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Failed reciprocity in close social relationships and health: findings from the Whitehall II study

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Abstract

Objective—To extend the model of effort-reward imbalance at work to close and more general social relationships and test the associations with different measures of health. Lack of reciprocity at work is associated with poorer health in a number of studies. However, few studies have analysed the effect of non-reciprocity in other kinds of social relationships on health.

Methods—The Whitehall II Study is an ongoing prospective study of British civil servants (N=10,308 at baseline in 1985–88). Cross-sectional data from the latest phase (7, N=6,944 in 2002–04) were used in the analyses. The main exposure was a questionnaire measuring non-reciprocal social relations in partnership, parent-children and general trusting relationships. Health measures included the SF-36 mental and physical component Scores, GHQ-30 depression subscale, Jenkins' Sleep disturbance questionnaire and the Rose Angina questionnaire. Logistic and linear regression models were analysed, adjusted for potential confounders and mediators of the association.

Results—Lack of reciprocity is associated with all measures of poorer health. This association attenuates after adjustment for previous health and additional confounders and mediators, but remains significant in a majority of models. Negative social support from a close person is independently associated with reduced health, but adjusting for this effect does not eliminate the association of non-reciprocity with poor health.

Conclusion—The effort-reward imbalance at work model has been extended to close and more general social relationships. Lack of reciprocity in partnership, parent-children and general trusting relationships is associated with poorer health.

Keywords

Reciprocity; Social Relationships; Effort-Reward Imbalance; SF-36; Rose-Angina

Introduction

The health-adverse impact of severe disappointing life events that disrupt intimate social relationships is well documented (1–3). Yet the adverse health effects of less dramatic but chronically recurring disappointments and frustrations are debatable. This paper applies a theoretical model of non-reciprocal social exchange at work, effort-reward imbalance(4), to

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less formalized, more intimate role relationships between partners, parents and children, and adults involved in trusting relationships in civic life.

The effort-reward imbalance model is based on the norm of reciprocity in contractual social exchange. According to this norm any action or service provided by person A to person B that has some utility to B, is expected to be returned by person B to A where the exchange expectancy concerns some agreed-upon standard of equivalence(5). If this norm is violated because a service in return is denied or fails to meet an agreed-upon level of equivalence, the social relationship is threatened or, in case of its continuation, strong negative emotions of anger and frustration are elicited among those concerned, resulting in a sense of being treated unfairly and in an unjust way. When experienced recurrently, injustice of exchange in important social role relations may result in adverse effects on health due to chronic stress reactions. Although the approach based on role-related social reciprocity bears some resemblance with the notion of negative social support(6) it is more specific because non-equivalence of return following recurrent investment in a transaction with a close person is considered a crucial stress-eliciting condition. This latter assumption was confirmed in several investigations based on the model of effort-reward imbalance at work(7). This important social role relation concerns the employment contract which defines distinct obligations or tasks to be performed in exchange with equitable rewards. The model of effort-reward imbalance at work claims that failed reciprocity in terms of high 'costs' spent and low 'gains' received occurs frequently under specific conditions (such as dependency, where employees have no alternative choice in the labour market) and increases the risk of stress-related physical and mental disorders.

In several prospective and cross-sectional epidemiological investigations, significantly elevated relative risks of coronary heart disease, depression, type 2 diabetes, alcohol dependence, and symptoms of ill health were documented in adult working populations exposed to effort-reward imbalance compared to those who were free from this type of chronic stress at work (8–10). Moreover, in ambulatory studies monitoring cardiovascular and hormonal responses over a working day, exposure to, or inappropriate coping with, effort-reward imbalance was related to elevated heart rate activity, reduced heart rate variability and elevated cortisol secretion(11–13).

