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Trust and health: testing the reverse causality hypothesis

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ABSTRACT

Background Social capital research has consistently shown positive associations between generalised trust and health outcomes over 2 decades. Longitudinal studies attempting to test causal relationships further support the theory that trust is an independent predictor of health. However, as the reverse causality hypothesis has yet to be empirically tested, a knowledge gap remains. The aim of this study, therefore, was to investigate if health status predicts trust.

Methods Data employed in this study came from 4 waves of the British Household Panel Survey between years 2000 and 2007 (N=8114). The sample was stratified by baseline trust to investigate temporal relationships between prior self-rated health (SRH) and *changes* in trust. We used logistic regression models with random effects, as trust was expected to be more similar within the same individuals over time.

Results From the 'Can trust at baseline' cohort, poor SRH at time (t−1) predicted low trust at time (t) (OR=1.38). Likewise, good health predicted high trust within the 'Cannot' trust cohort (OR=1.30). These patterns of positive association remained after robustness checks, which adjusted for misclassification of outcome (trust) status and the existence of other temporal pathways.

Conclusions This study offers empirical evidence to support the circular nature of trust/health relationship. The stability of association between prior health status and changes in trust over time differed between cohorts, hinting at the existence of complex pathways rather than a simple positive feedback loop.

INTRODUCTION

One hundred years after Durkheim[1] suggested links between individual health and social cohesion, social capital (considered a subset of social cohesion[2]) entered the field of public health.[3 4] Numerous studies have since reported positive associations between this phenomenon and health outcomes.[5 6]

Defined as 'social networks and norms of reciprocity',[7] social capital has been conceptualised at the collective level and individual level,[2 8–11] being measured by proxies such as *generalised trust* and *social participation*.[12] Interestingly, multilevel studies show that the greatest effects of social capital on health are at the individual level,[5 6 13–17] that is, only 0–4% of total variation in individual health may be attributable to collective social capital.[18–21] Of the individual-level social capital proxies, *generalised trust* has provided the most consistent association with health outcomes[22] and is, therefore, the outcome of interest in this temporality study of individual-level social capital and health. Hypotheses as to how individual-level social capital may influence health include psychological/psychosocial mechanisms and norms regarding health-related behaviours (eg, smoking).[3]

Numerous cross-sectional studies have reported positive associations between social capital (trust) and health outcomes.[5] Possible hypotheses behind reported associations include:

I. Trust independently predicts health (by the mechanisms proposed previously[3]);
II. Associations are non-causal, that is, past associations are confounded by unmeasured factors;[23 24]
III. Health status affects trust (reverse causality), for example, uncertainty/vulnerability associated with poor health lowers trust;[25]
IV. A reciprocal/circular relationship exists.[26]

However, scarcity of suitable (longitudinal) social capital data means that such hypotheses remain largely empirically untested.[6]

Regarding hypothesis (I), a PUBMED search identified six longitudinal studies incorporating three or more time-points required to correctly test temporal (causal) relationships,[27] while investigating trust and health.[26 28–32] All six reported that generalised trust positively influenced health.

Regarding the 'non-causal' hypothesis (II), Fujiwara and Kawachi[23] adjusted for shared genetic/environmental factors, utilising twin-pair data to confirm associations between generalised trust, participation and health. Likewise, a longitudinal, multilevel study by Giordano *et al*[24] concluded that associations between generalised trust and health remained after adjusting for shared environmental factors (the household).

Regarding (III), no studies were identified explicitly investigating reverse causality. This is in stark contrast to the field of crime and social capital research, where mutual pathways have been extensively researched.[33]

Regarding (IV), one paper demonstrated the potential for a 'mutually reinforcing' feedback loop between health and trust.[26] However, the study also reported that individuals with *poor* health predicted *increased* trust levels (ie, *negative* association), with no further discussion of this apparent paradox.[26]

An important knowledge gap, therefore, remains. Current evidence suggests that trust independently influences health and, as such, decision-makers have applied this knowledge at policy level to positively improve population health.[34] However, without rigorous testing of the reverse causality hypothesis, the direction of the trust/health relationship remains an assumption. The aim of this longitudinal individual-level study, therefore, is to investigate how later levels of trust are affected by prior health status.

