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Investigating the Association between Personality Traits and Mental Health with Accident Proneness in Iranian Male Workers of Chemical Industries

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ABSTRACT

The purpose of this study was to investigate the association between five personality traits of Zuckerman theory and the General Mental Health Index between two groups of individuals in terms of accident proneness score and to present a predictive model of accident proneness trait in the studied population. This cross-sectional study was conducted on 270 Iranian male workers of chemical industries having work experience of at least one year and a maximum age of 45 years voluntarily participated in the research. The baseline data and background information of all participants were collected and they were asked to fill out the GHQ-28 questionnaire, Zuckerman-Kuhlman personality questionnaire, and TAS subscale of the Zuckerman Sensation-Seeking Scale-V (SSS-V). The results showed that work experience (p=0.002), marital status (p=0.041), social dysfunction (p=0.037), severe depression (p=0.023), and aggression hostility (p=0.020) were significantly varied between the two groups of accident-prone and non-accident-prone. Also, using the variables investigated by the binary logistic regression model, the attribute of having or not having accident proneness was predicted at R Square of 0.416. It was found that personality traits of Aggression Hostility and Psychological Symptom of Social Dysfunction and Severe Depression have associated with accident proneness in the population under study.

KEYWORDS: *Accident Proneness, Personality Trait, General Health Questionnaire*

INTRODUCTION

Accident proneness is used to refer to the behavioral attributes of those people who are involved in accidents more than others. Greenwood and Woods (Greenwood & Woods, 1919) were the first to examine the relatively small proportion of British munitions workers who had the most experience of

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accidents. They argued that introducing this categorization of events to specific individuals could be rooted in their personality traits. Farmer and Chambers (Visser, Pijl, Stolk, Neeleman, & Rosmalen, 2007) using the concept of the death instincts presented by Freud, introduced the term accident preparedness for this phenomenon. Newer evidence is emerging suggesting that accident proneness is a personality trait (Haight, 2001).

The five-factor model (FFM) has been used to predict a wide variety of behaviors including driving and accident experience. Arthur, W., & Graziano showed a significant inverse relationship between conscientiousness and accidents caused by the negligence of the human factor or moving-violation tickets (Arthur Jr & Graziano, 1996). The results of a research show that there is a relationship between a wide range of personality traits and the behaviors lead to accidents.

Conscientiousness is one of the personality traits introduced by Barrick and Mount as a reliable factor for hard-working and accuracy at workplaces. Summarizing several studies over the past few years, Burke et al. concluded that conscientiousness and emotional stability correlate with job performance across different occupations (Burke et al., 2006). Also, in predicting job performance, conscientiousness is associated with safety and accidents. In a study, Graziano reported a significant inverse correlation between workplace injuries and conscientiousness. Besides, in a study by Wallis and Vodanovich (Wallace & Vodanovich, 2003) in manufacturing workers, it was concluded that there was a significant inverse correlation between conscientiousness and unsafe work behaviors and the resulting work accidents. Clark and Robertson (Chauvin, Hermand, & Mullet, 2007), through a meta-analysis, found that agreeableness and neuroticism personality traits, with adjusted coefficients of 0.44 and 0.30, were effective predictors of occupational accidents. In a case study of petrochemical workers in Iran, it was also found that personality traits conscientiousness and agreeableness are associated with occupational accidents (Rahimi Pordanjani, Mohamadzade Ebrahimi, & Rahimi Pordanjani, 2013).

Overall, research on extraversion and accident injury shows three types of relationships, including positive correlation, negative correlation, and non-correlation. Some studies have reported a positive correlation between extraversion and accidents. Some other studies have not found any correlation between these two variables or the correlation found between the variables has been contrary to expectations.

Numerous studies also showed a significant relationship between multiple health indices and five-factor personality traits and confirmed the correlation between general health subscales and components of personality type. For example, people with a neurotic personality type have lower general health, as Miller and Smith found evidence of a link between hostility and cardiovascular disease (Habibi, Karimi, Shahreza, Mahaki, & Nouri, 2016). According to what has been said, the purpose of this study was to investigate the relationship between the accident proneness with personality traits using the personality dimensions provided Zuckerman and Kuhlman as well as the general mental health index.

