.58 16.62	15.93 (4.26)	14.41 17.46	15.52 (4.37)	14.44 16.60
	AB	16.00 (4.22)	14.48 17.52	15.13 (4.78)	13.61 16.66	15.57 (4.49)	14.49 16.65

<sup>a</sup> Power with alpha at 0.05.



Table 4

Correlations between optimism, extraversion, conscientiousness, intellect, agreeableness, neuroticism, age, and gender; reliability coefficients for dependent variables ( $N = 240$ )

	Optimism	Extraversion	Conscientiousness	Intellect	Agreeableness	Neuroticism
Optimism	0.78					
Extraversion	0.30**	0.81				
Conscientiousness	0.04	0.26**	0.76			
Intellect	0.29**	0.50**	0.36**	0.74		
Agreeableness	0.25**	0.39**	0.38**	0.42**	0.77	
Neuroticism	-0.49**	-0.36**	-0.27**	-0.24**	-0.41**	0.81
Age	0.04	0.02	0.19**	0.03	0.00	-0.16*
Gender	-0.05	0.02	0.17**	-0.04	0.13*	0.13*

Standardised coefficients alpha are on diagonal.

\*  $P < 0.05$  (2-tailed).

\*\*  $P < 0.01$  (2-tailed).

effects for gender when the relationship between conscientiousness and gender would otherwise be significant [ $F(1) = 6.812$ ,  $P = 0.01$ ]. Other effects that would not pass the strict alpha level were those between gender and neuroticism [ $F(1) = 4.136$ ,  $P = 0.043$ ] and gender and agreeableness [ $F(1) = 4.067$ ,  $P = 0.045$ ]. Corresponding statistics for the full 360 sample were, for conscientiousness [ $F(1) = 9.883$ ,  $P = 0.002$ ], neuroticism [ $F(1) = 4.636$ ,  $P = 0.032$ ], and agreeableness [ $F(1) = 6.349$ ,  $P = 0.012$ ]. For optimism, extraversion and intellect, effect sizes ( $\eta^2$ ) were close to zero, with power varying between 0.06 and 0.12. For the personality variables showing significant gender differences, effect sizes ( $\eta^2$ ) were: conscientiousness 0.029 (power 0.74), neuroticism 0.018 (power 0.53) and agreeableness 0.017 (power 0.52).

For the complete samples of blood Type A and blood Type O individuals ( $N = 240$ ) the significant gender differences for the conscientiousness and agreeableness variables—with  $\eta^2$  of 0.037 and 0.057, respectively were achieved with power values of 0.85 and 0.97, respectively—with alpha set at 0.05. However, gender effect sizes for the other four dependent variables varied between zero and 0.008 with power to detect varying from 0.05 to 0.28. Of the effect sizes of blood type upon the six personality variables, only that for conscientiousness was greater than zero ( $\eta^2 = 0.014$ ). However, power to detect this effect was only 0.44. The mean for the blood Type A sample on this variable was 69.93 (95% CIs 68.34 and 71.53) and for the blood Type O sample the mean was 72.02 (95% CIs 70.42 and 73.61). Overlap between the 95% confidence intervals for these mean values is consistent with the non-significant result ( $F = 3.32$ ;  $P = 0.07$ ). Power values for the zero order effect sizes were between 0.06 and 0.07.

With no theoretical basis for ordering the dependent variables a step-down MANOVA was not undertaken. Significant inter-correlations between most combinations of dependent variables indicated that separate ANOVAs for each DV would be inappropriate. However, in view of hypothesis 6, inspection of Table 3 prompted a  $t$ -test between the neuroticism means for males and females of blood Type B [ $t = -3.223$ , d.f. 58,  $P = 0.002$ ].

Power values are shown in Table 3 for the six personality variables. The low power values—ranging from 0.09 to 0.50, indicate that the likelihood of correctly finding a significant result for any of the six personality variables ranged from 9 to 50%—low to medium power for this ana-

lysis. Cell sizes of approximately 165 would be required to bring the power of this test to an acceptable level of 0.80 or greater (Cohen, 1988; Hair, Anderson, Tatham, & Black, 1998; Laüter, 1978). Eta squared values ( $\eta^2$ ) calculated by SPSS tend to inflate effect sizes because not all error variance is taken into account. Cohen (1988) recommends omega squared ( $\omega^2$ ) as a more rigorous measure of effect size. For conscientiousness  $\omega^2$  is 0.012. For the other personality variables  $\omega^2$  values are all zero order. Thus, while a suspicion might remain of some small association between blood type and conscientiousness, once error variance is taken into account, effect sizes for the other personality variables are effectively zero.

## 4. Discussion

This study investigated the relationship between the four basic blood types (A, B, O, AB) and personality. It sought to determine whether there was a relationship between blood type, gender, and the dependent variables, extraversion, neuroticism, agreeableness, conscientiousness, intellect and optimism.