METHODS

Data collection

The British Household Panel Survey (BHPS) is a longitudinal survey of randomly selected private households, conducted by the UK's Economic and Social Research Centre. Since 1991, individuals within selected households have been annually interviewed with a view to identifying social and economic changes within the British population. Full details of the selection process, weighting and participation rates, can be found online.[35]

The raw data used for this panel study came from the BHPS individual-level responses in years 2000, 2003, 2005 and 2007. The same individuals (N=8114) were followed across this 7-year time frame; participation rate for year 2000 (as compared with year 1999) was 93.6%, and, compared with the original 1991 cohort, was 62.0%.

The research centre fully adopted the Ethical Guidelines of the Social Research Association; informed consent was obtained from all participants and strict confidentiality protocols were adhered to throughout data collection and processing procedures.

Dependent variable

Generalised trust was assessed by asking people: 'Would you say that most people can be trusted, or that you can't be too careful?'. Possible answers were 'Most people can be trusted', 'You can't be too careful' and 'It depends'. This variable was dichotomised (as standard), with only those respondents stating that most people could be trusted being labelled 'Can trust'; all negative responses (including 'it depends') were labelled 'Can't trust'.[36]

Explanatory variables

Self-rated health

Self-rated health (SRH) is considered a valid predictor of morbidity and future mortality.[37 38] The same individuals were asked: 'Compared to people your own age, would you say that your health has on the whole been: excellent, good, fair, poor or very poor?'. As is standard, this five-point scale was recoded into the dichotomous variable 'good' (excellent, good) and 'poor' (fair, poor, very poor) health.[39]

Social participation/social support

Social isolation and lack of social support have been associated with lower trust;[40] therefore, marital status, cohabiting and social participation were considered as potential confounders. Social participation was measured by asking respondents questions about being *active* members of listed voluntary community groups or any sports, hobby or leisure group activity found locally (see online supplementary appendix). Only those who answered positively to any of these were judged to participate, with all others being labelled 'No participation'.

Respondents were asked if they were 'married, separated, divorced, widowed or never married'. These five options were recoded into the dichotomous variable 'married' and 'not married' (separated, divorced, widowed or never married[41]). A further variable 'Lives alone' ('yes' or 'no') was used to capture individuals who cohabited.

Socioeconomic status variables

As low trust has been associated with individual-level disadvantage,[42] socioeconomic resources were included in these analyses. Social class was determined by respondents' most recent occupation, derived from the Registrar General's Social Classification of occupations. The usual six categories (see online supplementary appendix) were dichotomised into 'higher' (1–3a) and 'lower' (3b–6) social class.

Highest achieved education level was categorised as 'Undergraduate or higher', 'Year 13' and 'Year 11' or 'No formal qualifications'.

Household income was weighted according to size by summing the income of all household members and dividing this sum by the square root of the household size.[43] This item was maintained as a continuous variable (per £1000 increase) and was an expression of total income, net of taxation.

Confounders

Age, gender, smoking status and time were considered confounders in this study, age being stratified into quintiles (tables 1–4). Smoking status was categorised as 'smoker' and 'non-smoker' according to respondents' answer to the question 'Do you smoke cigarettes?'.

All explanatory variables (except gender) were lagged at time (t−1) in reference to trust at time (t).

Statistical analyses

All data were stratified by baseline (year 2000) trust to create two distinct cohorts: 'Can trust' and 'Cannot trust' at baseline. After initial disaggregation, the two 'trust' cohorts were modelled as separate entities. Models 1a-3a dealt solely with individuals from the 'Can trust at baseline' cohort (0), who now no longer trusted (1) (N=3125); models 1b-3b dealt with individuals from the 'Cannot trust at baseline' cohort (0), who now could trust (1) (N=4989); the outcome of interest in both sets of models was *change* from baseline trust status over time. When 'trust 2003' was the outcome, only explanatory variables from year 2000 were considered; when 'trust 2005' was the outcome, explanatory variables from 2003 were considered; and when 'trust 2007' was the outcome, explanatory variables from 2005 were considered.

To assess robustness, we performed two sensitivity tests. The first specified that individuals had to have two registrations of the *same trust level* in 2000 and 2003 before being included in their respective trust cohort, to reduce any misclassification bias of reported trust.