MATERIAL AND METHODS

This cross-sectional study was performed on 270 Iranian male workers with a maximum age of 45 years and a minimum of one-year work experience. The participants were healthy Iranian males working in chemical industries. Samples were randomly selected from 7 different chemical industries located in Tehran and Qazvin Provinces. Participation in this study was voluntary. Initially, 308 subjects were selected randomly and after initial screening, 38 subjects were excluded from the study as they failed to meet the inclusion criteria, such as no use of tobacco, alcohol, and drugs, drug abuse, and lack of mental and physical health. The analyses were done on the remaining 270 subjects.

The participants were asked to first fill out the basic and general information questionnaire and then the GHQ-28 questionnaire. Subsequently, the participants were asked about their physical and mental illnesses, the history of drug, alcohol, and tobacco use, BMI, history of exercise, and type of diet. At this step, after initial screening, those who were not in good health or taking certain medications were excluded from the study. The study excluded the subjects with the history of smoking, drinking, and addicting, as well as drug abuse. Participants have already been under the regular annual health and physical examination, and all had a physical and

mental health record. According to these records, only healthy individuals were pre-screened and participated in this study.

TOOLS

Accident Proneness:

An accident proneness questionnaire was used to investigate the accident proneness. The questionnaire consisted of 39 questions that the respondents answered the questions on a Likert scale, as completely agree, agree, no idea, disagree, or strongly disagree. The scores 1 to 5 were respectively given to the answers of agree, agree, no idea, disagree, and strongly disagree. The subjects, based on the assigned score, are divided into four categories of "low accident proneness" (for those with a score range of 39 to 78), "average accident proneness" (for a score range of 78 to 117), "high accident proneness" (for a score range of 117 to 156), and "very high accident proneness" (for a score range of 156 to 195). The Persian version of this questionnaire has been validated by Mahmoudi et al. (Mahmoudi, Mohammadfam, & Mortaza). In this study, the subjects were categorized into two classes of accident-prone and non-accident prone. The categorization of the subjects into two groups was performed based on the cut-off score of 117 as the participants with a score of up to 117 were categorized in the group of "non-accident-prone" and those with a score of higher than 117 in the group of "accident-prone".

Five-factor personality dimensions:

The Zuckerman-Kuhlman Personality Questionnaire was used to assess personality dimensions. This questionnaire is one of the tools for measuring personality traits and characteristics that have been developed within the framework of the alternative five-factor model (FFM) or Zuckerman's Five Factor Personality Model. The five-factor theory claims that personality traits have biological roots (McCrae & Costa Jr, 2008; Zuckerman, 2002). In the 50-question version of the questionnaire, each of the subscales has 10 items and the participant expresses his/her opinion on the items as "right" or "wrong" option. A higher score means having more of that trait. The ZPKQ-50-cc was used to assess personality traits. This five-factor personality tool, which is based on Zuckerman's theory, includes impulsive sensation seeking (lack of planning and willingness to perform impulsive behaviors and the general need for dangerous and emotional experiences), neuroticism-anxiety (tension, worry, lack of confidence, and fear), aggression- hostility (violence, inattention or anti-social behaviors), activity (need to do energetic activities), and sociability (number of contacts and friends). Each of these traits can have a score of 0 to 10. The Persian version of this questionnaire has been validated by Lamie et al (Lamei, Yaqoubi, & Mohammadzadeh, 2014).