### 4.1. Hypotheses

#### 4.1.1. Hypothesis 1

That blood Type B individuals would score higher on neuroticism than would individuals with blood types A, O, and AB was not supported. Results support Cramer and Imai (2002) and Rinieris et al. (1980), who found no relationship between blood type and neuroticism. Possible reasons why Angst and Maurer-Groeli (1974), Jogawar (1984) and Marutham and Indira (1990) found a relationship between blood Type B and neuroticism might include unequal cell sizes, and low incidences of blood Type B—particularly evident in the Angst and Maurer-Groeli and Marutham and Indira studies.

#### 4.1.2. Hypothesis 2

That blood Type O individuals would score higher on extraversion than would individuals with blood types A, B and AB was not supported. No significant relationship was found between blood type and extraversion for this sample. This finding supports Cramer and Imai (2002), but contradicts findings from Lester and Gatto (1987), who found blood Type Os to be extraverted, and de Mikusinski and Omar de Urteager (1983), who found blood Type O females to be extraverted. Possible reasons for these contradictory results could include design of previous studies. While de Mikusinski and Omar de Urteager used a large sample, only blood types A and O were represented and there were unequal cell sizes. Lester and Gatto's sample size was 92.

#### 4.1.3. Hypothesis 3

That blood Type A individuals would score higher on agreeableness than would individuals with blood types B, O, and AB was not supported. No significant relationship was found between blood type and agreeableness. This hypothesis was influenced by Cattell et al. (1964) and by some popular writing on blood type and personality. Cattell et al. (1964) found blood Type As to be

significantly higher on Factor I, tender-mindedness—one facet of agreeableness. Findings from this study support Cramer and Imai (2002), but do not support opinions about blood Type A expressed by Nomi and Beshar (1983) and by Constantine (1997).

#### 4.1.4. Hypothesis 4

That blood Type AB individuals would score higher on conscientiousness than would individuals with blood types A, B and O was not supported. Although not a significant relationship, blood Type AB respondents did score higher on conscientiousness than did respondents with other blood types. This hypothesis was influenced by Nomi and Beshar (1983), who stated that blood Type ABs were organised, reliable and punctual and had a high level of concentration, and Constantine (1997) who listed responsibility, dependability and trustworthiness among blood Type AB characteristics. Findings from this study support Cramer and Imai (2002), but do not support opinions expressed about blood Type ABs in the popular literature. While zero order effect sizes were calculated for the other five personality variables, the  $\omega^2$  value indicated that around 1% of the variance in conscientiousness might be attributable to blood type. Such a small effect size has no practical significance.

#### 4.1.5. Hypothesis 5

That there would be a main effect for gender on neuroticism was partly supported. While Cramer and Imai (2002) and Rinieris et al. (1980) found females to be significantly higher than males on neuroticism, Lester and Gatto (1987) found no relationship between gender and neuroticism. This study found a weak relationship between gender and neuroticism. Females with blood types A, B and O had higher mean scores on neuroticism than males did, while males with blood Type AB had a higher mean score on neuroticism than females did.

#### 4.1.6. Hypothesis 6

That there would be an interaction effect for gender and blood Type B with neuroticism was not supported. From the multivariate analysis no significant relationship was found between gender, blood type and neuroticism. While Rinieris et al. (1980) found that females scored significantly higher than males on neuroticism, they found no relationship between blood type and neuroticism. Lester and Gatto (1987) found no relationship between blood Type B and neuroticism, or between gender and neuroticism. Neither of these studies reported on interaction effects for these variables. The seemingly contradictory *t*-test result, which showed a highly significant difference between blood Type B male and female neuroticism means probably reflects the higher mean age of males in this sub-sample (50.53 compared with 41.97 for females). The significant negative correlation between age and neuroticism ( $r = -0.17$ ) probably accounts for this result. Blood Type B males had the highest mean age of any sub-group—around 6 years older than other males in the sample. This reflected the extra effort that went into recruiting blood Type B males, a greater proportion of whom were retired than in other sub-groups.

#### 4.1.7. Hypothesis 7

That blood Type O individuals would have higher optimism scores than would individuals with other blood types was not supported. No significant relationship was found between blood type and optimism, contradicting Furukawa (1927, 1930) and Nomi and Beshar (1983).

#### 4.2. *Exploratory aim*

The exploratory analysis between blood type and intellect (openness) revealed no significant relationship between these variables. The relationship between gender and intellect agrees with previous findings of no gender differences (Costa & McCrae, 1992b; Feingold, 1994).

