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Personality versus traffic accidents; meta-analysis of real and method effects

Anders af Wåhlberg[a,*], Peter Barraclough[b], James Freeman[b]

[a] Empirica, Nybygget, Knypplan 111, S-74894 Örbyhus, Sweden
[b] Centre for Accident Research and Road Safety, Queensland University of Technology, Australia

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ABSTRACT

Problem: The association between personality and traffic accident involvement has been extensively researched, but the literature is difficult to summarise, because different personality instruments and statistics have been used, and effect sizes differ strongly between studies.
Method: A meta-analysis of studies which had used measures of personality which could be converted into Big Five dimensions, and traffic accidents as the dependent variable, was undertaken.
Analysis: Outlier values were identified and removed. Also, analyses on effects of common method variance, type of instrument, dissemination bias and restriction of variance were undertaken.
Results: Outlier problems exist in these data, which prohibit any certainty in the conclusions. Each of the 5 personality dimensions were predictors of accident involvement, but the effects were small ($r < .1$), which is much weaker than in a previous meta-analysis. Effect sizes were dependent upon variance in the accident variable, and the true (population) effects could therefore be larger than the present estimates, something which could be ascertained by new studies using high-risk samples over longer time periods. Newer studies and those using Big Five instruments tended to have smaller effects. No effects of common method variance could be found.
Conclusions: Tests of personality are weak predictors of traffic accident involvement, compared to other variables, such as previous accidents. Research into whether larger effects of personality can be found with methods other than self-reports is needed.

1. Introduction

1.1. Personality as predictor of traffic accident involvement

The present paper summarizes the literature on personality (in terms of the Big Five system) as a predictor of traffic accident involvement in a meta-analysis. Several methodological problems are considered, such as outliers, dissemination bias and conversion of data between different personality systems.

* Corresponding author.
E-mail address: aw@empirica.pm (A. af Wåhlberg).

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Personality as a phenomenon is multi-faceted, but can usually be defined as the stable behavioural tendencies of people over time, or the psychological traits which cause such behaviours. This has been conceptualised in many different ways through the years, but today it is agreed by most researchers that the most parsimonious description is by five dimensions; Openness, Agreeableness, Conscientiousness, Neuroticism and Extraversion. Most other systems map onto these dimensions, and results can therefore be converted between them.

Throughout the history of traffic safety, researchers have studied the influence of individual differences in personality on accident record (although at first the term 'accident proneness' was used; Greenwood & Woods, 1919; see also papers by Drake, 1940; Harris, 1950; Parker, 1953). Many researchers have proposed that certain personality features, in terms of recurrent behaviours, cause accidents. In terms of the Big Five model (and its facets), Clarke and Robertson (2005) summarised the theoretical basis for their traffic accident-causing properties thus; people high on Extraversion tend to be poor on vigilance and take more risks. Those high on Neuroticism have been suggested to be easily distracted, less likely to seek control of the environment and prone to react to stress. Conscientiousness features several inter-related concepts which are thought to make people safe, such as planning, self-control and decision-making, while lack of Agreeableness is associated with accidents by the mechanism of aggression in terms of emotion as well as behaviour. Finally, Openness has been suggested to be positively correlated with accidents, due to the routine character of driving, where traits such as experimentation and improvisation are not in accord with safe operation. However, most researchers who investigate the link between personality and accidents refer to previous significant associations reported, and describe the behaviours typical of a certain personality dimension (e.g. Arthur et al., 2001; Begg, Langley, & Williams, 1999; Burns & Wilde, 1995; Clement & Jonah, 1984; Hartman & Rawson, 1992).

Many researchers also express a strong belief in the predictive capacity of tests of personality versus accidents (e.g. Arthur et al., 2001; Brandau, Daghofer, Hofmann, & Spitzer, 2011; Hansen, 1988; Jonah, 1997). However, results, as always, have been mixed, and this belief may therefore be unfounded. For example, Shaw and Sichel (1971) and Shaw (1965) reported correlations between .4 and .7 for their personality tests and accidents for bus drivers, while Carty, Stough, and Gillespie (1998) found a strong negative association (−.212) instead of the expected positive one for Extraversion, and many other such examples exist. Results are thus very heterogeneous, which make interpretation difficult. A meta-analytic approach is therefore needed, where the reasons for this apparent heterogeneity can be identified, and estimates of the true (population) effects calculated.

Two meta-analyses of personality versus accidents have already been published; Arthur, Barrett, and Alexander (1991) and Clarke and Robertson (2005). However, there are several reasons for why a new analysis of the personality-traffic accident association is needed. Apart from now being outdated, the Arthur et al. study used a personality taxonomy which excluded some available studies (e.g. Andersson, Nilsson, & Henriksson, 1970; Jamison & McGlothlin, 1973; Quenault, 1967). Similarly, the Clarke and Robertson study excluded many available papers, while including some which used methodologies which were different from those of the majority. Furthermore, moderator effects and dissemination bias were not investigated in these studies.

We therefore wanted to undertake a new meta-analysis which used a very different approach to the problem of meta-analysing personality as a predictor of traffic accident involvement, taking into account not only the well-known problems of dissemination bias and methodological moderator effects, but also effects which are probably peculiar to accident prediction studies. The main aim of the study was therefore to estimate the population effect while keeping known or suspected moderators constant, as will now be described.

1.2. Technical issues in meta-analysis; Heterogeneity and the population effect

This section describes some of the methodological problems associated with meta-analysing data, under the general headings of trying to estimate a population effect, and the overall problem of heterogeneous data, i.e. very different results in different studies. Also, possible remedies are suggested.

In research on psychological mechanisms, it is usually the goal to infer from sampled data what all people are like in a defined population. For example, are high levels of empathy usually associated with low levels of aggression? In a meta-analytic context, it would specifically be asked what the effect size is, i.e. how strong is the link between the two concepts? When effect sizes from different studies are combined, however, it is important that the data included is actually drawn from the same population, meaning those who share this trait/mechanism. For example, the link between empathy and aggression might have different strength in different cultures. If studies from different cultures are then combined, the ensuing effect size will be slightly misleading, showing really the mean effect for two (or more) different populations. When effect sizes from different populations are mixed, it is said that the meta-dataset is heterogeneous, i.e. the numbers differ more between themselves than could be expected by random sampling (which can be ascertained by statistical testing).

Heterogeneity can also be caused by differences in methodology. For example, it can be expected that experiments and field studies will yield different effect sizes, although they are ostensibly studying the same problem, because part of the effect is actually created by the method used (e.g., a social science analogue to Heisenberg's uncertainty principle).