General Mental Health:

The General Health Questionnaire (GHQ) is a multidimensional, self-administered questionnaire designed to assess discrete psychiatric disorders found in various community settings (Goldberg et al., 1997). This test is non-diagnostic and is used only to screen for general mental health. This questionnaire was first developed by Goldberg in 1972 (Goldberg, 1972) and its 28-question version was designed in 1979 by Goldberg and Hillier (Goldberg & Hillier, 1979) through factor analysis on its former expanded form. The 28-question form consists of 4 subscales, each containing 7 questions. Questions 1 to 7 were related to somatic symptoms, 8 to 14 anxiety/insomnia, 15 to 21 social dysfunction, and questions 22 to 28 severe depressions. This test examines the symptoms in question over the past month (Goldberg et al., 1997). All questions were 4-choice and each item scores 0, 1, 2, or 3 using the Likert scoring scale. The scores vary from 0 to 84 and a lower score reflects higher mental health. The Persian version of the questionnaire has been validated by Nazifi et al. (Nazifi et al., 2014).

Investigation of risk-taking behaviors:

To investigate risk-taking behaviors, in addition to collecting accident records, two indicators of Zuckerman's subscale of TAS (Thrill and Adventure seeking) and risky driving were used.

Zuckerman Sensation-Seeking Scale-V (SSS-V):

The fifth version of the Zuckerman Sensation Seeking Scale (SSS) was used to evaluate the TAS trait. The Persian version of this tool has been validated by Ekhtiari et al. According to Zuckerman's sensation seeking theory, the sensation-seeking consists of four subscales, with scores ranging from

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zero to 10. The score of the TAS subscale will be between 0 and 10 and a higher score indicates higher sensation seeking (Ekhtiari et al., 2008; Zuckerman, 1993).

Risky driving:

Two objective and subjective components were used to investigate the risky driving characteristics. The number of traffic offenses perpetrated in the past year as an objective characteristic was determined through an online inquiry by the traffic police. The number of participants' traffic offenses in the past year was the objective attribute obtained through an online inquiry from traffic police. The participants were also asked whether they tended to drive at unusual speeds, dangerous overtaking, and in general, exciting/dangerous driving propensity. These two components were used as risky driving indicators.

Statistical analysis:

In this study, mean and standard deviation were used to describe the quantitative variables with normal distribution, and the number and percentage were used to describe the categorical variables. Chi-square test was used for statistical analysis of the qualitative variables and a t-test was used to analyze quantitative variables (personality traits and general mental health scale). Binary logistic regression was used to determine the effect of confounders and predictors determining. The statistical analysis of the data was done via SPSS software version 24.

Ethics:

The protocol of this study was approved by the Ethics Committee of Tehran University of Medical Sciences. According to the Code of Ethics, all of the participants were informed of the entire study process and signed the informed consent form before conducting the study. Also, all of the participants were free to leave the study at any stage of the study implementation process. The participants were also assured that their personal information to be kept confidential. Using the coding system, the confidentiality of the participants' information was ensured.

RESULTS

The mean age of the participants in this study, who were all male and workers of chemical industries, was 37.1 years with a standard deviation of 5.5 years. Their mean body mass index was 26.15 kg/m2. The participants' average work experience was 13.8 years and the average monthly income was USD 302. The descriptive statistics indices of the 270 participants in this study have been presented in Table 1 including age, work experience, education level, history of the accident leading to referral to medical centers, history of the accident in first-degree relatives leading to referral to medical centers, risky behaviors, risky driving, job satisfaction percentage, percentage of marriage, and monthly income. To classify the participants into two groups of accident-prone and non-accident-prone, the score of 117 was considered as the cut point. Accordingly, 87 subjects were classified in the group of accident-prone and 183 classified in the group of non-accident prone. The mentioned variables were also analyzed based on the mean score of accident proneness in two groups of accident-prone and non-accident-prone.

