Interaction of personality traits with social deprivation in determining mental wellbeing and health behaviours

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ABSTRACT

Background Associations between personality traits, mental wellbeing and good health behaviours were examined to understand further the social and psychological context of the health divide.

Methods In a cross-sectional study, 666 subjects recruited from areas of high and low socioeconomic deprivation had personality traits and mental wellbeing assessed, and lifestyle behaviours quantified. Regression models (using deprivation as a moderating variable) assessed the extent to which personality traits and mental wellbeing predicted health behaviour.

Results Deprived (vs. affluent) subjects exhibited similar levels of extraversion but higher levels of neuroticism and psychoticism, more hopelessness, less sense of coherence, lower self-esteem and lower self-efficacy (all \( P < 0.001 \)). They ate less fruit and vegetables, smoked more and took less aerobic exercise (all \( P < 0.001 \)). In the deprived group, personality traits were significantly more important predictors of mental wellbeing than in the least deprived group (\( P < 0.01 \) for interaction), and mental wellbeing and extraversion appeared more strongly related to good health behaviours.

Conclusions Persistence of a social divide in health may be related to interactions between personality, mental wellbeing and the adoption of good health behaviours in deprived areas. Effectiveness of health messages may be enhanced by accommodating the variation in the levels of extraversion, neuroticism, hopelessness and sense of coherence.

Keywords deprivation, health behaviours, mental wellbeing, personality traits, socioeconomic status

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Introduction

Associations between personality, mental wellbeing, socioeconomic status (SES) and health have been well documented. Personality is assessed commonly using either a five-factor (comprising neuroticism, extraversion, agreeableness, openness to experience and conscientiousness) or a three-factor (neuroticism, extraversion and psychoticism) model and links can be seen with health related decision-making. Personality traits show consistent associations with smoking, diet and exercise. Smoking has been associated with higher levels of neuroticism, with extraversion and psychoticism. Lower levels of agreeableness and conscientiousness also predict smoking behaviour. A greater propensity to exercise has been associated with lower levels of neuroticism and with higher extraversion. Similarly, higher conscientiousness is associated with a greater likelihood of exercising and consuming fruit and vegetables. The influence of neuroticism is more complex: it has been associated with higher scores on dietary restraint but also with a tendency to increase emotional eating. These relationships between personality and health behaviours may explain, in part, why personality predicts mortality and morbidity, possibly independent of SES and level of social support.

Personality factors associated with health-related behaviours may also help explain why certain sub-groups within the population experience significantly better, or worse, health than others. It may be significant that low SES is associated with high levels of neuroticism, low levels of conscientiousness, higher hostility and depression, the latter dispositions reflecting lower mental wellbeing. The concept of sense of coherence (SoC) is of particular interest in this context because of its significant association both with mental wellbeing and SES. SoC does not define a personality type but is rather a disposition which characterizes the individual’s confidence that their internal and external environments are comprehensible, manageable and meaningful. High SoC is associated with lower levels of psychological morbidity, lower trait anxiety and better self-reported health status. The fact that income, education and extended social networks all contribute positively to SoC would confirm the relevance of SES to the factor: broadly, low SES is associated with lower SoC. Whilst SoC shows relative stability in adulthood, it can change if significant and enduring events occur in personal circumstances. It has been proposed that the potential for SoC to change may be of relevance in health promotion in that suitably tailored interventions may then be devised to provide positive experiences, and support, that allow strengthening of an individual’s SoC with positive consequences for health.

The rationale for the present study was to investigate to what extent personality traits and mental wellbeing influence uptake of positive health behaviours, and to test the hypothesis that these characteristics have a differential impact on affluent and deprived communities. Subjects participating in the ‘Psychological, Social and Biological Determinants of Ill-health’ (pSoBid) study were recruited from the ends of the socioeconomic gradient in a large Scottish city, and we have reported previously that those from deprived areas fare significantly less well than their more affluent counterparts on a range of biological measures that influence health. The current analysis investigates the association between personality traits, mental wellbeing and the uptake of healthy living advice (eating fruit and vegetables, smoking cessation and aerobic exercise) in the two social groups.

