Socioeconomic inequality in recovery from poor physical and mental health in mid-life and early old age: prospective Whitehall II cohort study

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ABSTRACT

Background Few studies have examined the influence of socioeconomic status on recovery from poor physical and mental health.

Methods Prospective study with four consecutive periods of follow-up (1991–2011) of 7564 civil servants (2228 women) recruited while working in London. Health was measured by the Short-Form 36 questionnaire physical and mental component scores assessed at beginning and end of each of four rounds. Poor health was defined by a score in the lowest 20% of the age–sex-specific distribution. Recovery was defined as changing from a low score at the beginning to a normal score at the end of the round. The analysis took account of retirement status, health behaviours, body mass index and prevalent chronic disease.

Results Of 24 001 person-observations in the age range 39–83, a total of 8105 identified poor physical or mental health. Lower grade of employment was strongly associated with slower recovery from poor physical health (OR 0.73 (95% CI 0.59 to 0.91); trend P=0.002) in age, sex and ethnicity-adjusted analyses. The association was halved after further adjustment for health behaviours, adiposity, systolic blood pressure (SBP) and serum cholesterol (OR 0.85 (0.68 to 1.07)). In contrast, slower recovery from poor mental health was associated robustly with low employment grade even after multiple adjustment (OR 0.74 (0.59 to 0.93); trend P=0.02).

Conclusions Socioeconomic inequalities in recovery from poor physical health were explained to a considerable extent by health behaviours, adiposity, SBP and serum cholesterol. These risk factors explained only part of the gradient in recovery for poor mental health.

INTRODUCTION

Socioeconomic inequalities in health are thought about primarily in terms of gradients in incident disease and mortality.1 An equally important dimension of health inequality relates to perceived poor mental and physical health,2–4 which may have a greater impact on quality of life than living with a chronic disease.5 Prevalence of poor health and corresponding functional limitations is determined by the rate of remission as well as the rate of incidence. As a result, a socioeconomic gradient in recovery from low health-related functional states is sufficient to produce inequality in the prevalence of suboptimal health, even if incidence does not differ by socioeconomic status.

It is to be expected that individuals with relatively robust financial and psychosocial resources are more resilient in their response to incident disease and loss of function. Hospital and register-based studies show faster functional improvements and return to work among higher compared with lower socioeconomic groups of psychiatric patients.6,7 A primary-care based study found that higher education level was associated with faster recovery from back pain.8 After stroke, patients discharged to home in less deprived areas were less likely to become dependent or to die.9 However, recovery from poor self-perceived health in the general population has been little studied from a health inequality perspective, and existing findings are conflicting.10–13

We examined socioeconomic inequalities in recovery from poor self-reported mental and physical health over 23 years according to employment grade defined by occupation and analysed the role that chronic disease, health behaviours, body mass index (BMI) and other physiological risk factors might play in producing the recovery dimension of health inequality.

METHODS

The Whitehall II cohort study was established in 1985, based on 10 308 civil servants (3413 women) aged 35–55 years recruited from 20 offices in London. The response rate was 73%.14 Data collections involving completion of a self-administered questionnaire and a clinical examination were made approximately every five years.14 We analysed data across four 5-year periods between 1991 and 2013 (table 1). Participants were followed into retirement, regardless of their employment history, and eligible to be included in a period if they completed the Short-Form 36 (SF-36) questionnaire at beginning and end of the period. All participants provided informed consent.

Outcome

The SF-36 was administered on five occasions. The 36-item questionnaire has eight scales: physical functioning, role limitations due to physical problems, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems and general mental health.15 16 The scales can be summarised into mental component score (MCS) and physical component score (PCS) based on factor analysis to produce two scores scaled
The end of each round.

defined as improvement from a low to a normal score, that

health as the lowest 20% of the distribution (online supplemen-

PCS differ by age and sex, and we used data from all five phases

self-reports and clinic data at the beginning of each period.

blood pressure (SBP) and serum cholesterol) were derived from

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et al. J Epidemiol Community Health: first published as 10.1136/jech-2017-209584 on 8 February 2018. Downloaded from http://jech.bmj.com/ J Epidemiol Community Health: first published as 10.1136/jech-2017-209584 on 8 February 2018. Downloaded from

from 0 to 100 (high score indicating good health) with mean 50

and SD 10, using the US population as reference. 17 18 MCS and

PCS differ by age and sex, and we used data from all five phases

to generate age-sex-specific cut-points in order to define poor

health as the lowest 20% of the distribution (online supplemen-
tary tables S1 and S2). Recovery from a low MCS and PCS was
defined as improvement from a low to a normal score, that is,
above the cut-point for age and sex, between the beginning and

the end of each round.