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Table 1. Demographic information of the participants

		Accident Proneness		
	Total n=270 Mean ± SD	**Prone** n=87 Mean ± SD	**Non** n=183 Mean ± SD	**P-value**
Age	37.1±5.5	37.9±5.3	36.7±5.4	0.080
Work experience	13.8±6.4	15.9±5.5	12.8±6.6	<0.001*
College Education n (%)	90 (33.3)	33 (37.9)	57 (31.1)	0.269
Accident History n (%)	153 (56.7)	57 (65.5)	96 (52.5)	0.043*
Family Injury History n (%)	111 (41.1)	48 (55.2)	63 (34.4)	0.001*
Risk Taking Behavior n (%)	78 (28.9)	36 (41.4)	42 (23.0)	0.002*
Risky driving n (%)	63 (23.3)	30 (34.5)	33 (18.0)	0.003*
Work satisfy	68.8±20.3	61.6±19.6	72.2±19.8	<0.001*
Married n (%)	255(94.4)	81 (93.1)	174 (95.1)	0.507
monthly income (USD)	302.0±144.4	319.8±146.3	293.4±143.2	0.162

**Significant (2-tailed)*

According to the statistical analysis by the chi-square and t-test, work experience significantly differed in two groups of accident-prone and non-accident prone (p-value <0.001).

Based on the results, 32% of the participants earned high scores for accident proneness trait, hereafter referred to as accident-prone subjects, and 68% earned low scores for accident proneness trait, then referred to as non-accident-prone subjects. Based on this classification, the baseline variables in these two groups were compared statistically and it was found that among the variables studied, a significant difference was found between the trait of accident proneness and the variables of work experience (p-value <0.001), history of an accident leading to referral to health centers (p-value=0.043), history of the accident in first-degree relatives leading to referral (p-value=0.001), the tendency to risky behaviors (p-value=0.002), risky driving (p-value=0.003), and job satisfaction (p-value <0.001) in both groups.

There was no significant difference between the two groups in terms of postgraduate education (p-value = 0269), marital status (P-value=0.507), and monthly income (p-value = 0.162).

Table 2 presents the results of the variables examined in this study, i.e. GHQ index and the five personality traits (Zuckerman-Kuhlman) of the participants. Accordingly, the scores of each subscale were presented as two groups of accident-prone and non-accident-prone.

Based on the chi-square and t-test statistical analyses, all four dimensions and GHQ total scores were significantly different between the two groups of accident-prone and non-accident-prone. Besides, all personality traits, except for sociability, had significant differences in the two groups.

The statistical comparison of general mental health in the two groups revealed that all subscales and the total score of general mental health were statistically significant in the two accident-prone and non-accident-prone groups (GHQ All items score p-value=0.022, somatic symptom (p-value=0.002), anxiety insomnia (p-value=0.002), social dysfunction (p-value<0.001), severe depression (p-value <0.001).

By examining Zuckerman-Kuhlman's five personality traits in the two groups, it was found that all personality traits, except for the sociability trait,

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were significantly different in the two groups (neuroticism-anxiety p-value=0.013, impulsive sensation seeking (p-value <0.001), activity (p-value=0.039), sociability (p-value=0826), aggression-hostility (p-value <0.001).

Table 2. Descriptive statistics indicators of GHQ subscales and Zuckerman Coleman's five-factor personality traits

			Accident Prone		
		Total n=270 Mean (SD)	**Prone** n=87 Mean (SD)	**Non** n=183 Mean (SD)	**P-value**
General Health Questionnaire Scales	All items Score	18.8 (6.8)	20.14 (5.4)	18.1 (7.4)	0.022*
	Somatic symptom	3.8 (2.6)	4.48 (2.1)	3.4 (2.7)	0.002*
	Anxiety Insomnia	4.6 (3.2)	5.48 (1.8)	4.2 (3.6)	0.002*
	Social dysfunction	9.2 (3.1)	8.07 (2.7)	9.7 (3.2)	<0.001*
	Severe depression	1.2 (1.9)	2.10 (2.2)	0.8 (1.5)	<0.001*
Zuckerman-Kuhlman personality Trait	Neuroticism-Anxiety	2.8 (2.4)	3.34 (2.2)	2.6 (2.4)	0.013*
	Impulsive sensation seeking	3.5 (2.4)	4.34 (2.6)	3.1 (2.2)	<0.001*
	Activity	6.5 (2.0)	6.17 (2.1)	6.7 (2.0)	0.039*
	Sociability	4.9 (1.3)	4.90 (1.2)	4.9 (1.4)	0.826
	Aggression-Hostility	3.5 (2.2)	4.24 (2.2)	3.2 (2.2)	<0.001*

**Significant (2-tailed)*

Multivariate analysis was performed using a logistic binary regression model, whose results are available in Table 3, and the R Square of 0.416 was obtained. In this model, the p-value of the variable's work experience, marital status, social dysfunction, severe depression, and aggression-hostility was at the significance level.