This model has been extended to include other types of cooperative social relationships, whether characterized by a formal contract or by an informal mutual agreement on shared obligations, such as the marital and parental relationships or trusting relationships in civic life (14). In this approach, negative aspects of close social relationships are analysed as an imbalance experienced between high efforts spent and low (or no) rewards received in turn. Despite the fact that the constraints of demands are often less obvious than in paid employment and that reward transmitters are more often of an emotional than of an economic nature there are sufficient communalities between these different types of social exchange. First, they concern crucial social roles in adult life, in particular the marital and parental or maternal roles, the work role, or civic roles within a community. Social roles are defined by mutual obligations and expectations of behaviour addressed to persons who hold a specific position within a societal structure. As role behaviour is instrumental in meeting important needs of people's everyday life a violation of role-related norms of reciprocity is likely to elicit strong negative emotions and associated stress reactions. Moreover, social roles such as marital and parental or maternal roles are embedded in the adult life course and may cause recurrent positive or negative experience of social exchange, comparable to the experience of continued exposure to a favourable or unfavourable psychosocial work environment. Similarly, failed reciprocity may be experienced as a chronic condition of unfair treatment or as a critical life event that harms feelings of trust and belonging. Two earlier reports found evidence of an association of failed reciprocity in close social relationships with depressive symptoms and poor self-rated

health, but they were restricted to either small samples or older age groups and did not take into account negative affect or prior health status as important confounders(14;15).

We set out to analyse this association in a large study population, the participants of the Whitehall II study of British male and female civil servants. Moreover, to test the robustness of the association, we include five different indicators of health. Within the limitations of a cross-sectional analysis, we test the hypothesis that the experience of failed reciprocity in one of the three types of close social relationships (marital or partnership, parents and children, trusting relationships in civic life) is associated with reduced health. This association is expected to persist after adjustment for important confounders and mediators, in particular negative social support(16–18), and additionally age, gender, employment grade, prior health status, health-related behaviours and social networks. Investigating the potential confounding role of negative social support is of primary importance as non-reciprocal close relations and negative social support may measure distinct but overlapping concepts that may affect health independently of each other. So far, there is limited evidence available for each one of these associations(19–25). Yet, to our knowledge, no previous investigation has explored their separate effects in a single data set.

Methods

Data

The Whitehall II study is an ongoing longitudinal study of 10,308 male and female civil servants (initially aged 35 to 55) based in London, originally set up in 1985(26). Repeated data collection was carried out in 1989 (phase 2), 1991–1993 (phase 3) 1995 (phase 4), 1997–1999 (phase 5), 2001 (phase 6) and 2002–04 (phase 7). In this paper, cross sectional data from the seventh phase (N=6914) were analysed, for the most part, as that was when the main exposure (non-reciprocal social relations) was measured.

Measures

Main health indicators (phases 5 and 7 of the study)—Two measures of self-reported physical and mental functioning are measured, based on the UK standard version of the Short Form 36 Health Survey (SF-36)(27). This is a 36 item questionnaire covering issues relating to physical, psychological and social functioning. Detailed information on the use of the SF-36 in the Whitehall study has been reported elsewhere(28). The original eight scales of this questionnaire can be summarized into physical and mental functioning components by a method based on factor analysis(29). Each score ranges from 0 to 100, with low scores implying low functioning. A mean of 50 is observed in the general US population. We defined scores in the lowest quartile of the Physical Component Score (PCS) and of the Mental Component Score (MCS) to represent reduced health in terms of poor physical and mental functioning.

As a third indicator of reduced health we assessed sleep problems, applying the scale described by Jenkins et al.(30) This scale consists of 4 items, asking respondents how often in the past month they had woken up several times in the night, had trouble staying asleep, or woke up too early in the morning. There were 6 response options, ranging from 0 (not at all) to 5 (22–31 days). The total amount of sleep problems was computed with scores ranging from 0 (no problems) to 20 (severe problems). The Cronbach's alpha in this sample was 0.77. Being in the highest quartile of the sleep problems scale represents the group with the greatest sleep problems.

A four item depression subscale scored 0–12 (Cronbach's alpha=0.88) was identified from the 30 item General Health Questionnaire on the basis of factor analysis and comparison with the items of the depression subscale of the 28 item General Health Questionnaire(6). The

depression subscale was dichotomised so that the highest scoring quartile (scores >3) represented the highest level of depressive symptoms which was contrasted to the remaining group. As a fifth indicator of health we included the seven item Rose angina questionnaire (31). This widely used measure defines angina pectoris as pain located over the sternum or in both the left chest and left arm that is precipitated by exertion, causes the person to stop, and goes away in 10 minutes or less.