The second tested for other temporal pathways by running *all* explanatory variables from time (t) alongside their respective *lagged* (t−1) counterparts, the outcome being trust at time (t). If association between SRH at time (t−1) and trust at (t) held if the model also contained SRH at time (t), this would confirm the robustness of the main results.

For all analyses, we used logistic regression models with random effects, as trust was expected to be more similar *within* the same individual over time than *between* different individuals. The model allowed a random intercept for each individual and we obtained SEs that were adjusted for the temporal correlation of trust *within* the same individual across the timeframe of our study. The equations for logistic regression models with random effects are as follows:

$$\mathrm{Log}(Y_{ij}) = \beta_{0j} + \beta \mathbf{X}_{i-1j}$$

$$\beta_{0j} = \beta_0 + \mu_{0j}$$

Where i=time, j=individual, μ_{0j}=the random intercepts (assumed to be independently normally distributed with a common variance), X_{i-1j} is a vector of lagged explanatory

Table 1 Baseline (year 2000) frequencies of all considered variables expressed as integers and percentages (%) of N_T (8114) stratified by trust

	Generalised trust at baseline		
	Can trust	Cannot trust	Total (N_T)
Age			
16–34	713	1704	2417
	22.8%	34.2%	29.8%
35–44	744	993	1737
	23.8%	19.9%	21.4%
45–54	650	882	1532
	20.8%	17.7%	18.9%
55–64	515	567	1172
	16.5%	13.2%	14.4%
65+	503	753	1256
	16.1%	15.1%	15.5%
Total	3125	4989	8114
	100.0%	100.0%	100.0%
Gender			
Male	1456	2147	3603
	46.6%	43.0%	44.4%
Female	1669	2842	4511
	53.4%	57.0%	55.6%
Total	3125	4989	8114
	100.0%	100.0%	100.0%
Self-rated health			
Good health	2396	3293	5689
	76.7%	66.0%	70.1%
Poor health	729	1696	2425
	23.3%	34.0%	29.9%
Total	3125	4989	8114
	100.0%	100.0%	100.0%
Social Participation: local groups, organisations or group leisure activities			
Active participation	1544	1767	3311
	49.4%	35.4%	40.8%
Zero participation	1581	3222	4803
	50.6%	64.6%	59.2%
Total	3125	4989	8114
	100.0%	100.0%	100.0%
Marital status			
Married	2015	2766	4781
	64.5%	55.4%	58.9%
Not married	1110	2223	3333
	35.5%	44.6%	41.1%
Total	3125	4989	8114
	100.0%	100.0%	100.0%
Lives alone			
Yes	407	677	1084
	13.0%	13.6%	13.4%
No	2718	4312	7030
	87.0%	86.4%	86.6%
Total	3125	4989	8114
	100.0%	100.0%	100.0%
Education achieved*			
Undergraduate or higher	1230	1918	3148
	39.4%	38.4%	38.8%
Year 13	901	1518	2419
	28.8%	30.4%	29.8%
Year 11 or less	583	886	1469
	18.7%	17.8%	18.1%
No qualifications	379	642	1021
	12.1%	12.9%	12.6%
Total	3093	4694	8057
	100.0%	100.0%	100.0%
Employment status			
Employed	1992	3062	4984
	61.5%	61.4%	61.4%
Full-time student	141	203	344
	4.5%	4.1%	4.2%
Retired	609	961	1570
	19.5%	19.3%	19.3%
Unemployed	453	763	1216
	14.5%	15.3%	15.0%
Total	3125	4989	8114
	100.0%	100.0%	100.0%
Social class: based on latest (RGSC) occupation			
High social class	2049	2456	4505
	65.60%	49.20%	55.50%
Low social class	937	2279	3216
	30.0%	45.70%	39.60%
Not applicable	139	254	393
	4.40%	5.10%	4.80%
Total	3125	4989	8114
	100.0%	100.0%	100.0%
Smoking status			
Smoker	588	1506	2094
	18.8%	30.2%	25.8%
Non-smoker	2537	3483	6020
	81.2%	69.8%	74.2%
Total	3125	4989	8114
	100.0%	100.0%	100.0%
Household income (annual)—size weighted			
<£9588	633	1396	2029
	20.3%	28.0%	25.0%
£9589–£15 055	723	1305	2028
	23.1%	26.2%	25.0%
£15 056–£22 493	787	1243	2030
	25.2%	24.9%	25.0%
£22 494+	982	1045	2027
	31.4%	20.9%	25.0%
Total	3125	4989	8114
	100.0%	100.0%	100.0%

Source: The British Household Panel Survey Wave J, 2000.
*Missing N=57.
RGSC, Registrar General's Social Classification of occupations.

variables, β_0 is the fixed overall intercept and β, the corresponding vector of coefficients.

