Married couples' risk of same disease: cross sectional study

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Abstract

Objective To determine whether people whose marital partners have depression, diabetes, hypertension, ischaemic heart disease, stroke, hyperlipidaemia, peptic ulcer disease, or asthma or chronic obstructive pulmonary disease are at increased risk of the same disease.
Design Cross sectional study.
Setting 10 practices from the Trent Focus Collaborative Research Practice Network.
Participants 8386 married couples (16 772 individuals) from a population of 29 014 participants aged 30-74 years.
Outcomes Risk of disease in participants whose marital partner had that disease compared with those whose partner did not.
Results After both partners' age, smoking, and obesity and which general practice they attend were adjusted for, participants whose marital partner had asthma, depression, hypertension, hyperlipidaemia, and peptic ulcer disease were at increased risk of having the same disease. The adjusted odds ratios were 1.69 (95% confidence interval 1.43 to 2.98) for asthma, 2.08 (1.71 to 2.54) for depression, 1.32 (1.04 to 1.67) for hypertension, 1.44 (1.19 to 1.75) for hyperlipidaemia, and 2.01 (1.48 to 2.73) for peptic ulcer disease.
Conclusion Partners of people with specific diseases are at increased risk of the disease themselves—at least 70% increased risk for asthma, depression, and peptic ulcer disease. This implicates shared environmental causes in some diseases in addition to any genetic or distant exposure or shared behaviours with respect to seeking health care.

Introduction

Studies in twins have clarified the contributions of genetic and environmental factors to the development of diseases by identifying genetic factors.[1 2] The study of cohabiting couples can identify environmental factors because such couples usually are not genetically related. Shared environmental factors may put cohabiting partners at risk of the same diseases, and this could have implications for screening and other interventions. Interventions targeted at couples may be more effective than those targeted at individuals.[3]

In 1998, we published a study from a single practice that showed a statistically significant association between having a spouse with hypertension and increased risk of hypertension.[4] This effect was independent of age, obesity, smoking status, and the extent to which the patients had been screened for hypertension. Apart from one large, population based study that showed statistically significant husband-wife associations for cancers of the tongue and stomach and for non-Hodgkin's lymphoma,[5] we found no adequate evidence for spouse concordance for many other common but important diseases, such as ischaemic heart disease, diabetes, peptic ulcer disease, asthma, and stroke. Some small studies showed concordance between married couples for psychological wellbeing,[6] dietary habits,[7] and warfarin dosage.[8] Results from studies of coronary risk factors have been inconsistent—some but not all found concordance, particularly when age, body weight, and smoking status were adjusted for.[9–14]

We hypothesised that the association between marital partners for hypertension found in our previous study[4] could be generalised to other relatively common diseases managed in general practice. We aimed to determine whether people whose marital partners have a specific disease are at increased risk of the same disease. We studied common and important diseases in which plausible biological environmental mechanisms could have a role (asthma or chronic obstructive pulmonary disease, depression, diabetes, hypertension, ischaemic heart disease, stroke, hyperlipidaemia, or peptic ulcer disease). For example, hyperlipidaemia may be related to diet and peptic ulcer disease is associated with *Helicobacter pylori*.

Methods

We conducted a cross sectional study in 10 general practices with data of proved quality from the Trent Focus Collaborative Research Network. The study population consisted of all registered patients aged 30-74 years inclusive. Ethical approval was obtained from the four local research ethics committees.

Identification of participants with specific diseases

We used the computerised records to identify participants with and without each of the eight diseases. Records with a Read code or current related treatment, or both, identified participants with the disease, and records with no Read code and no relevant treatment identified participants without evidence of that disease.

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Disease and related drugs identified in patients' records*

Asthma or chronic obstructive pulmonary disease
Bronchodilators
Inhaled steroids

Depression
Antidepressants

Diabetes mellitus
Oral hypoglycaemics
Insulin

Hyperlipidaemia
Lipid lowering drugs

Ischaemic heart disease
Nitrates

Peptic ulcer disease
Ulcer healing drugs

*No specific drug was related to stroke and hypertension.

Participants with diabetes mellitus, for example, were those whose records had a Read code for diabetes or a current prescription for an oral hypoglycaemic agent or insulin. When no specific drug was related to a disease (for example, for stroke and hypertension), we identified diseases by the Read code alone.

Data extraction

We used MIQUEST software to extract standardised electronic data from the clinical computer system in each general practice.[15] We extracted the first recorded date of onset of each of the eight diseases for all patients in the study population. For related drugs, we extracted dates and number of prescriptions (box). We defined the current use of a drug as more than one prescription within the previous 12 months.