Main exposure (phase 7)—Non-reciprocal social relations were measured using an 9 item questionnaire from which three scales were extracted by factor analysis: a scale containing items relating to marital (or partnership) life (3 items); a scale measuring critical parent-children exchange (4 items); and a scale measuring failed reciprocity in unspecified trusting relationships (2 items) (14) (see Table 1 and Appendix). All items are answered in two steps. Firstly, subjects agree or disagree on whether or not the item content describes a typical experience of their social relationships. Subsequently, respondents who agree are asked to evaluate to what extent, they usually feel distressed (“bothered”) by this experience. Ratings are given on a four-point Likert-scale ranging from not at all to very much. Both answers are combined by creating a scale ranging from 0 (disagree) to 4 (agree, very much distressed). For each factor, means and standard deviation are calculated, and tertiles of the scores are defined (the lower two tertiles of the scale for children were combined as there were too few participants in the lowest tertile). The validity and reliability of these three factors have been repeatedly established(14;15).

Other covariates (phase 7)—Health behaviours such as smoking, physical activity (measured in METS scores), excessive alcohol intake (greater than 28 units/week for men, 21 units/week for women) and fruit/vegetable consumption were measured from the phase 7 questionnaire. Negative social support and social networks were also measured from the phase 7 questionnaire using four items included in the Close Person’s Questionnaire (32) for the former and questions on frequency of contact with relative and friends(32) drawn from Berkman and Syme (33) for the latter.

Analysis

We first analysed the factorial structure of the non-reciprocity items and whether separate scales for each type of close relationship could be constructed (Table 1). After exploration of bivariate associations of all health measures and main socio-demographic variables with non-reciprocity scores (Table 2) the main hypothesis is tested using linear and logistic regression models (Table 3). The baseline model adjusts for age and sex. Further nested models were analysed to examine the effect of confounders and mediators such as negative social support (model 2), previous health status (assessed at phase 5), employment grade, health-related behaviours and social networks (model 3). Previous health status was specific to the health outcome analysed, so for example the analysis of phase 7 sleep problems was adjusted for sleep problems at phase 5. Health related behaviours included smoking, alcohol consumption, physical activity and fruit/vegetable consumption.

Results

In Table 1, the factorial structure of items measuring nonreciprocal social exchange outside work is displayed. The factor loadings suggest three factors may be distinguished, corresponding to the expected domains of non-reciprocity in partnership, children and general trust. The amount of variance explained and the Cronbach’s α values are satisfactory. In addition, further analysis was carried out to test if these factors were distinct from each other and the measure of negative social support. Factor analysis using oblique rotation allowing for correlated factors revealed moderate to weak correlations (<0.45) between the factors. There

was a moderate correlation (0.43) between negative social support and non-reciprocal partnership relationships, however factor analysis of the items comprising these scales revealed distinct and non-overlapping factors.

Table 2 represents the mean of the non-reciprocal relationships (for partners, children and general trust) by the health measures and key covariates. Almost all differences are statistically significant with higher means of non-reciprocity among those with reduced health. In addition, means are higher in younger compared to older participants, in women compared to men, and in divorced/widowed/separated versus married participants. A social gradient was found for general trust, but not for relationships with partners or children.

Table 3 represents the results of the linear and logistic regression analyses testing the main hypothesis with respect to four continuous measures of health, (1) sleep problems, (2) GHQ-depression, (3) SF-36 Physical (PCS) and (4) SF-36 Mental (MCS) functioning, and the binary health measure of (5) Rose angina. Model 1 adjusts for age, and gender Model 2 is nested within Model 1 and further adjusts for negative social support. Model 3 is nested within Model 2 and further adjusts for previous health status, employment grade, health behaviours (smoking, alcohol, physical activity and diet) and social networks. Insert Table 3 about here

The results in all the analyses in Model 1 column of Table 3 show a consistent pattern of association of poor health in the group scoring highest on measures of failed reciprocity compared to the lowest scoring group. Higher levels of non-reciprocity were associated with higher levels of sleep problems, GHQ-30 depression and lower levels of SF_36 physical and mental health. Health differences are particularly pronounced in case of depression and poor mental functioning. Elevated odds of Rose-angina are also observed with increasing non-reciprocity. Some reductions in the size of these coefficients are observed when negative social support is taken into account (Model 2), although nearly all the associations remain statistically significant. There is a further reduction in these associations when previous health, employment grade, health behaviours and social networks are taken into account (Model 3). The confidence intervals in 10 out of 15 model estimates for the highest level of non-reciprocity indicate statistically significant associations.