All considered explanatory variables were utilised for all analyses, which were conducted using GLLAMM V.2.3.20,[44] within the statistical software package STATA V.11.2.[45]

RESULTS

Table 1 shows frequencies and total percentages of all considered explanatory variables, stratified by baseline trust status (year 2000).

Table 2 further describes transitions in individual trust status over time.

Table 2 Transitions of trust status between 2000 and 2007 expressed as integers and percentages (%) of N_T (8114), stratified by trust at baseline

Can trust at baseline (year 2000)	Remains trusting	1661	53.1%
	Now cannot trust	1464	46.9%
Total		3125	100%
Cannot trust at baseline (year 2000)	Remains untrusting	2919	58.5%
	Now can trust	2070	41.5%
Total		4989	100%

Source: The British Household Panel Survey Wave J, M, O and Q (2000, 2003, 2005 and 2007).

Model 1a: 'Can trust' cohort

The outcome of interest in model 1a was *change* from 'Can trust at Baseline' (0) to 'Now cannot trust' (1), between 2000 and 2007. As shown in table 3, poor SRH at time (t−1) was associated with lack of trust at time (t) (OR=1.38). Of the socioeconomic status (SES) variables, those with low social class or those who had completed Year 13 of high school at time (t−1) predicted a lack of trust at time (t), (OR=1.95 and 1.54, respectively).

Of the social support variables, not being married at time (t−1) predicted low trust at time (t) (OR=1.32), as did being female and smoking at (t−1) (OR=1.23 and 1.45, respectively).

Model 1b: 'Cannot trust' cohort

The outcome of interest in model 1b was *change* from 'Cannot trust at Baseline' (0) to 'Now can trust' (1), between 2000 and 2007. As shown in table 3, good SRH and active participation at time (t−1) predicted high levels of trust at time (t) (OR=1.30 and 1.21, respectively). Of the SES variables, high social class at (t−1) predicted high trust at (t) (OR=1.51), as did non-smoking status and being male at (t−1) (OR=1.39 and 1.41, respectively).

Sensitivity tests

Double coding

Table 4 shows results after specifying that individuals had to have two consecutive registrations of the *same trust level* ('Can trust' or 'Cannot trust') in years 2000 and 2003 before being included in their respective trust cohort (N_T=6036). In model 2a (Can trust cohort), though similar patterns were seen, associations between poor SRH, not being married, being female and smoking at time (t−1), and lack of trust at time (t), were no longer significant at $p<0.05$. Being of low social class and

Table 3 ORs with 95% CIs of trust levels at time (t) according to logistic regression analysis of all lagged (t−1) explanatory variables between years 2000 and 2007, results stratified by baseline trust status (N_T=8114)