Variables

The socioeconomic status of each participant was verified in
each period, based on last known (current or most recent) civil

service employment grade. Employment grade was assigned by
combining official occupational grade into three categories: high
(administrative), intermediate (professional or executive) and
low (clerical or support officer). Employment grade classifies the
cohort by salary, job characteristics such as control over work
content and opportunity for use of skills, and social status. 14

Health-related behaviours (smoking, alcohol intake and

physical exercise) and health status (BMI, long-standing illness,
coronary heart disease (CHD), stroke, diabetes mellitus, systolic
blood pressure (SBP) and serum cholesterol) were derived from
self-reports and clinic data at the beginning of each period.

Statistical methods

The analytic sample was defined as person-observations with
poor physical or mental health at the beginning and a valid
SF-36 score at the end of any of the four periods. We summarised
risk factors at the start of each of the four periods. We imputed
missing risk factor data using multiple imputation which
replaces missing values with randomly selected draws from
the missing data distribution conditional on the observed data,
specified by an imputation model, creating multiple imputed
datasets. 19 Multiple imputation accounts for uncertainty due to
missing data and obtains unbiased estimates and SE if the missing
at random assumption is plausible, that is, the reason for the
missing data is associated with observed, but not unobserved,
data. 19 The imputation model included the risk factors described
earlier, MCS and PCS and the following auxiliary variables
which were associated with at least one of the risk factors with
missing data. 20 The risk factors were total cholesterol, SBP, fruit
and vegetable consumption, chest pain, angina, high general
health questionnaire score and receiving antihypertensive drug

treatment at the beginning of the period and family history of
angina, heart attack, stroke, high blood pressure or diabetes. We
used 10 cycles to impute missing values in each imputed dataset
and generated 20 imputed datasets which were analysed sepa-
rately and the results combined using logistic regression models
for recovery from poor physical and mental health, adjusted for
age and sex, for each period separately. Socioeconomic gradi-
ents in recovery did not differ across periods; therefore, the
four periods of observation were combined. We fitted logistic
regression models for all periods combined including period as
a stratification variable in the models. Models were adjusted for
(1) age, sex and ethnicity, and additionally for (2) demographic
factors (marital and retirement status), (3) health behaviours
(smoking habit, alcohol consumption and physical activity),
adiposity (BMI) and other physiological risk factors (SBP and
serum cholesterol), (4) prevalent disease (long-standing illness,
CHD, stroke and diabetes) and (5) all of these covariates. Attenu-
ation of the low versus high employment grade difference in
recovery rate was calculated by comparing the coefficient from
an adjusted model with that from the age, sex and ethnicity-ad-
djusted model on the log odds scale. Sensitivity analyses were
conducted using an alternative definition of recovery from poor
physical and mental health: improvement in PCS/MCS ≥8
points. Analyses were performed using Stata V.13.1.

RESULTS

Of 24001 person-observations, 4699 (19.6%) identified poor
physical health and 4584 (19.1%) poor mental health at the
beginning of the four observation periods, with 1178 (4.9%)
identifying both conditions. There were socioeconomic gradi-
ents in the prevalence proportions of poor physical and mental
health according to employment grade (figure 1). Approxi-
mately half the person-observations with poor health at the
beginning of a period involved recovery (MCS 43%–52%, PCS
44%–50%) (table 1). The distribution of demographic factors,

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Main findings

Odds of recovery from poor mental and physical health were lower in lower employment grades. Socioeconomic inequality in recovery on the physical health component was accounted for partly by distribution of health behaviours, adiposity, SBP and serum cholesterol across the strata. Inequality in recovery on the mental component was less well explained by these potential intermediate factors. There was a tendency for those in the lower strata to have poorer health at the start of each round of

