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Short communication

Economic disadvantage modifies the association of height with low mood in the US, 2004: The disappointment paradox

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Abstract

Introduction: Taller stature is associated with greater health potential reflected by reduced risks for coronary heart disease (CHD) and depression. Previous studies demonstrated that the reduced CHD and depression risks associated with tall stature were eliminated by financial disadvantage in adult life.
Hypothesis: The reduced risk of depression, defined as low mood, associated with taller stature is eliminated by adult financial adversity. This study also attempts to replicate earlier findings, that the reduced risk of CHD associated with taller stature is eliminated by adult financial adversity.
Methods: The Behavioral Risk Factor Surveillance System is an ongoing survey of the adult population of the US conducted by state health departments and the Centers for Disease Control and Prevention, providing a representative sample of 45,210 adults resident in USA in 2004 with data on low mood and CHD. Low mood was defined by self-reported low mood for more than 15 days in the previous month and CHD by a diagnosis of angina or coronary heart disease. Short stature was defined as the lower 20% of sex-standardised heights and economic disadvantage as household income below $15,000 per annum.
Results: Tall stature was associated with a statistically significant reduced risk for low mood in the entire population. After stratification by economic disadvantage, taller individuals in the higher income stratum maintained a statistically significant reduced risk of low mood, with an odds ratio (and 95% confidence interval) of 0.90 (0.90, 0.91) after adjustment for potential confounding factors and application of the survey weighting. In contrast, taller stature represented a *raised* risk for low mood in the lower income stratum, with a statistically significant odds ratio of 1.27 (1.26, 1.28) with weighting. This effect modification was

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confirmed by interaction testing, producing an odds ratio for interaction of 1.39 (1.37, 1.39; $p < 0.001$). This phenomenon was most profound among white males, with an odds ratio for interaction of 2.20 (2.16, 2.25). Effect modification by economic disadvantage was also observed for the association of height with CHD, producing an odds ratio for interaction of 1.57 (1.56, 1.59; $p < 0.001$).

Conclusions: Although taller stature indicates better heath potential in terms of low mood and CHD, this potential is eliminated by economic disadvantage in later life. Indeed, taller stature is associated with an *increased* risk among those who experience economic disadvantage. Possible explanations are that childhood adversity reducing height may confer resilience against some forms of adult adversity. Alternatively, as taller stature signals greater childhood advantage, then financial adversity may represent a form of disappointment among this group: the disappointment paradox.

Keywords: Height; Growth; Income; Angina; Coronary heart disease (CHD); Psychosocial; Depression; Health; Morbidity; Physical stature; US; Disappointment

1. Introduction

Some conditions and exposures in early life can have significant consequences for development and for health in later life. Although influenced by genetic factors, taller adult stature is a marker for better development and health associated with beneficial exposures in early life (Lichtenstein et al., 1992; Terrell and Mascie-Taylor, 1991). Taller stature is associated with reduced risks for a variety of diseases, including coronary heart disease and cardiovascular disease (CVD) (Hebert et al., 1993; Cook et al., 1994; Osika et al., 2006).

We previously hypothesised that taller stature might confer resilience against economic adversity in terms of coronary heart disease (CHD) risk, but we found anomalous effect modification among some groups. Although in the entire population taller stature was associated with a reduced CHD risk, among those experiencing adult economic disadvantage taller people were at *higher* risk of CHD than shorter people (Osika et al., 2006). Further support for the existence of this phenomenon comes from a British study that found shorter men from the north who moved to the more affluent south had a lower CVD risk than taller men who moved from the south to the north (Wannamethee et al., 2002).

We suspected psychosocial mechanisms might be involved, such that the depression or stress caused by economic disadvantage was responsible for eliminating the protective characteristics signalled by taller stature. As taller stature indicates advantages in childhood, economic disadvantage in later life may represent a form of relative disadvantage among taller people leading to 'disappointment' with adverse psychosocial sequelae. In a different dataset we showed that the benefit of taller stature in decreasing the risk of depression is eliminated by financial disadvantage in older ages (Montgomery et al., 2007), consistent with our hypothesis.

The main focus of the current paper is to replicate the findings on depression risk (indicated by low mood) using a third dataset and also to replicate the original findings on CHD. The hypothesis is that economic disadvantage in later life eliminates, *or even reverses*, the protective association of taller stature with the disease outcomes.

2. Subjects and methods

This study is an analysis of data collected in 2004 by the Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is an ongoing random-digit dialling telephone survey of the adult