Finally, based on multivariable analysis by logistic binary regression, all the variables were entered in the regression model to determine the simultaneous effect of the variables on the likelihood of accident proneness. Work experience (p-value=0.002), married (p-value=0.041), social dysfunction (p-value= 0.037), severe depression (p-value=0.023), and aggression-hostility (p-value= 0.020) were determinants, all with a statistical significance level. This regression model, with a power of 41.6%, can predict the likelihood of accident proneness.

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Table 3. Details of the analyzed elements for prediction

Variable	B	Odds Ratio	P-value	95% C.I	
				Lower	Upper
Age	-0.089	0.915	0.208	0.796	1.051
Work experience (year)	0.188	1.207	0.002*	1.069	1.363
Income (USD)	-0.002	0.998	0.283	0.995	1.002
Accident history	0.159	1.172	0.686	0.543	2.531
Family injury history	0.380	1.462	0.337	0.674	3.173
Job satisfaction	-0.007	0.993	0.526	0.972	1.014
Risky driving	0.683	1.980	0.149	0.783	5.010
Married status	-1.996	0.136	0.041*	0.020	0.925
College education	0.161	1.175	0.754	0.429	3.220
Risk taking Trait	0.653	1.921	0.116	0.852	4.330
Somatic symptoms	0.038	1.039	0.686	0.865	1.247
Anxiety Insomnia	0.122	1.130	0.114	0.971	1.313
Social dysfunction	-0.152	0.859	0.037*	0.744	0.991
Severe depression	0.284	1.328	0.023*	1.039	1.698
Neuroticism-Anxiety	-0.201	0.818	0.089	0.649	1.031
Impulsive sensation seeking	0.146	1.157	0.136	0.955	1.401
Activity	-0.166	0.847	0.113	0.690	1.040
Sociability	0.024	1.024	0.873	0.764	1.372
Aggression-Hostility	0.221	1.248	0.020*	1.036	1.503
Constant	2.383	10.838	0.329		

a. Variable(s) entered on step 1: Age, work experience, Income, Accident history, Family history injury, job satisfaction, Risky driving, Married, College education, Risk taking Trait, Somatic symptoms, Anxiety Insomnia, Social dysfunction, Severe depression, Neuroticism-Anxiety, Impulsive sensation seeking, Activity, Sociability, Aggression-Hostility.
*Significant

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DISCUSSION

The purpose of this study was to investigate the association between personality dimensions and mental health status on the accident proneness. Based on the results, personality dimensions and mental health indices were significantly different in the two groups of accident-prone and non-accident-prone. In the multivariate regression analysis, it was found that the aggression-hostility personality trait from the five-factor personality dimensions could be one of the predictive elements in association to the trait of accident proneness.

The social dysfunction and severe depression subscales, as general health indicators, were also recognized to be among significant predictors of accident proneness. It was also found that work experience and marital status could be predictors of accident proneness. It has been the subject of debate for more than a quarter of a century in the psychological literature that some people experience more accidents than others. The greater readiness of these people to experience the accident is called "accident proneness", which can be considered as a combination of human traits that drives a person toward accidents.

The implications of this concept can be explored in three sections: (a) Are people prone to experiencing external events? (B) What is the cause of accident proneness? and (c) what can be done to reduce the number of accidents due to the accident proneness? Research has also shown that the occurrence of an accident in the same situation varies for individuals, and these are the psychological and personality factors that affect the extent of their vulnerability and can predict prone and non-prone individuals (James & Dickinson, 1950). In a study by Omar Baghdadi et al. on 166 male and female drivers, it was claimed that the Jerky Driving Index could be an indicator for accident proneness (Bagdadi & Várhelyi, 2011).