Methods

Ethical approval

The study was approved by the Glasgow Royal Infirmary Research Ethics Committee and all participants gave written informed consent.

Study population and protocol

The design of the pSoBid study, including the recruitment strategy, response rates and study protocol has been described elsewhere. Briefly, selection of subjects was based on the Scottish Index of Multiple Deprivation (SIMD) 2004, which ranks small areas on the basis of multiple deprivation indicators. Subjects were recruited from five general practices that served the bottom 5% of SIMD (i.e. relatively deprived) and a further five practices in areas classified as being in the top 20% of the SIMD (i.e. relatively affluent). Between December 2005 and May 2007 we recruited approximately equal numbers from both areas, equal numbers of males and females and equal numbers from each age group (35–44, 45–54 and 55–64 years old).

At Visit 1, participants completed lifestyle and psychology questionnaires. The lifestyle questionnaire included questions on physical activity, alcohol intake, dietary habits and smoking behaviour. Psychological questionnaires completed at this visit examined the affective state and coping/control. Assessment included completion of the General Health Questionnaire-28 (GHQ-28), the Generalized Self-Efficacy Scale (GSS), the SoC Scale and the Beck Hopelessness Scale (BHS).
Two weeks later at Visit 2, participants completed the Rosenberg Self-esteem Scale (RSES)\(^{39}\) and Eysenck Personality Questionnaire (EPQ-R)\(^{4}\) which comprises measures of extraversion, neuroticism and psychoticism. The scale includes a so-called 'Lie' scale to detect those who may attempt to answer so as to portray themselves in a socially acceptable way.

**Quantification of health behaviours**

A score for the consumption of fruit and vegetables was calculated from participants' self-reported intake of a range of 21 food categories.\(^{40}\) Responses for each question ranged from the number of portions consumed per day, weekly or monthly. Participants selected one response per food category. Responses to four questions from the food frequency questionnaire relating to fruit and vegetable intake were aggregated to give an overall monthly diet score, i.e. frequency of intake of fresh fruit, cooked green vegetables, cooked root vegetables and raw vegetables or salad.

Questions on habitual physical activity at work and in recreation allowed participants to be classified as inactive, moderately inactive, moderately active or active.\(^{41}\) For the present analysis, the number of hours per month when each participant undertook vigorous physical activity (defined as undertaking activities vigorous enough to cause sweating or a faster heartbeat) was also calculated. Participants' smoking behaviours were assessed according to whether they had ever smoked regularly (at least one cigarette a day for 12 months or more), the material smoked and the age at which they had started and stopped smoking if applicable.

**Statistical analysis**

Descriptive statistics are presented as mean (SD) for continuous variables and count (%) for categorical variables. Continuous variables were compared between the most deprived and the least deprived group using \(t\)-tests or Wilcoxon tests as appropriate. Categorical variables were compared between the most deprived and the least deprived groups using Fisher's exact test. The BHS score was log-transformed. Associations between measures of mental wellbeing (outcomes) and personality traits (predictors), and then between health behaviours (outcomes) and mental wellbeing scores and personality traits (predictors) were assessed using linear or logistic regression models, including interactions between predictor variables and deprivation. All models were adjusted for age, sex and years of education and included deprivation as a moderator variable. Results are presented as effect estimates and 95% confidence intervals within each deprivation group, and \(P\)-values for tests of interaction. Analyses were conducted in R for Windows v. 2.9.\(^{42}\)

**Results**

Of the 2712 subjects invited, 666 participated and attended both study visits, giving an overall response rate of 24.6%. By design, there were approximately equal numbers of men and women in each of the three age groups: 342 were drawn from the least deprived areas and 324 from the most deprived. For the least deprived group as a whole the response rate was 33.9% and for the most deprived group of 19.0%.