In addition to the results displayed in Table 3, we examined 2-way interaction effects between non-reciprocity and gender, age, marital status and occupational grade, but found little evidence of effect modification of non-reciprocity by gender, age, marital status and occupational grade.

Discussion

This study found consistent associations of reports on failed reciprocity in social relationships with five measures of reduced health in the Whitehall II study population. Effects remained significant after adjusting for negative social support, an important condition associated with poorer health(32). Findings support the significance for health of a theoretical model, the effort-reward imbalance model, that focuses on experienced violation of the norm of reciprocity in core social roles in adult life beyond the work role, namely in marital and parental roles and civic roles(4;34). The findings of this study are in line with those from two previous investigations(14;15)., but are more robust as they are based on a large sample, include five different health measures and are adjusted for the effects of important confounders and mediators.

Failed reciprocity may be linked with poor health through unhealthy behaviours (addictive behaviours may increase in non-reciprocal relationships), although there was little evidence for this from this study. Failed reciprocity may also affect health by eliciting strong negative emotions and stress reactions, which may be either chronic (experience of continued unjust treatment) or acute (experience of a critical life event of deceived trust), but in all cases it is

the mismatch between efforts spent and rewards received in turn that matters most. Adjusting for negative social support from a close person reduced the associations between the different health outcomes and non-reciprocity, although both remained independently associated with health. Non-reciprocal partnerships were moderately correlated with negative social support from a close person which suggests that some of the association between non-reciprocity and health may be mediated through negative social support(35). Although mean scores of failed reciprocity from partner and general trust were higher in women than in men we did not observe gender-specific differences in the strength of association with health. Previous reports found gender differences with regard to health effects of providing and receiving support (23–25). For instance, in a Finnish prospective study giving more support than receiving was beneficial for health among women, whereas in men, the reversed effect was found(23). However, in this study, providing and receiving support was not weighted against efforts spent, as in the current approach, and the two remaining types of social relationships, parental and civic roles, were not included.

Despite these merits several limitations must be considered. First, given the cross-sectional design reverse causation cannot be excluded, especially so in case of depression and poor mental functioning. Depressed people may perceive their close social relationships in a more negative way, they may be more vulnerable even to minor experiences of unfair treatment, or their behaviour may evoke non-reciprocal responses in their partners. This interpretation is less likely in case of angina pectoris where similar associations with reduced health were observed. The analyses were adjusted for previous health status, reducing the likelihood of reverse causation. As all the health measures and all exposure measures are based on self-reported data the problem of common method variance needs to be addressed(36). Unfortunately, negative affect was not measured concurrently with the variables analysed, although adjusting for negative affect measured around fifteen years earlier did not change the results. It should also be noted that in previous studies on associations of effort-reward imbalance with self-reported health effects in general remained significant after adjusting for negative affect(37),(38).

A further limitation concerns the measurement of experienced failed reciprocity which is exclusively based on participants' self assessment. We were not able to validate information by triangulating data with those received from partners. Obviously, more detailed observational or experimental studies of microsocial exchange(19;20) are needed to supplement epidemiological findings. Moreover, for reasons explained above, a quantitative estimate of a mismatch between effort spent and reward received, as applied to the measurement of effort-reward imbalance at work(7), was not feasible in the frame of assessing non-reciprocity in close social relationships. Given the constraints of economic measures in large-scale epidemiological investigations, the few items of this questionnaire cannot adequately represent the rich dynamics of imbalanced interpersonal exchange. Important additional aspects of non-reciprocity (e.g., unpaid domestic work, unequal role distribution) including exposure time have not been assessed. On the other hand, our measure comprises condensed information on quality of exchange in three important domains of close social relationships, and these domains are replicated as independent scales at the measurement level(14;15).