Lagged (t−1) explanatory variables		Model 1a Can trust at baseline cohort (N=3125) Now cannot trust ORs (95% CI)	Model 1b Cannot trust at baseline cohort (N=4989) Now can trust ORs (95% CI)
Time	Continuous	1.21 (1.12 to 1.30)***	0.80 (0.75 to 0.85)***
Self-rated health	Good health	1.0	1.30 (1.14 to 1.48)***
	Poor health	1.38 (1.16 to 1.64)***	1.0
Social class: derived from occupation-based RGSC schema	Higher social class	1.0	1.51 (1.30 to 1.75)***
	Lower social class	1.95 (1.61 to 2.37)***	1.0
Household income—size weighted	Per £1000 increase	1.0 (1.00 to 1.00)***	1.00 (1.00 to 1.00)***
Marital status	Married	1.0	1.21 (1.02 to 1.43)*
	Not married	1.32 (1.05 to 1.66)*	1.0
Lives alone	No	1.0	0.81 (0.65 to 1.02)
	Yes	0.82 (0.61 to 1.11)	1.0
Gender *(not lagged)*	Male	1.0	1.41 (1.21 to 1.65)***
	Female	1.23 (1.01 to 1.49)*	1.0
Social participation: membership of local voluntary groups	Active member	1.0	1.21 (1.07 to 1.36)***
	Non-member	1.13 (0.98 to 1.31)	1.0
Smoking status	Non-smoker	1.0	1.39 (1.18 to 1.63)***
	Smoker	1.45 (1.16 to 1.83)**	1.0
Employment status	Employed	1.0	0.86 (0.72 to 1.04)
	Full-time student	0.82 (0.51 to 1.31)	0.79 (0.52 to 1.20)
	Retired	1.13 (0.91 to 1.40)	1.21 (1.02 to 1.43)*
	Unemployed	1.05 (0.83 to 1.33)	1.0
Education achieved	University or higher	1.0	1.15 (0.72 to 1.04)
	Year 13	1.54 (1.28 to 1.85)***	0.84 (0.69 to 1.02)
	Year 11 or less	1.13 (0.93 to 1.39)	0.93 (0.75 to 1.15)
	No qualifications	1.10 (0.87 to 1.40)	1.0
Age (years)	16–34	1.0	0.88 (0.69 to 1.14)
	35–44	0.72 (0.53 to 0.96)*	0.74 (0.57 to 0.97)*
	45–54	0.92 (0.68 to 1.25)	0.87 (0.66 to 1.14)
	55–64	0.96 (0.69 to 1.33)	0.86 (0.65 to 1.14)
	65+	0.91 (0.65 to 1.27)	1.0
Variance at Level 2 (individual)	Random intercept (SD)	3.96 (0.29)	3.45 (0.21)

Source: The British Household Panel Survey, Waves J, M, O and Q (2000, 2003, 2005 and 2007).
Reference group=1.0.
Significant p values are *<0.05, **<0.01, ***<0.001.
RGSC, Registrar General's Social Classification of occupations.

completing Year 13 education at (t−1) remained associated with a lack of trust at time (t).

In model 2b (Cannot trust cohort), poor SRH at (t−1) and being female predicted high trust at time (t) (OR=1.24 and 1.41, respectively). Smoking status, active participation, high social class and being retired at (t−1) were no longer associated with high trust in the sensitivity test for this cohort.

Temporal pathways testing

Table 5 shows the results after running *all* explanatory variables from time (t), alongside their respective *lagged* (t−1) counterparts, the outcome being trust at time (t). Note that although *all* explanatory variables at time (t) and (t−1) were included in each model, only the results for SRH are shown. From model 3a, SRH at times (t−1) and (t) had positive association with trust, with the effect of SRH at time-point (t) being the stronger (OR=1.26 and 1.66, respectively). Conversely, in model 3b, the strength of association between good health and high trust was identical for time (t−1) and at (t) (OR=1.24).

DISCUSSION

This longitudinal study explicitly tested the reverse causality hypothesis. We investigated temporal relationships between lagged values in SRH at time-point (t−1) and generalised trust at (t). Results, in conjunction with past temporality research,[28] provided a more detailed overview of the health/trust relationship, with empirical evidence now suggesting not a simple 'cause–effect' relationship but one which appeared circular in nature.

As a robustness check, our first sensitivity test specified that individuals had to have consecutive registrations of the *same trust level* in years 2000 and 2003 before cohort definition (table 4). This was considered prudent, as approximately 45% of individuals from our sample changed trust status over the 7-year timeframe (table 2), which could have introduced misclassification bias. Despite some loss of significance, results revealed similar patterns of association between SRH and trust seen in the main analyses (table 3), which, in part, added strength to the notion of a circular trust/health relationship. Lack of statistical significance in table 4 may be the result of the reduced sample size (≈25%) or that after double-coding only two points in time (2005 and 2007) remained to measure changes in trust.