Table 2 Association of employment grade with recovery from poor physical and mental health across all periods

| Employment grade | Person-observations | Score, mean (SD) | Recovered, N (rate*) | Adjusted for age, sex and ethnicity | Adjusted for all demographic factors† | Adjusted for age, sex, ethnicity, behaviours, BMI, risk factors‡ | Adjusted for age, sex, ethnicity and prevalent disease§ | Multiply adjusted¶ |
|------------------|---------------------|------------------|----------------------|-------------------------------------|--------------------------------------|-------------------------------------------------------------|------------------------------------------------------|-------------------|
| **Poor physical health (n=4699)** | | | | | | | | |
| High | 1872 | 39.3 (7.1) | 965 (51.6) | Ref | Ref | Ref | Ref | Ref |
| Intermediate | 2193 | 37.4 (8.3) | 1014 (46.2) | 0.86 (0.75 to 0.98) | 0.89 (0.78 to 1.01) | 0.90 (0.79 to 1.03) | 0.85 (0.75 to 0.98) | 0.93 (0.81 to 1.06) |
| Low | 634 | 34.4 (8.1) | 246 (38.8) | 0.73 (0.59 to 0.91) | 0.77 (0.62 to 0.96) | 0.85 (0.68 to 1.07) | 0.71 (0.57 to 0.89) | 0.85 (0.68 to 1.07) |
| P value for trend | 0.002 | 0.013 | 0.086 | 0.001 | 0.142 |
| **Poor mental health (n=4584)** | | | | | | | | |
| High | 1896 | 38.8 (8.1) | 955 (50.4) | Ref | Ref | Ref | Ref | Ref |
| Intermediate | 2142 | 36.9 (8.5) | 1014 (47.3) | 0.84 (0.74 to 0.96) | 0.89 (0.78 to 1.02) | 0.88 (0.77 to 1.00) | 0.85 (0.74 to 0.96) | 0.93 (0.81 to 1.06) |
| Low | 546 | 35.6 (8.2) | 234 (42.9) | 0.62 (0.50 to 0.78) | 0.67 (0.54 to 0.84) | 0.71 (0.57 to 0.89) | 0.63 (0.51 to 0.78) | 0.74 (0.59 to 0.93) |
| P value for trend | <0.001 | 0.001 | 0.002 | <0.001 | 0.025 |

Cut-point for recovery depends on age and sex.

*Rate of recovery per 100 persons.
†Adjusted for age, sex, ethnicity, marital status and retirement status.
‡Adjusted for age, sex, ethnicity, smoking habit, alcohol consumption, physical activity, BMI, systolic blood pressure and serum cholesterol.
§Multiply adjusted for age, sex, marital status, ethnicity, retirement status, health behaviours (smoking habit, alcohol consumption and physical activity), BMI, systolic blood pressure, serum cholesterol and prevalent disease (long-standing illness, CHD, stroke and diabetes). Missing values imputed using multiple imputation with 20 imputed datasets. BMI, body mass index; CHD, coronary heart disease.
observation, and accordingly a reduced likelihood of moving out of the bottom 20% of scores. Nevertheless, the socioeconomic gradients in odds of recovery from poor mental or poor physical health were independent of the respective initial SF-36 score.

This study evaluated whether socioeconomic status was a determinant of recovery both from poor mental and physical health among adults initially aged 39–63 years. Participants were followed up for 23 years with repeat collections of the SF-36 questionnaire and other information on health status at 5-year intervals (1991–2013). The socioeconomic gradient in recovery was similar across periods; therefore, the four periods of observation were combined with a multilevel logistic regression model. This method estimates error variances allowing for multiple observations on the same individual. As well as controlling for marital status and other personal characteristics, we were able to adjust for prevalent chronic disease and for health behaviours, adiposity, SBP and serum cholesterol at the start of each person-observation. Socioeconomic inequalities in the odds of recovery from poor physical and mental health were each partially explained by health behaviours and other physiological risk factors, as is the case with decline in health-related functioning, and incidence of cardiometabolic disease.18 21

Dropout rates were higher in the lower employment grades than higher, and this was a potential limitation. However, it is likely those who dropped out had poorer health and functioning than those who remained in the study, and estimates of the gradient in odds of recovery by employment grade are probably underestimated.