Although we included five different measures of health that were only moderately interrelated, no clinically validated health data were included in this analysis. Further investigations are needed to link failed social reciprocity prospectively with incident disease, as was done previously in case of effort-reward-imbalance at work (reviews (8),(9),(10). A final limitation is related to the sample under study. Despite the fact that several previous findings from the Whitehall II study were replicated in other cohort studies(18;39) we cannot exclude the possibility that the results reflect experiences that are typical for male and female civil servants or for a middle-aged to early old age population in North Western Europe. However, similar

results were reported from different age groups in two other countries, the United States and Germany, thus reducing the probability of this limitation(14;15).

In conclusion, we found a consistent association of failed reciprocity in three domains of close social relationships with reduced health in a large cohort of middle-aged to early old age men and women, the Whitehall II cohort. Findings support the core notion of a theoretical model, the effort-reward imbalance model, which has mainly been analyzed in the frame of work and health. If corroborated by additional evidence, this approach may have direct implications for counseling activities in the prevention and treatment of disorders with a more proximal stress-related background.

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Appendix

Items from the Non-Reciprocal Social Relations Questionnaire

The following questions are related to your personal life situation, your children, your spouse or partner and other people you deal with. Please, give a response that fits best with your typical experiences.

- i. Have you ever had to put the relationship with your partner ahead of your own needs in order to maintain a good relationship?
- ii. Has the relationship with your partner always been characterised by mutual understanding?
- iii. Have you always been satisfied with the balance between what you have given your partner and what you have received in return?
- iv. Compared to your expectations, do you think that you are generally well respected by your children?
- v. Have you always received sufficient support from your children in difficult situations?
- vi. Has/Have your child/children been educated up to the level you had hoped for?
- vii. Do you feel that you have always received adequate appreciation for providing help in your family (such as taking care of your grand-children)?
- viii. Has any person you gave your trust seriously disappointed or hurt you?
- ix. Has anyone ever committed an injustice against you or betrayed you without you being compensated for it?

Yes	No	Not Applicable
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If Yes/No: How much does this bother you?

Not At All	A Little	Somewhat	Greatly
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Items of Negative Social Support from the Close Person's Questionnaire

Thinking about the person you are closest to, please tell us how you would rate the practical and emotional support they have provided for you IN THE LAST 12 MONTHS.

	Not at all	A little	Quite a lot	A great deal
e) How much in the last 12 months did this person give you worries, problems and stress ?				
i) How much in the last 12 months would you have liked to have confided more in this person?				
j) How much in the last 12 months did talking to this person make things worse?				
n) How much in the last 12 months would you have liked more practical help with major things from this person?				

Table 1

Factor Analysis of items on Lack of Reciprocity from Partners, Children and General Trust: Whitehall II, Phase 7

	Factor 1 Partner	Factor 2 Children	Factor 3 General Trust
Good relationship with partner ahead of own needs	-0.72	0.04	0.06
Mutual understanding in relationship to partner	-0.85	-0.01	0.02
Balance of give and take in relationship to partner	-0.86	0.00	0.00
Well respected by children	0.00	0.67	0.03
Sufficient support from children	-0.11	0.85	-0.05
Children educated up to the level you hoped for	0.18	0.63	0.07
Appreciation for providing help in family	-0.18	0.77	-0.05
Disappointment	-0.14	0.05	0.76
Injustice	0.06	-0.03	0.90
<i>Eigenvalue</i>	<i>3.12</i>	<i>1.54</i>	<i>1.08</i>
<i>Explained variance</i>	<i>34.70</i>	<i>17.09</i>	<i>12.03</i>
<i>Cronbach's alpha</i>	<i>0.78</i>	<i>0.69</i>	<i>0.62</i>

Table 2

Unadjusted Mean (N) of Lack of Reciprocity from Partners, Children and General Trust by health and sociodemographic variables: Whitehall II, Phase 7