Significant differences (Table 1) were found between the most and least deprived groups in health behaviours (smoking, exercise and diet indices) and in indicators of mental wellbeing (SoC, self-esteem, hopelessness and self-efficacy, GHQ scores). In terms of personality factors deduced from the responses to the EPQ,\(^{4}\) the most deprived group showed significantly higher levels of neuroticism and psychoticism than those from least deprived areas. The groups did not differ in mean extraversion or in 'lie' scores.

The distribution of extraversion scores (Supplementary data, Fig. S1) was similar in the groups, while a greater proportion of the most deprived subjects scored higher on neuroticism. In the case of psychoticism, both groups were characterized by low scores but there was a skew towards higher scores in the deprived group. The distribution of mental wellbeing scores also differed between the two groups with the least deprived group having lower levels of hopelessness and self-esteem (note that on the RSES high scores denote low self-esteem), a greater SoC and increased self-efficacy.

**Personality, deprivation and mental wellbeing**

Figure 1 and Table 2 examine the extent to which personality traits predicted mental wellbeing in affluent and deprived subjects. The impact of personality, extraversion in particular, appeared different in the two groups and formal tests of interaction with deprivation category were significant for hopelessness versus neuroticism and extraversion (\(P = 0.0017\) and \(P < 0.001\), respectively), for SoC (\(P < 0.001\) for extraversion) and self-esteem (\(P = 0.006\) for extraversion). High levels of neuroticism and low levels of extraversion were associated strongly in both groups with increased hopelessness, reduced SoC, reduced self-esteem and reduced self-efficacy. However, it was also seen that in the most deprived, individuals who were high in neuroticism or low

**Figure 1 and Table 2**

Explain the content of Figure 1 and Table 2 with relevant data and findings. The data from Figure 1 and Table 2 are used to illustrate the relationship between personality traits and mental wellbeing in different deprivation groups.
in extraversion reported lower mental wellbeing (a greater degree of hopelessness, lower SoC and less self-esteem) than their counterparts in the least deprived group. It was noteworthy that those in the deprived group with low levels of neuroticism (score of < 4) and those with high levels of extraversion (scores > 6) exhibited a degree of mental wellbeing similar to that in the least deprived group.

### Mental wellbeing, deprivation and positive health behaviours

#### Consumption of fruit and vegetables

The most deprived group ate on average one-third fewer portions of fruit and vegetables per month than the least deprived (Table 1). While none of the tests of interaction with deprivation was significant in the regression models in
Table 3, consumption of fruit and vegetables was lower in those expressing increased hopelessness and greater in those with higher SoC, self-esteem and self-efficacy. In general, within the least deprived group, mental wellbeing scores were not linked significantly to fruit and vegetable consumption, whereas in the most deprived group these associations were statistically significant.

Extraversion was related significantly to fruit and vegetable consumption only in the most deprived group ($P = 0.002$), but again a test of interaction was not significant ($P = 0.237$) (Table 3). Neither neuroticism nor psychoticism was linked with fruit and vegetable consumption in either social group. In a multivariate model of fruit and vegetable consumption, only higher self-efficacy in both groups ($P = 0.003$) and greater extraversion in people living in deprivation ($P = 0.031$) emerged as statistically significant predictors (Supplementary data, Table S1).

**Smoking**

Table 1 shows that 66.3% of the least deprived group had never smoked, while 71.4% of the most deprived had smoked at some time and 44.6% were current smokers.
Among those who had smoked at some time in their lives, 81.4 and 37.6% had stopped smoking in the least and most deprived groups, respectively (\(P\), 0.001).

In the deprived subject group those with a higher SoC had greater success in giving up (\(P\) = 0.034 for interaction with deprivation category, Table 3). A similar association seemed to be present for those with greater self-efficacy; however, interaction was not statistically significant for this variable. In general, individuals living in less deprived areas were more likely to stop smoking but this tendency showed no association with any of the tested predictors.