The SF-36 is a standardised method to assess physical and mental health where both scores have a mean value of 50 and an SD of 10 in the general US population.17 The PCS in particular is strongly associated with age and data are analysed over >20 years of follow-up, such that few younger participants would fall into the lowest quintile if a single cut-point defined poor health. Therefore, this study defined cut-points for poor health as the age–sex–specific lowest quintile of functioning scores at each measurement phase. The age–sex–specific lowest quintile for physical functioning was between 22 and 50 (online supplementary table S1) while for mental functioning it was between 40 and 51 (online supplementary table S2).

Strengths and weaknesses in relation to other studies

Previous findings on socioeconomic differences in recovery from poor mental or physical health have been mixed, at least in part due to their small size. Socioeconomic status was not associated with recovery from a mobility limitation in a comparison of 185 non-manual and 447 manual men.11 Eighteen-month follow-up for recurrent or persistent common mental disorder among 750 employed adults and those in lower strata of education or socioeconomic class had no significant disadvantage after controlling for baseline mental health (The Clinical Interview Schedule-Revised score).22 In contrast, higher socioeconomic status was associated with return to work and lower recurrence following psychiatric work disability in a larger study of almost 4000 adults.7 The present study, although based only on civil servants, has an effective sample size of >8000 as a result of combining four cycles of observation over the follow-up period.

What the study adds

Some previous cohort studies based on education level suggest more rapid recovery from mobility disability is associated with years of school and college, with the implication that self-efficacy contributes importantly to the recovery aspect of socioeconomic inequality.10 11 The present study uses the SF-36, well characterised for measuring functional health status change and health inequality in the general population.16 18 23 Employment grade rather than education level here predicted recovery from poor physical and mental health. This measure of adult socioeconomic status characterises classes of individuals with similar income, pension rights, job security and work skills, all of which are resources that may directly or indirectly influence rate of recovery from poor health. Further, low employment grade is associated with clustering of adverse behavioural and vascular risk factors,24 25 and with rapid arterial ageing.26

The SF-36 questionnaire measures the functional aspects of health. Here, the socioeconomic gradient in the recovery from a low PCS was no longer significant in the maximally adjusted model, indicating that health behaviours, BMI, SBP and serum cholesterol together provide a good statistical explanation for the socioeconomic gradient. Although the association was halved in size in the maximally adjusted model, the same set of covariates...
had a weaker attenuating effect on inequality in recovery from poor self-rated mental health. We did not explore the extent to which each covariate accounted for the respective gradients since causal explanations were outside the scope of this analysis. It would appear that a common cause explanation for the physical and mental health gradients may be important.27 Adverse health-related behaviours and degree of adiposity were associated with lower socioeconomic status, and our analysis suggests they contributed to the gradient in both recovery outcomes.28 29

In conclusion, socioeconomic inequalities in the odds of recovery from poor physical and mental health, measured by multiple repeat data on the self-reported SF-36 instrument, were demonstrated over >20 years of follow-up. We adjusted for severity of ill-health at the start of each wave. The study sheds fresh light on the nature of health inequality, in showing that recovery from, as well as incidence of, poor health needs to receive detailed policy attention.

Acknowledgements The authors thank all of the participating civil service departments and their welfare, personnel and establishment officers; the British Occupational Health and Safety Agency; the British Council of Civil Service Unions; all participating civil servants in the Whitehall II study and all members of the Whitehall II study team. The Whitehall II Study team comprises research scientists, statisticians, study coordinators, nurses, data managers, administrative assistants and data entry staff, who make the study possible.

Contributors EJB and MJS designed the study, AT conducted the initial analysis and drafted the paper. CAW and MJS completed the analysis. NEG, MGM, MK and AS-M commented on the draft paper.

Funding The Whitehall II study is supported by grants from the UK Medical Research Council (MRC K013351), British Heart Foundation (BHF RG/16/11/32334) and the US National Institutes on Aging (RO1AG013196, RO1AG034454).

Competing interests EJB is supported by the BHF (RG/16/11/32334) and the European Commission (FP7 project no. 613598). MK is supported by the MRC (K013351) and Nordforsk, the Nordic Programme on Health and Welfare.

Patient consent Obtained.

Ethics approval The study was approved by the University College London Medical School Committee on the ethics of human research.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement Whitehall II data, protocols and other metadata are available to bona fide researchers for research purposes. Please refer to the Whitehall II data sharing policy at http://www.ucl.ac.uk/whitehall/data-sharing.

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