Different temporal pathways may coexist or confound each other, leading to further bias. Results of our second sensitivity test are shown in table 5. From model 3a, SRH at times (t−1) and (t) both had positive associations with trust at (t). However, the association between poor health and lack of trust was

Table 4 Double coding of trust (2000–2003): ORs with 95% CIs of changes in trust status over time (2003–2007) according to multivariate logistic regression analysis of all lagged (t−1) explanatory variables (NT=6036)

Lagged (t−1) explanatory variables		Model 2a Can trust: 2000–2003 (N=2379) No longer trusts ORs (95% CI)	Model 2b Cannot trust: 2000–2003 (N=3657) Now can trust ORs (95% CI)
Time	Continuous	0.75 (0.63 to 0.90)**	1.59 (1.34 to 1.88)***
Self-rated health	Good health	1.0	1.24 (1.01 to 1.54)*
	Poor health	1.10 (0.84 to 1.44)	1.0
Social class: derived from occupation-based RGSC schema	Higher social class	1.0	1.23 (0.98 to 1.54)
	Lower social class	1.51 (1.13 to 2.01)**	1.0
Household income—size weighted	Per £1000 increase	1.0 (1.00 to 1.00)**	1.00 (1.00 to 1.00)
Marital status	Married	1.0	1.22 (0.93 to 1.58)
	Not married	1.41 (1.00 to 1.99)	1.0
Lives alone	No	1.0	0.74 (0.52 to 1.05)
	Yes	1.34 (0.86 to 2.09)	1.0
Gender	Male	1.0	1.41 (1.14 to 1.76)**
	Female	1.06 (0.82 to 1.37)	1.0
Social participation: membership of local voluntary groups	Active member	1.0	1.06 (0.87 to 1.30)
	Non-member	1.08 (0.86 to 1.37)	1.0
Smoking status	Non-smoker	1.0	1.26 (0.98 to 1.60)
	Smoker	1.32 (0.94 to 1.85)	1.0
Employment status	Employed	1.0	0.86 (0.64 to 1.15)
	Full-time student	1.04 (0.43 to 2.50)	0.74 (0.32 to 1.71)
	Retired	1.18 (0.87 to 1.60)	0.91(0.65 to 1.28)
	Unemployed	1.09 (0.76 to 1.56)	1.0
Education achieved	University or higher	1.0	1.24 (0.89 to 1.74)
	Year 13	3.19 (2.17 to 4.69)***	0.60 (0.41 to 0.88)*
	Year 11 or less	1.39 (0.98 to 1.96)	0.90 (0.62 to 1.32)
	No qualifications	1.15 (0.76 to 1.74)	1.0
Age (years)	16–34	1.0	0.73 (0.49 to 1.09)
	35–44	1.12 (0.75 to 1.66)	0.71 (0.47 to 1.07)
	45–54	1.25 (0.83 to 1.88)	0.73 (0.49 to 1.10)
	55–64	1.13 (0.71 to 1.79)	0.79 (0.52 to 1.20)
	65+	1.04 (0.63 to 1.70)	1.0
Variance at level 2 (individual)	Random intercept (SD)	3.90 (0.50)	2.85 (0.38)

Source: The British Household Panel Survey, Waves J, M, O and Q (2000, 2003, 2005 and 2007).
Reference group=1.0.
Significant p values are *<0.05, **<0.01, ***<0.001.
RGSC, Registrar General's Social Classification of occupations.

Table 5 Temporal pathway testing: ORs with 95% CIs of changes in trust status over time (2000–2007) according to multiple variable logistic regression analysis of *all* lagged (t−1) and unlagged (t) explanatory variables (N_T=8114)

Lagged (t−1) explanatory variables		Model 3a Can trust at baseline cohort (N=3125) Now cannot trust ORs (95% CI)	Model 3b Cannot trust at baseline cohort (N=4989) Now can trust ORs (95% CI)
Time	Continuous	1.25 (1.15 to 1.40)***	0.79 (0.74 to 0.85)***
Self-rated health—lagged (t−1)	Good health	1.0	1.24 (1.08 to 1.42)**
	Poor health	1.26 (1.05 to 1.50)**	1.0
Self-rated health—Unlagged (t)	Good health	1.0	1.24 (1.08 to 1.43)**
	Poor health	1.66 (1.39 to 1.97)***	1.0
Variance at level 2 (individual)	Random intercept (SD)	3.99 (0.29)	3.45 (0.21)

Note: Only self-rated health is shown
Source: The British Household Panel Survey, Waves J, M, O and Q (2000, 2003, 2005 and 2007).
Reference group=1.0.
Significant p values are *<0.05, **<0.01, ***<0.001.

stronger when the two events were reported at time (t), offering some empirical support for the 'mutually reinforcing' feedback loop hypothesis.[26] In model 3b, the positive association between health and trust was mirrored; however, the strength of association was identical at time (t−1) and (t), that is, unlike model 3a, the influence of good health on high trust remained stable over time.