#### 4.3. *Gender differences and personality*

Results on gender differences for this sample generally match major findings from the literature. Supporting Cramer and Imai (2002) gender differences for neuroticism ( $P=0.043$ ) and agreeableness ( $P=0.045$ ) approached significance. There was an association between conscientiousness and gender ( $P=0.010$ ). Females scored higher than males did on neuroticism, agreeableness, and conscientiousness. Effect sizes ( $\eta^2$ ) for these variables were large, although power values varied between 0.52 and 0.74. Previous studies have found significant gender differences for neuroticism and agreeableness, with females scoring higher on both dimensions. Consistent with previous studies no gender differences for extraversion were found (Costa & McCrae, 1992b; Feingold, 1994; Marusic & Bratko, 1998). With regard to intellect, Marusic and Bratko found a significant gender difference, while Costa and McCrae, and Feingold did not. No significant gender differences were found in this study for optimism, supporting Scheier et al. (1994).

#### 4.4. *Research design of previous blood type and personality studies*

Statistical analyses from previous studies included analysis of variance and  $t$ -tests as in most cases only one or two dependent variables, usually extraversion and neuroticism, were tested. Exceptions were Lester and Gatto (1987), who performed a one way analysis of variance on the four blood groups with the personality variables of depression, psychoticism, extraversion and neuroticism, Cramer and Imai (2002), who calculated separate ANOVAs for the 60-item NEO-PI, and Cattell et al. (1964) who performed analysis of variance on 14 factors with blood type. While some statistical procedures are robust to unequal cell sizes, equal cell sizes provide for a more consistent design.

While most studies included both males and females, Furakawa (1927) studied Japanese females only, Cattell et al. (1964) studied Italo/American boys, and Maurer-Groeli (1974) studied 19-year-old male army inductees. Only three studies reported on gender differences. de Mikusinski and Omar de Urteger (1983) found gender differences between blood types A and O with introversion/extraversion, while Lester and Gatto (1987) found no relationship between gender and depression, psychoticism, neuroticism or extraversion.

#### 4.5. *Implications and future research*

Sample size and equal numbers of males and females for each blood type was an important design feature of this study and a considerable advantage when compared with the inconsistent methodology of previous blood type and personality studies. Previous studies undertook no multivariate analyses and thus took no account of the general finding that some personality traits are significantly inter-correlated. As demonstrated in this study with the significant neuroticism

and gender difference for the blood Type B sub-sample, if single personality traits are tested in isolation then apparently significant effects might be found. A possible reason for inconsistent findings from previous studies is that different personality measures might reveal varying patterns in data that are inappropriately sampled and for which in some cases there were no checks on other possible influences, such as age [Maurer-Groeli (1974) controlled for the age variable].

Neither the popular literature nor previously published studies referred to, can identify a strong theoretical or conceptual basis as to why there should be an association between blood type and personality. The closest that anyone has come to providing such a basis is an evolutionary argument that different personality characteristics might have been associated with varying demands placed upon humans during our evolutionary chronology and that an individual's blood type reflects this archetype (D'Adamo & Whitney, 1997). Seeking the rationale for different blood types' existence to provide a theoretical basis for studies using this as a research variable, could prove valuable.

While the biological basis of personality is essentially unchallenged by the results of this study, the notion that blood type influences personality receives no support here. From this research there is no basis for assuming that personality characteristics within a normal population are other than randomly distributed among individuals with different blood types. If the genetic component of an individual's personality is unrelated to their blood type, then researchers should more fruitfully turn their attention elsewhere when seeking genetic bases for personality variability.

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## References

- Angst, J., & Maurer-Groeli, Y. (1974). Blood groups and personality. *Archiv fur Psychiatric and Nervenkrankheiten*, 218, 291–300.
- Cattell, R. B., Boutourline, H. Y., & Hundleby, J. D. (1964). Blood groups and personality traits. *American Journal of Human Genetics*, 16, 397–402.
- Cattell, R. B., Brackenridge, C. J., Case, J., Propert, D. N., & Sheehy, A. J. (1980). The relation of blood types to primary and secondary personality traits. *The Mankind Quarterly*, 21, 35–51.
- Cattell, R. B., & Hundleby, J. D. (1972). Blood groups and personality traits. *American Journal of Human Genetics*, 24, 485–486.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.
- Cohen, J. (1992). A power primer. *Psychological Bulletin*, 1, 155–159.
- Constantine, P. (1997). *What's your type?* New York: Penguin Books.
- Costa, P. T., & McCrae, R. R. (1985). *The NEO Personality Inventory manual*. Odessa, FL: Psychological Assessment Resources.
- Costa, P. T., & McCrae, R. R. (1992a). Four ways five factors are basic. *Personality and Individual Differences*, 13, 653–665.
- Costa, P. T., & McCrae, R. R. (1992b). *Revised NEO Personality Inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual*. Odessa: Psychological Assessment Resources.
- Cramer, K. M., & Imai, E. (2002). Personality, blood type, and the five-factor model. *Personality and Individual Differences*, 32, 621–626.
- D'Adamo, P. J., & Whitney, C. (1997). *The eat right diet*. London: Century.
- D'Adamo, P. J., & Whitney, C. (2001). *Live right for your type*. Ringwood, Australia: Viking.