	Partner	Child	Trust
<i>Sleep Problems</i>			
Lowest quartile (fewest problems)	0.58 (1284)	0.15 (1054)	0.70 (1489)
Quartile 2	0.72 (1391)	0.22 (1143)	0.81(1581)
Quartile 3	0.85 (1458)	0.25 (1203)	0.93 (1659)
Highest Quartile (highest problems)	1.12 (1307)	0.39 (1071)	1.23 (1564)
<i>p for trend</i>	0.00	0.00	0.00
<i>GHQ-Depression</i>			
No	0.76 (4815)	0.22 (3960)	0.85 (5554)
Case	1.28 (620)	0.52 (507)	1.45 (732)
<i>p for trend</i>	0.00	0.00	0.00
<i>SF_36 PCS</i>			
Lowest quartile (worst health)	0.94 (1233)	0.32 (1081)	1.12 (1526)
Quartile 2	0.81 (1358)	0.26 (1106)	0.92 (1537)
Quartile 3	0.73 (1378)	0.21 (1137)	0.78 (1560)
Highest Quartile (best health)	0.81 (1354)	0.23 (1053)	0.83 (1533)
<i>p for trend</i>	0.00	0.00	0.00
<i>SF_36 MCS</i>			
Lowest quartile (worst health)	1.30 (1238)	0.47 (1016)	1.40 (1511)
Quartile 2	0.85 (1337)	0.25 (1056)	0.88 (1539)
Quartile 3	0.62 (1377)	0.19 (1128)	0.74 (1553)
Highest Quartile (best health)	0.55 (1371)	0.13 (1177)	0.65 (1553)
<i>p for trend</i>	0.00	0.00	0.00
<i>Rose Angina</i>			
No	0.81 (5241)	0.25 (4294)	0.90 (6051)
Yes	1.11 (197)	0.41 (177)	1.19 (238)
<i>p for trend</i>	0.00	0.00	0.00
<i>Agegroup</i>			
50–55	0.95 (1018)	0.34 (710)	0.99 (1154)
55–60	0.87 (1664)	0.27 (1278)	0.99 (1893)
60–65	0.82 (1172)	0.27 (996)	0.92 (1355)
65–74	0.69 (1603)	0.19 (1504)	0.79 (1913)
<i>p for trend</i>	0.00	0.00	0.00
<i>Employment Grade</i>			
High	0.82 (2738)	0.24 (2238)	0.85 (2966)
Intermediate	0.83 (2258)	0.28 (1767)	0.97 (2689)
Low	0.75 (435)	0.23 (459)	1.00 (629)
<i>p for trend</i>	0.24	0.04	0.00
<i>Sex</i>			
Men	0.77 (4160)	0.25 (3471)	0.84 (4543)
Women	0.97 (1297)	0.27 (1017)	1.11 (1772)
<i>p for trend</i>	0.00	0.26	0.00
<i>Marital Status</i>			
Married/Cohabit/Civil Partnership	0.79 (5014)	0.24 (3916)	0.81 (4942)
Widowed	1.05 (133)	0.77 (24)	1.12 (633)
Divorced	1.47 (191)	0.42 (312)	1.76 (453)
Separated	0.84 (109)	0.25 (227)	0.91 (274)
<i>p for trend</i>	0.00	0.00	0.00

Table 3

Linear and Logistic Regression coefficients (95% CI) of poor health by Lack of Reciprocity and Negative Social Support- continues on next page