**Aerobic exercise**

Only the association of aerobic exercise with hopelessness showed a statistically significant interaction between deprivation groups (\(P\) = 0.034 for interaction with deprivation category, Table 3). A similar association seemed to be present for those with greater self-efficacy; however, interaction was not statistically significant for this variable. In general, individuals living in less deprived areas were more likely to stop smoking but this tendency showed no association with any of the tested predictors.

**Discussion**

**Main findings of this study**

In general the pSoBd cohort exhibited the same relationships between personality traits, health behaviours and SES that have been reported previously. Participants from areas of multiple deprivation had significantly higher levels of neuroticism and psychoticism than their more affluent counterparts. Similarly, a significantly lower level of mental wellbeing among the more deprived group, and its association with high neuroticism and low extraversion, is consistent with existing evidence. The higher prevalence of harmful health behaviours (smoking, poor diet and lack of exercise) in the most deprived group, again, replicates previous research.

A novel finding is that personality traits appeared to have a significantly greater impact on mental wellbeing among participants from more deprived circumstances. Further, personality and wellbeing impacted more on the pattern of health behaviours in this group compared with their more affluent counterparts. In the more deprived group, mental wellbeing—low hopelessness and a high degree of self-esteem, SoC and self-efficacy—and high extraversion were significant predictors of consumption of fruit and vegetables. In contrast no personality trait or aspect of mental wellbeing appeared to predict this health behaviour in the more affluent group. Success in smoking cessation was associated in the most deprived (but not the least deprived) with SoC and self-efficacy. We did not see an influence of personality trait on smoking cessation in either group. Engagement in aerobic exercise was lower in the more deprived group and was associated positively in that group with high extraversion, SoC, self-esteem and self-efficacy and inversely to high psychoticism and hopelessness.

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### Table 2: Relationship of personality traits and deprivation to mental wellbeing

<table>
<thead>
<tr>
<th>Mental wellbeing scale</th>
<th>EPQ trait</th>
<th>Effect (95% CI)</th>
<th>Interaction P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Least deprived</td>
<td>Most deprived</td>
<td></td>
</tr>
<tr>
<td>BHS</td>
<td>Neuroticism</td>
<td>0.066 (0.043, 0.089)</td>
<td>0.017</td>
</tr>
<tr>
<td></td>
<td>Extraversion</td>
<td>-0.025 (-0.047, -0.003)</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td>Psychoticism</td>
<td>0.019 (-0.041, 0.080)</td>
<td>0.605</td>
</tr>
<tr>
<td>SoC</td>
<td>Neuroticism</td>
<td>-2.158 (-2.528, -1.787)</td>
<td>0.297</td>
</tr>
<tr>
<td></td>
<td>Extraversion</td>
<td>0.535 (0.135, 0.935)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>Psychoticism</td>
<td>-0.603 (-1.705, 0.499)</td>
<td>0.693</td>
</tr>
<tr>
<td>RSES</td>
<td>Neuroticism</td>
<td>0.749 (0.612, 0.887)</td>
<td>0.082</td>
</tr>
<tr>
<td></td>
<td>Extraversion</td>
<td>-0.368 (-0.511, -0.225)</td>
<td>0.006</td>
</tr>
<tr>
<td></td>
<td>Psychoticism</td>
<td>-0.093 (-0.498, 0.312)</td>
<td>0.293</td>
</tr>
<tr>
<td>GSS</td>
<td>Neuroticism</td>
<td>-0.524 (-0.685, -0.364)</td>
<td>0.064</td>
</tr>
<tr>
<td></td>
<td>Extraversion</td>
<td>0.430 (0.274, 0.586)</td>
<td>0.400</td>
</tr>
<tr>
<td></td>
<td>Psychoticism</td>
<td>0.344 (-0.089, 0.777)</td>
<td>0.089</td>
</tr>
</tbody>
</table>