Although in the present study, a significant difference was reported between the two accident-prone and non-accident-prone groups, in the multivariate analysis, risky driving was not recognized as a predictor for accident proneness. This can be attributed to the differences in the research methodology, including the study population and the classification method of risky driving. Another study by Moghadam et al. 2017 on the behavioral analysis of participants, a significant difference was found in the aggressive violations in two groups of accident-prone and non-accident-prone (Moghaddam, Tabibi, Sadeghi, Ayati, & Ravandi, 2017). The result of the present study showed that aggression-hostility could be a predictive indicator of accident proneness.

Chiara Pavan et al. in a study found that impulsiveness personality traits had a significant difference in the two accident-prone and non-accident-prone groups (Pavan et al., 2009). In the study of the impulsive sensation-seeking trait in this study, it was found that there is a significant difference between the two groups.

According to the results of research in the field of accident proneness and personality traits, the distribution of events among the general population cannot be attributed to factors, such as chance. Bristol, for example, estimated that 10% of the working population could be responsible for 75% of the accidents happened. Blain found in his study that 4% of all drivers are responsible for one-third of road accidents. These studies and many other studies point to an undeniable fact that a small fraction of the general population is responsible for a large proportion of accidents. Thus, personality traits can play a role in the occurrence of accidents.

Research shows that there is a relationship between a wide range of personality traits and a tendency to have risky behaviors, and some employees are inherently prone to accidents. In support of the findings of the present study, another study reported a significant inverse correlation between workplace injuries and conscientiousness (Demerouti, 2006). In a similar study, a significant inverse correlation was found between the rate of accidents at work and conscientiousness (Arthur Jr & Graziano, 1996). This is true even in the case of accidents that the workers are not responsible for and therefore do not deserve to be blamed. Clark and Robertson (Clarke & T Robertson, 2005), in the meta-analysis, found that agreeableness and neuroticism personality traits with modified coefficients of 0.44 and 0.30 were effective predictors of occupational accidents, respectively.

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Overall, research on extraversion and being injured in accidents shows three types of relationships, including positive correlation, negative correlation, and non-correlation. Some studies have reported a positive correlation between extraversion and being injured in accidents (Lajunen, 2001). In general, each of the personality traits influences individuals' behavior in workplaces and predicts many behaviors of personnel. For this reason, the use of validated personality trait tools helps to develop a culture of compliance and prevention of work accidents. For this reason, using validated personality trait tools helps develop a culture of safety compliance and the prevention of work-related accidents. For example, personality traits like conscientiousness, by enhancing one's sense of responsibility, creating a positive sense of compliance with organizational and business rules, and reinforcing the sense of collectivism in him/her, prevents him/her from risky behaviors.

Also, the findings of the present study indicated that general mental health is associated with the accident proneness. The findings by Barkhordari et al (Barkhordari, Malmir, & Malakoutikhah, 2019). on analysis of the individual and social factors affecting occupational accidents also indicated the role of factors, such as occupational stress, family conflicts, general health, and generally the components of mental health on the event of accidents at workplaces, which was in line with the results of the present study. In better words, it can be claimed that people who are under psychological stresses, such as anxiety, depression, etc. are more likely to experience accidents because they suffer from cognitive errors in their workplace. In other words, people with anxiety and depression and other pathological symptoms, due to emotional problems and inability to regulate emotions as well as engaging with dysfunctional thoughts, are unable to focus on safety issues of their work and do not pay enough attention to safety standards, which may put them at risk and provide background for workplace accidents.

Based on the evidence of the present study, it is suggested that the issues of employee personality traits, especially in job selection and fitness for work, be considered. It is also recommended that more studies be done in the country, especially with objective indicators of personality traits.

CONFLICT OF INTEREST

The authors of this paper declare no conflict of interest.

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