From the above points, it appears that the health/trust relationship is more complex than the direct cause–effect response previously postulated.[26 28–32] Empirical evidence from this and other temporality research[28] suggests that the trust/health relationship is circular in nature. However, as patterns of association between SRH and trust seem cohort dependent, our results do not fully support the existence of a mutually reinforcing feedback loop.[26] This is clearly seen in table 5 (model 3a) where the (larger) impact of poor health on low trust at (t) could be due to feelings of uncertainty or vulnerability.[25] Those individuals reporting poor health for longer periods (ie, at (t) and (t−1) due to, say, chronic illness) would retain the propensity not to trust for longer and may be behind weaker associations between poor health at (t−1) and low trust at (t).

Alternatively, patterns of association in table 5 could reflect levels of healthcare *utilisation* (UK residents have universal *access* to healthcare). It has been theorised that healthcare institutions are 'purveyors of wider societal norms', such as generalised trust.[46] Therefore, it is plausible that in welfare states such as the UK, the positive association between prior health and later trust could be mediated, in part, by healthcare utilisation.[47] As poor health and low trust have both been associated with low healthcare use,[47] such behaviour may deny individuals the appropriate medical treatment and also limit exposure to institutions that help perpetuate the societal norm of trust.[46]

Strengths and limitations

A major strength is the longitudinal design of this study, tracking the *same* individuals (N=8114) at four time-points over 7 years. The study captures associations between lagged (t−1) explanatory variables and *changes* from baseline trust, allowing us to build on past temporal research in this field.[28] To the best of our knowledge, this is the first time the reverse causality hypothesis of the SRH/trust relationship has been explicitly investigated. The large sample size meant that disaggregation by baseline trust status still allowed for two large independent cohorts, which enabled us to investigate *changes* from baseline trust. The fact that data were obtained via interview rather than relying on postal questionnaires contributed to the very high participation rate of around 90%, year on year.[35]

A major limitation of this study is that the BHPS sample was originally selected to reflect the UK population as a whole and avoided oversampling of smaller-sized communities. Furthermore, our longitudinal data were unsuitable to perform any meaningful contextual analysis. The outcome 'generalised trust' was dichotomised (see methods). Although handled in the standard fashion,[36] there is always some loss of information on dichotomisation. Further, as trust and other variables used in this study were self-reported, they were also subject to misreporting bias. The 'double-coded' sensitivity test was employed to reduce this risk. Although temporal relationships are considered 'essential' in establishing causality,[48] it is a gross oversimplification to assume that all pathways have been investigated in this study. By year 2000, only 62.0% of the original cohort members were able to answer the questions posed,[35] introducing selection bias into this study (this is assumed to be small, however, as strength and direction of associations are both as expected).

What is already known on this subject?

Past social capital research suggests that generalised trust may be an independent predictor of health. Despite emerging longitudinal data within this field adding weight to this argument, the reverse causality hypothesis (ie that health predicts trust) has yet to be empirically investigated.

What this study adds?

This longitudinal individual-level study attempted to fill a knowledge gap by investigating temporal relationships between health and trust. Our results showed that prior health status consistently predicted changes from baseline trust levels, which suggests that pathways behind positive associations are more than the simple 'cause' and 'effect' mechanisms previously hypothesised.

CONCLUSION

The circular relationship between trust and health, as shown in this study, suggests that pathways other than direct positive (causal) effects are present.[28] Nor did we find evidence to fully support the existence of a positive (mutually reinforcing) feedback loop between health and trust.[26] We noted that strength and stability of the association between SRH and trust was cohort dependent. Our results, therefore, offered some empirical support to other theories postulated to describe the complex mechanisms behind the trust/health relationship.[25 46] Further longitudinal research is required to capture event-timings more precisely, in order to disentangle the ways that trust and health appear to affect each other over time.

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Contributors GNG and ML conceived the study design. GNG built the datasets, performed all analysis and drafted the first version of the manuscript. ML helped finalise the draft. GNG and ML read and approved the submitted version of the manuscript.

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