- de Mikusinski, E. B., & Omar de Urteaga, A. G. (1983). The blood group as a genetic determinant of personality types. *Interdisciplinaria*, 4(2), 153–166.
- Eysenck, H. J. (1977). National differences in personality as related to ABO blood group polymorphism. *Psychological Reports*, 41, 1257–1258.
- Eysenck, H. J. (1982). The biological basis of cross-cultural differences in personality: blood group antigens. *Psychological Reports*, 51, 531–540.
- Eysenck, H. J. (1990). Genetic and environmental contributions to individual differences: the three major dimensions of personality. *Journal of Personality*, 58, 245–261.
- Feingold, A. (1994). Gender differences in personality. *Psychological Bulletin*, 116, 429–456.
- Furukawa, T. (1927). A study of temperament by means of human blood groups. *Japanese Journal of Psychology*, 2, 612–634.
- Furukawa, T. (1930). A study of temperament and blood groups. *Journal of Social Psychology*, 1, 494–509.
- Gibson, J. B., Harrison, G. A., Clarke, V. A., & Hiorns, R. W. (1973). IQ and ABO blood groups. *Nature*, 246(December 21/28), 498–500.
- Goldberg, L. R. (1992). The development of markers for the big-five factor structure. *Psychological Assessment*, 4, 26–42.
- Goldberg, L. R. (1993). The structure of phenotypic personality traits. *American Psychologist*, 48, 26–34.
- Hair, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (1998). *Multivariate data analysis* (5th ed.). NJ: Prentice-Hall.
- Hogan, R. (1986). *Hogan Personality Inventory manual*. Minneapolis, MN: National Computer Systems.
- Howell, D. C. (1997). *Statistical methods for psychology* (4th ed.). Belmont CA: Duxbury.
- Hoyersten, J. G. (1997). The concept of personality from antiquity until 1800 A.D. *Nordic Journal of Psychiatry*, 51, 385–394.
- Jang, K. L., Livesley, W. J., & Vernon, P. A. (1996). Heritability of the big five personality dimensions and their facets: a twin study. *Journal of Personality*, 64, 577–591.
- Jogawar, V. V. (1984). Personality correlates of human blood groups. *Indian Journal of Clinical Psychology*, 11, 5–8.
- Keller, A. (1992). *The vital factor*. Clayton: Wilke Color.
- Laüter, J. (1978). Sample size requirements for the  $t^2$  test of MANOVA (tables for one-way classification). *Biometrical Journal*, 20, 389–406.
- Lester, D., & Gatto, J. (1987). Personality and blood group. *Personality and Individual Differences*, 8, 267.
- Mai, F. M. M., & Beal, R. W. (1967). A study of the personality of voluntary blood donors. *The Medical Journal of Australia* (July 22), 156–159.
- Marusic, I., & Bratko, D. (1998). Relations of masculinity and femininity with personality dimensions of the five-factor model. *Sex Roles*, 38, 29–44.
- Marutham, P., & Indira, J. P. (1990). A study of the possible relationship of blood types to certain personality variables. *Indian Journal of Clinical Psychology*, 17, 79–81.
- Maurer-Groeli, Y. (1974). Blutgruppen, Persönlichkeit und Schulabschluss: Eine Untersuchung mittels FPI. (Blood-group, personality and level of education: an investigation by means of the FPI). *Schweizerische Zeitschrift Fuer Psychologie*, 33, 407–410.
- Nomi, T., & Beshner, A. (1983). *You are your blood type*. New York: Pocket Books.
- Norton, H. W. (1971). Blood groups and personality traits. *American Journal of Human Genetics*, 23, 225–226.
- Owen, D. R. (1972). Blood type gene frequency and mental ability: premature conclusions? *Psychological Reports*, 31, 835–839.
- Plomin, R., & Caspi, A. (1999). Behavioural genetics and personality. In L. A. Pervin, & O. P. John (Eds.), *Handbook of personality: theory and research* (2nd ed.) (pp. 251–276). New York: Guilford.
- Rinieris, P. M., Christoloudous, G. N., & Stefanis, C. N. (1980). Neuroticism and ABO blood types. *Acta Psychiatrica Scandinavica*, 61, 473–476.
- Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): a re-evaluation of the life orientation test. *Journal of Personality and Social Psychology*, 67, 1063–1078.
- Thompson, G. N. (1936). Blood type as related to intelligence, emotions, and personality. *Journal of Applied Psychology*, 20, 785–789.