\(^a\)Regression analyses are presented as effect estimates and 95% confidence intervals. P-values for test of interaction of personality trait and deprivation. Each model included deprivation and personality trait and their interaction and additionally adjusts for age, sex and years of education.
What is already known on this topic

The nearest parallel report on diet is the finding that a high level of conscientiousness predicts fruit and vegetable consumption in a sample of college students. The three-factor model of personality applied in the present study does not permit extraversion to be decomposed into ‘sub-facets’ or traits as in the case of the five-factor model so it is more difficult to determine the basis of the association. However, some insight is provided by the measures of mental wellbeing which variously reflect the traits of optimism, assertiveness and goal-directed activity associated with high extraversion and which may plausibly underlie the effect.

Table 3 Relationship between mental wellbeing and personality traits to health behaviours in affluent and deprived groups

<table>
<thead>
<tr>
<th>Effect (95% CI)</th>
<th>Interaction P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Least deprived</td>
</tr>
<tr>
<td><strong>Fruit and vegetable consumption</strong></td>
<td></td>
</tr>
<tr>
<td>Mental wellbeing scale</td>
<td></td>
</tr>
<tr>
<td>BHS</td>
<td>−0.878 (−2.525, 0.769)</td>
</tr>
<tr>
<td>SoC</td>
<td>0.067 (−0.404, 0.539)</td>
</tr>
<tr>
<td>RSES</td>
<td>−0.372 (−1.579, 0.835)</td>
</tr>
<tr>
<td>GSS</td>
<td>0.900 (−0.308, 2.109)</td>
</tr>
<tr>
<td>Eysenck personality trait</td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>−0.206 (−1.954, 1.542)</td>
</tr>
<tr>
<td>Extraversion</td>
<td>1.078 (−0.526, 2.683)</td>
</tr>
<tr>
<td>Psychoticism</td>
<td>−1.323 (−5.522, 2.877)</td>
</tr>
<tr>
<td><strong>Smoking cessation</strong></td>
<td></td>
</tr>
<tr>
<td>Mental wellbeing scale</td>
<td></td>
</tr>
<tr>
<td>BHS</td>
<td>0.006 (−0.155, 0.66)</td>
</tr>
<tr>
<td>SoC</td>
<td>−0.032 (−0.080, 0.015)</td>
</tr>
<tr>
<td>RSES</td>
<td>0.001 (−0.110, 0.111)</td>
</tr>
<tr>
<td>GSS</td>
<td>−0.018 (−0.126, 0.090)</td>
</tr>
<tr>
<td>Eysenck personality trait</td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>0.045 (−0.101, 0.192)</td>
</tr>
<tr>
<td>Extraversion</td>
<td>0.047 (−0.092, 0.186)</td>
</tr>
<tr>
<td>Psychoticism</td>
<td>−0.11. (−0.448, 0.223)</td>
</tr>
<tr>
<td><strong>Vigorous aerobic exercise</strong></td>
<td></td>
</tr>
<tr>
<td>Mental wellbeing scale</td>
<td></td>
</tr>
<tr>
<td>BHS</td>
<td>−0.001 (−0.069, 0.066)</td>
</tr>
<tr>
<td>SoC</td>
<td>0.002 (−0.017, 0.021)</td>
</tr>
<tr>
<td>RSES</td>
<td>−0.043 (−0.093, 0.006)</td>
</tr>
<tr>
<td>GSS</td>
<td>0.035 (−0.015, 0.085)</td>
</tr>
<tr>
<td>Eysenck personality trait</td>
<td></td>
</tr>
<tr>
<td>Neuroticism</td>
<td>−0.008 (−0.078, 0.062)</td>
</tr>
<tr>
<td>Extraversion</td>
<td>0.007 (−0.058, 0.071)</td>
</tr>
<tr>
<td>Psychoticism</td>
<td>−0.007 (−0.176, 0.163)</td>
</tr>
</tbody>
</table>

*aMonthly fruit and vegetable consumption.
*bRegression analyses are presented as effect estimates and 95% confidence intervals. P-values for test of interaction of personality trait/mental wellbeing scale and deprivation. Each model included deprivation and personality trait/mental wellbeing scale and their interaction and additionally adjusts for age, sex and years of education.