Sleep Problems	Model 1	Model 2	Model 3	N
<i>Lack of Reciprocity: Partner</i> ¹				4813
Intermediate ³	0.09 (0.02, 0.17)	0.04 (-0.04, 0.11)	0.03 (-0.04, 0.09)	1976
High ³	0.44 (0.35, 0.52)	0.30 (0.21, 0.38)	0.12 (0.05, 0.19)	1551
<i>Negative social support</i> ¹				4813
Intermediate ³		0.22 (0.14, 0.30)	0.13 (0.06, 0.20)	981
High ³		0.33 (0.26, 0.41)	0.19 (0.13, 0.25)	1766
<i>Lack of Reciprocity: Children</i> ²				3933
High ³	0.27 (0.19, 0.35)	0.22 (0.14, 0.29)	0.08 (0.01, 0.14)	1017
<i>Negative social support</i> ¹				3933
Intermediate ³		0.19 (0.10, 0.28)	0.11 (0.03, 0.18)	772
High ³		0.35 (0.27, 0.42)	0.17 (0.11, 0.23)	1400
<i>Lack of Reciprocity: Trust</i> ¹				5525
Intermediate ³	0.07 (-0.01, 0.16)	0.05 (-0.04, 0.13)	0.02 (-0.04, 0.09)	825
High ³	0.37 (0.30, 0.43)	0.31 (0.24, 0.38)	0.13 (0.08, 0.19)	1640
<i>Negative social support</i> ¹				5525
Intermediate ³		0.24 (0.16, 0.32)	0.14 (0.07, 0.20)	1109
High ³		0.39 (0.32, 0.45)	0.22 (0.16, 0.27)	1955
General Health Questionnaire-30 Depression				
<i>Lack of Reciprocity: Partner</i> ¹				4750
Intermediate ³	0.06 (-0.06, 0.18)	-0.06 (-0.18, 0.06)	-0.02 (-0.12, 0.09)	1953
High ³	0.67 (0.54, 0.80)	0.34 (0.21, 0.47)	0.16 (0.04, 0.28)	1529
<i>Negative social support</i> ¹				4750
Intermediate ³		0.24 (0.11, 0.37)	0.12 (0.01, 0.23)	973
High ³		0.79 (0.67, 0.90)	0.46 (0.36, 0.56)	1738
<i>Lack of Reciprocity: Children</i> ²				3877
High ³	0.63 (0.50, 0.75)	0.50 (0.37, 0.62)	0.27 (0.17, 0.38)	999
<i>Negative social support</i> ¹				3877
Intermediate ³		0.26 (0.12, 0.40)	0.11 (-0.01, 0.23)	764
High ³		0.82 (0.71, 0.94)	0.48 (0.37, 0.58)	1378
<i>Lack of Reciprocity: Trust</i> ¹				5453
Intermediate ³	0.05 (-0.08, 0.18)	0.00 (-0.13, 0.13)	-0.01 (-0.13, 0.10)	816
High ³	0.62 (0.52, 0.73)	0.50 (0.40, 0.61)	0.25 (0.16, 0.34)	1610
<i>Negative social support</i> ¹				5453
Intermediate ³		0.29 (0.17, 0.41)	0.16 (0.06, 0.26)	1098
High ³		0.84 (0.74, 0.94)	0.49 (0.40, 0.58)	1924
SF-36 Physical Component Score				
<i>Lack of Reciprocity: Partner</i> ¹				4633
Intermediate ³	-0.38 (-0.97, 0.22)	-0.15 (-0.75, 0.45)	-0.16 (-0.66, 0.34)	1926
High ³	-1.24 (-1.87, -0.61)	-0.63 (-1.30, 0.04)	-0.23 (-0.79, 0.33)	1484
<i>Negative social support</i> ¹				4633
Intermediate ³		-0.51 (-1.15, 0.14)	-0.09 (-0.63, 0.45)	936
High ³		-1.45 (-2.03, -0.87)	-0.50 (-0.98, -0.02)	1695
<i>Lack of Reciprocity: Children</i> ²				3783
High ³	-1.02 (-1.64, -0.41)	-0.79 (-1.41, -0.16)	-0.36 (-0.88, 0.16)	978
<i>Negative social support</i> ¹				3783
Intermediate ³		-0.77 (-1.49, -0.04)	-0.27 (-0.87, 0.34)	731
High ³		-1.46 (-2.07, -0.84)	-0.45 (-0.96, 0.05)	1340
<i>Lack of Reciprocity: Trust</i> ¹				5314
Intermediate ³	-0.74 (-1.41, -0.07)	-0.65 (-1.32, 0.02)	-0.07 (-0.62, 0.47)	793
High ³	-1.42 (-1.94, -0.90)	-1.19 (-1.72, -0.66)	-0.57 (-1.00, -0.14)	1565
<i>Negative social support</i> ¹				5314
Intermediate ³		-0.77 (-1.39, -0.16)	-0.23 (-0.73, 0.27)	1059
High ³		-1.54 (-2.06, -1.02)	-0.57 (-0.99, -0.14)	1873
SF-36 Mental Component Score				
<i>Lack of Reciprocity: Partner</i> ¹				4633
Intermediate ³	-0.87 (-1.46, -0.28)	-0.25 (-0.83, 0.33)	-0.43 (-0.95, 0.10)	1926
High ³	-4.83 (-5.45, -4.20)	-3.15 (-3.80, -2.49)	-1.84 (-2.43, -1.25)	1484
<i>Negative social support</i> ¹				4633
Intermediate ³		-1.60 (-2.23, -0.97)	-1.04 (-1.60, -0.48)	936
High ³		-3.97 (-4.53, -3.41)	-2.54 (-3.05, -2.04)	1695
<i>Lack of Reciprocity: Children</i> ²				3783
High ³	-3.31 (-3.92, -2.71)	-2.54 (-3.14, -1.95)	-1.23 (-1.76, -0.70)	978