Identification and definition of married couples

We defined a married couple as "two individuals aged 30-74 years living at the same address; of different sex; and with the same surname, titles of Mr and Mrs, and a difference in age of less than 15 years." This definition identified married couples living together, but it excluded cohabiting or same sex couples. It also excluded households with more than two adults aged 30-74 years, because in such cases it would have been difficult to be confident about the non-genetic nature of the relationship and the probability of shared exposure.

To validate our definition, we used one author's general practice as a pilot site. We compared our computer generated classification against that derived from information from staff and the patients' notes and found no discrepancies.

A researcher visited each main study practice to identify married couples by using the definition above. Each eligible person (those aged 30-74) was allocated to a household with a unique identifying code for each postal address, and each surname was given a unique code. Only anonymised data were taken away from the practices' premises.

Statistical analysis

We analysed only the data about participants who met our definition of married couples. We used an unconditional logistic regression analysis to calculate odds ratios and 95% confidence intervals for the risk of disease in participants whose marital partner had a particular disease compared with those whose marital partner did not. We used female disease status as the outcome variable and male disease status as the exposure variable: however, virtually identical results were obtained when these were reversed. We adjusted for the possible confounding effects of age of both partners and, in further analyses, for the possible confounding effects of most recently recorded category for obesity and of most recently recorded smoking status in both partners. We allowed for clustering by general practice by defining this as a clustered variable and using a robust standard error.

We coded age into bands of 10 years, because the prevalence of each disease studied varied with age in a non-linear way. For each disease, we checked the appropriateness of this categorisation by calculating the mean age of participants with and those without disease within each age band and found no important differences. Obesity was coded into four categories according to body mass index ((weight (kg)/(height $(m)^2$))—<20, 20-24, 25-29 and ≥ 30) or a fifth category when no value for body mass index was recorded. We included this category for "not recorded" in order to include the maximum number of participants in the analysis and to reduce selection bias due to missing data.[16] In a similar way, participants were coded as non-smoker, current smoker or former smoker, or not recorded. We used Stata 7.0 and SPSS 10.04 for the analyses.

We used Pearson's correlation coefficient to determine the correlation between couples for body mass index. We calculated a partial correlation coefficient that adjusted for both partners' ages. We coded the most recent blood pressure reading into high (systolic ≥ 160 mm Hg or diastolic ≥ 90 mm Hg) or not high (this category included missing values), and we calculated odds ratios adjusted for the participants' and partners' ages, obesity, smoking status, and general practice. We also looked at the outcome when a participant had high blood pressure or a Read code for hypertension. We calculated age adjusted odds ratios to quantify spouses' concordance for smoking. We used a two tailed significance level of 0.01 for the main outcome variables because of the number of outcomes under investigation.

Sample size

We calculated that we needed a sample of 8150 married couples to have 80% power at the two sided 0.01 significance level to detect an odds ratio of 1.5 for diseases with a prevalence of 10% (for example, hypertension) and an odds ratio of 3.6 for diseases with a prevalence of 2% (for example, diabetes). We assumed that an average practice had approximately 3000 individuals aged 30-74 years, and we calculated that we needed 10 practices to include 8150 married couples. We used data from the Office for National Statistics website (www.statistics.gov.uk) to estimate the proportion of married couples in the population.[17]

Results

Characteristics of the study population

In total, 29 014 people aged 30-74 living in households with only one or two adults in this age range were registered with the 10 practices. Of these, 8386 women (56.8% of 14 757 women aged 30-74) and 8386 men (58.8% of 14 257 men aged 30-74) were part of a married couple according to our definition.

Table 1 shows the number of married men and women whose records had a computer Read code for each disease or treatment for each disease, or both. Table 2 shows the baseline characteristics and data available for the participants.

Risk of disease in participants whose marital partner has disease

Participants whose marital partner had asthma, depression, hypertension, hyperlipidaemia, or peptic ulcer disease were at increased risk of having the disease themselves after we adjusted for age, obesity, and smoking status in both partners and for the general practice at which the participants were registered (table 3). The odds ratio for diabetes was higher in women whose partners had diabetes than in those whose partners did not, but the confidence intervals were wide because of the low prevalence of diabetes compared with most of the other diseases we studied. The odds ratios for ischaemic heart disease and stroke were higher in women whose spouses had these diseases, but this was not statistically significant (table 3).

