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Intelligence and persisting with medication for two years: Analysis in a randomised controlled trial

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ABSTRACT

The study examined whether verbal intelligence is associated with persisting to take medication for up to two years. The design is a prospective follow-up of compliance with taking medication in high-risk individuals participating in a randomised, placebo-controlled trial set in Central Scotland. Participants were 1993 people aged between 50 and 77 years with an ankle brachial index ≤0.95. The medication was 100 mg aspirin or placebo daily.
The principal outcome measure was continuing with taking medication or stopping it due to having 'changed one's mind'. Higher verbal intelligence was associated with a greater likelihood of continuing to take medication up to two years after randomisation. For a standard deviation increase in Mill Hill Vocabulary Scale score, risk of stopping medication in the first two years of the study was 0.75 (95% CI 0.64 to 0.87, $p<0.001$). Comparing the highest and lowest quartiles of IQ, the lowest IQ group's relative rate of stopping medication was 2.51 (95% CI 1.52 to 4.22). The effect was not attenuated after adjustment for sex, smoking, or level of deprivation. Verbal intelligence is associated with continuing, medium-to-long term engagement with health self-care, even in the face of uncertainty about whether active treatment is being received, whether the treatment is known to be effective in general, and whether it will be helpful to the individual taking it. Such persisting with potentially helpful health behaviours in the face of uncertainty might partly explain why people with higher intelligence live longer and suffer less morbidity from chronic diseases.

1. Introduction

Higher intelligence (IQ), measured in childhood or early adulthood, is associated with living longer (Batty, Deary, & Gottfredson, 2007). The emerging field of cognitive epidemiology aims to establish the limits of this association, uncover its mechanisms, and explore its implications (Deary & Batty, 2007). One of the favoured explanations is that intelligence influences chronic disease onset and ultimately survival via its association with health behaviours (Gottfredson, 2004). This view conceptualises health self-care as a complex set of tasks that require knowledge, decision-making, planning, and engagement. It is hypothesised that people with higher intelligence will manage health self-care more effectively. Supporting evidence from self-reports shows that people with higher childhood intelligence tend to exercise more and have diets that accord better with health information, are less likely to smoke or to be obese or overweight, and have fewer hangovers from drinking alcohol (Batty, Deary, Schoon, & Gale, 2007a,b; Batty, Deary, & Macintyre, 2006, 2007).

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These findings suggest that people with higher intelligence tend to behave more healthily, perhaps being better able to take a long view about the implications of their behaviour. They are largely derived from community-based samples, most of which were too young to be at high risk of age-related chronic disease. In the present study we shall inquire whether intelligence influences self-care and disease management in individuals with a chronic pathology who are at moderately increased risk of dying at a younger age. The setting is a community-based, double-blind, randomised clinical trial of subjects screened for generalised atherosclerosis using the ankle brachial index (ABI) (Price et al., 2008). Individuals with an increased risk of cardiovascular events and all-cause mortality—as indicated by a ratio of systolic blood pressure in the ankle to that in the arm (ABI) below a pre-determined cut-off (Ankle Brachial Index Collaboration, 2008)—were randomised to daily low-dose aspirin or placebo. The present study investigates whether higher intelligence, measured shortly after randomisation into the trial, predicted longer-term compliance with study medication for up to two years in individuals who knew themselves to be at relatively high risk of cardiovascular disease.

There is already some information on the factors that affect older people's compliance with medication, especially in randomised controlled trials. Some of this research has concentrated on how compliance varies as a result of the design of trials and the different interventions used to enhance compliance (Russell, Conn, & Jantarakupt, 2006). However, there is variation in compliance even within single trials, where all participants are exposed to the same regimen of treatment and encouragements to comply. This motivated the research for person-level predictors of compliance. A large quantitative review of compliance with medical recommendations found that older age, female gender, higher income (but not general socio-economic status), and education were associated with better compliance (DiMatteo, 2004). The review lacked information on intelligence. It cannot be assumed that intelligence—including verbal intelligence, which will be tested here—is acting as a proxy for education. Although they are strongly correlated, verbal intelligence is highly heritable, and large-scale longitudinal data show that verbal intelligence at age 11 strongly predicts educational outcomes at age 16 (Deary, Spinath, & Bates, 2006; Deary, Strand, Smith, & Fernandes, 2007).

It has been suggested that both verbal intelligence and education are partly-independent contributors to better health literacy (Paasche-Orlow & Wolf, 2007). Health literacy is, in turn, posited to be a mediator of the influence of intelligence and education on good compliance (Paasche-Orlow & Wolf, 2007). However, findings concerning health literacy and compliance are not univocal, and it is possible that some so-called health literacy measures are likely to be acting as little more than verbal ability measures. In a study of very brief (3-day) compliance with anti-retroviral therapy, HIV-infected patients with low health literacy were more likely to show adherence (Paasche-Orlow et al., 2006). The measure of health literacy was the REALM, which tests people on their ability to pronounce 66 medically-related words. Of course, this measure is likely to be related highly to general vocabulary, which will be tested in the present study as the independent variable. In a separate study, both education and health literacy were significant, independent predictors of very brief adherence to combination antiretroviral therapies in HIV patients (Kalichman, Ramachandran, & Catz, 1999). In this case, the health literacy measure was the Test of Health Literacy in Adults, which involves understanding written passages and numerical information concerning health care situations. These studies provide examples of two important omissions in our knowledge concerning the adherence aspect of personal health management. First, intelligence is arguably a missing, more fundamental variable, which is prior to, and a strong determinant of, education and health literacy. Therefore, associations between intelligence and adherence to medications should be examined. Second, the adherence in the above studies is assessed over very short time spans: good health management involves longer-term adherence to behaviours that are beneficial to health. This is especially true among older people where common chronic illnesses, such as cardiovascular disease, account for a substantial proportion of the morbidity and mortality burden.

The present study will examine the association between measured intelligence and a particular aspect of compliance with health care within a randomised clinical trial. The participants' intelligence was assessed on average about three months into the trial. By the time participants had reached the stage where they took the mental test (the Mill Hill Vocabulary Scale), they had already made a number of health-related decisions in the affirmative. First, they responded positively to the initial contact by the study team. Second, they attended a non-GP, non-hospital-based medical research clinic to be assessed. Third, they agreed to be, and were, randomised to aspirin or placebo treatment. Fourth, they had persisted with medication for about three months. Fifth, they agreed to take the Mill Hill Vocabulary Scale. Therefore, in terms of a model of health-based decision making, they had already proceeded a long way. Much of health behaviour and behaviour change research would focus on the factors that made people make some of these choices—and intelligence might be associated with any or all of them—but health self-care with respect to chronic disease involves a long-standing commitment to experts' recommendations regarding optimal health behaviours (Gottfredson, 2004). In the men and women we shall study here, we focus on their persistence with treatment over the next 21 months of the study—after a number of 'good' initial decisions—that was associated with intelligence.

Further particularities of the study setting make the study valuable and novel within cognitive epidemiology. Participants within the trial are deciding whether or not to continue a medication for a theoretical benefit. Their blood pressure readings suggest a possible future problem, but not one that is as yet symptomatic, and the risks are communicated to them. They are not certain to be taking the active medication; they have a 50% chance of being on placebo. In this regard, taking part in the trial might be driven by altruism to some extent, because persisting with the medication could add to the greater good by adding to medical knowledge, and verbal intelligence might be related to that aspect. They are aware that it is not known whether even the active medication is effective in reducing risk of cardiovascular disease in people at risk as defined by their ABI, which is why the study was being