Sleep Problems	Model 1	Model 2	Model 3	N
<i>Negative social support</i> ¹				3783
Intermediate ³		-1.89 (-2.59, -1.20)	-1.15 (-1.76, -0.54)	731
High ³		-4.67 (-5.26, -4.09)	-2.93 (-3.45, -2.41)	1340
<i>Lack of Reciprocity: Trust</i> ¹				5314
Intermediate ³	-0.36 (-1.02, 0.30)	-0.10 (-0.74, 0.55)	0.17 (-0.40, 0.73)	793
High ³	-3.95 (-4.46, -3.43)	-3.25 (-3.76, -2.75)	-1.70 (-2.16, -1.24)	1565
<i>Negative social support</i> ¹				5314
Intermediate ³		-1.90 (-2.49, -1.30)	-1.29 (-1.82, -0.77)	1059
High ³		-4.63 (-5.13, -4.13)	-3.01 (-3.46, -2.56)	1873
Rose Angina				
<i>Lack of Reciprocity: Partner</i> ¹				5227
Intermediate ⁴	1.37 (0.91, 2.05)	1.25 (0.83, 1.89)	1.34 (0.87, 2.06)	2142
High ⁴	1.99 (1.33, 2.96)	1.56 (1.02, 2.39)	1.51 (0.96, 2.36)	1695
<i>Negative social support</i> ¹				5227
Intermediate ⁴		1.01 (0.65, 1.59)	0.91 (0.57, 1.46)	1056
High ⁴		1.75 (1.23, 2.49)	1.47 (1.01, 2.13)	1938
<i>Lack of Reciprocity: Children</i> ²				4277
High ⁴	1.46 (1.04, 2.04)	1.32 (0.94, 1.86)	1.19 (0.83, 1.70)	1120
<i>Negative social support</i> ¹				4277
Intermediate ⁴		1.35 (0.86, 2.10)	1.12 (0.70, 1.79)	836
High ⁴		1.84 (1.29, 2.63)	1.54 (1.06, 2.25)	1539
<i>Lack of Reciprocity: Trust</i> ¹				6002
Intermediate ⁴	1.09 (0.73, 1.62)	1.04 (0.70, 1.56)	1.06 (0.70, 1.62)	897
High ⁴	1.53 (1.15, 2.06)	1.39 (1.03, 1.87)	1.15 (0.84, 1.57)	1801
<i>Negative social support</i> ¹				6002
Intermediate ⁴		1.18 (0.79, 1.75)	1.01 (0.67, 1.52)	1197
High ⁴		1.89 (1.40, 2.56)	1.60 (1.16, 2.21)	2142

¹ Reference category is the lowest tertile

² Reference category is the lowest and middle tertile

³ Linear Regression beta coefficients

⁴ Logistic Regression odds ratio coefficients

Model 1- adjusted for age and sex

Model 2- adjusted for Model 1, age, sex and negative social support

Model 3- adjusted for Model 2, prior health status, grade, health behaviours, social networks