*cPredicted possibility in those who ever smoked of becoming a former smoker.
*dNumber of hours per month of vigorous aerobic exercise.

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higher scores for extraversion and psychoticism than those who had never smoked, and our results showed that personality was not a predictor of ‘never smoking’. Neither of these other studies considered the factor of SES.

The beneficial influence of extraversion on the propensity to exercise has been reported before. The lower level of exercise associated with greater hopelessness in the deprived group is consistent with the apathy and inactivity associated with negative affect.  Personality traits and measures of mental wellbeing appeared not to be related to involvement in exercise in the affluent group.

What this study adds
Our findings provide support for the proposal that more attention should be paid to personality traits and parameters of mental wellbeing when designing health promotion activities. In the case of personality, the practicality of such a proposal might be questioned in the light of the commonly held assumption that adult personality is stable and largely unchangeable, and hence impervious to interventions that might modify those traits associated with negative health behaviours. However, this objection has been well addressed by Roberts et al. who cite evidence that personality traits do change and may be modifiable. They suggest that a focus upon social factors that may modify personality traits might have broad-reaching effects across the individual’s activities. Although their proposal is cogently made, the practical, and indeed ethical, complexities of developing and implementing such an intervention programme might seem formidable. There might, however, be greater scope for less controversial intervention through the manipulation of resources and experiences that influence the cognitions that underlie some of the measures of mental wellbeing employed in this study. For example, it was evident, within the most deprived group, that an individual’s SoC was a significant determinant of their success in smoking cessation, engaging in aerobic exercise and uptake of a healthy diet. Moreover, it was noted above that while SoC shows some stability in adulthood, it is amenable to change in the light of significant and influential life experiences; Nilsson et al. have provided data to support the conclusions of a 2006 systematic review that factors which are known to promote health, such as educational provision and social support, may act to enhance SoC with positive consequences for self-reported health.

It is recognized that the adoption of more health-enhancing behaviours may be more difficult to achieve in poorer communities among individuals expressing low extraversion, high hopelessness and a low SoC. However, the present results may add further support to the importance of accounting for individual differences. Interventions may be more effective when they are adapted to certain personality characteristics and have a focus upon supporting and enhancing those aspects of mental wellbeing such as SoC which have a demonstrated positive association with health.

Limitations of this study
Selected from ends of the socioeconomic gradient, subjects in our sample may not represent the population as a whole. Further, there is possible response bias, particularly due to difficulties in recruiting younger men from the most deprived areas. To explore this, we examined the characteristics of non-respondents and found that within each age, sex and socioeconomic stratum participants were comparable to non-participants. The use of the three-factor measure of personality was also a limitation in that we were unable to assess the impact of conscientiousness which has been reported to be an important determinant of many health behaviours. Finally, as a cross-sectional study it is not possible to infer causality from the observed statistical relationships, nor the differences in associations between deprivation groups, not all of which constituted statistically significant interactions, and which were not adjusted for multiple statistical testing. Nevertheless, the consistent pattern of relatively stronger associations within the more deprived group, compared with no or weaker associations in the less deprived group, adds weight to the hypothesis that personality traits and mental wellbeing are more important determinants of health behaviours within areas of high socioeconomic deprivation. We propose this should be the focus of future research.

Supplementary data
Supplementary data are available at the Journal of Public Health online.

Authors’ contributions
CJP, JC, JSM, AM, CMM, GDB, HB, KAD, NS, PG, YNV, CT and KM contributed equally to conception, design and final approval of the version of the manuscript. CJP, KM and JSM have been involved in drafting the manuscript and revising it critically for important intellectual content. AM and CMM performed the statistical analysis. YNV supervised the recruitment of subjects and data collection.
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