On multivariate analysis, the adjusted odds ratio for high blood pressure in women whose partners had high blood pressure compared with those whose partners did not was 1.40 (95% confidence interval 1.19 to 1.64). In an additional analysis of women with either raised blood pressure or a diagnosis of hypertension, the adjusted odds ratio was still 1.40 (1.16 to 1.44).

The correlation between marital partners for body mass index was significant (r=0.21, $P<0.001$). When we adjusted for the age of both partners, the partial correlation was 0.20 ($P<0.001$). We found a significant association between married partners for smoking status ($P<0.001$)—the age adjusted odds ratio for participants being smokers was 4.44 (3.84 to 5.14) for those whose partners were current smokers or former smokers compared with non-smokers. We repeated the analyses including only married couples for whom complete data on smoking and body mass index were available (2654 couples, 31.6%) and found no important differences in the odds ratios, although confidence intervals were wider and significance levels reduced compared with the original analysis because of the smaller sample size.

Table 2 Characteristics of men and women in 8386 married couples

	No (%)	
	Women	Men
Age (years):		
<35	852 (10.2)	537 (6.4)
35-44	2332 (27.8)	2116 (25.2)
45-54	2516 (30.0)	2501 (29.8)
55-64	1716 (20.5)	1893 (22.6)
65-74	970 (11.6)	1339 (16.0)
Smoking status:		
Non-smoker	3364 (40.1)	2478 (29.5)
Current smoker or former smoker	2103 (25.1)	2376 (28.3)
Not recorded	2919 (34.8)	3532 (42.1)
Body mass index (kg/m^2):		
<20	370 (4.4)	133 (1.6)
20-24.99	2955 (35.2)	1876 (22.4)
25-29.99	2286 (27.3)	2832 (33.8)
⩾30	1309 (15.6)	937 (11.2)
Not recorded	1466 (17.5)	2608 (31.1)
No of years registered with practice:		
<1	152 (1.8)	155 (1.8)
1	173 (2.1)	189 (2.3)
2	213 (2.5)	214 (2.6)
3	205 (2.4)	224 (2.7)
4	235 (2.8)	236 (2.8)
5-10	1192 (14.2)	1278 (15.2)
>10	4684 (55.9)	4528 (54.0)
Not recorded	1532 (18.3)	1562 (18.6)
Blood pressure		
Recorded	7698 (91.8)	6820 (81.3)
Not recorded	688 (8.2)	1566 (18.7)

We calculated the number of months of registration for the 13 678 (81.6%) participants with a recorded registration date. Overall, 4684 (68.3%) women and 4528 (66.4%) men with recorded dates had been registered with their practice for more than 10 years (table 2). We used an analysis of covariance, in which we adjusted for age as a covariate, to calculate the age adjusted mean length of registration with 95% confidence intervals in participants with and without each disease. We found no differences in the length of registration between participants with and without each disease for any of the conditions studied.

Discussion

Participants were significantly more likely to have asthma, depression, hypertension, hyperlipidaemia, or

Table 1 Participants aged 30-74 years in whom diseases were identified by Read code, treatment, or Read code or treatment (n=8386)

	No (%) participants identified					
	By Read code		By treatment		By Read code or treatment	
Disease (Read code)	Women	Men	Women	Men	Women	Men
Asthma or chronic obstructive pulmonary disease (H31-33)	840 (10.0)	780 (9.3)	106 (1.3)	89 (1.1)	946 (11.3)	869 (10.4)
Depression (1B17, 2257, 1465, e11, e2b)	432 (5.2)	175 (2.1)	691 (8.2)	327 (3.9)	1123 (13.4)	502 (6.0)
Diabetes mellitus (C10)	149 (1.8)	286 (3.4)	7 (0.1)	14 (0.2)	156 (1.9)	300 (3.6)
Hypertension (G20)	909 (10.8)	962 (11.5)	NA	NA	909 (10.8)	962 (11.5)
Ischaemic heart disease (G3)	237 (2.8)	550 (6.6)	12 (0.1)	12 (0.1)	249 (3.0)	562 (6.7)
Hyperlipidaemia (C32)	334 (4.0)	493 (5.9)	90 (1.1)	179 (2.1)	424 (5.1)	672 (8.0)
Stroke (G6)	106 (1.3)	192 (2.3)	NA	NA	106 (1.3)	192 (2.3)
Peptic ulcer disease (J13, J16Y4)	444 (5.3)	416 (5.0)	322 (3.8)	349 (4.2)	766 (9.1)	765 (9.1)

NA=not applicable.

Table 3 Risk of disease in 8386 women aged 30-74 years whose partner had that disease compared with those whose partner did not

Disease	Odds ratio (95% CI)	
	Adjusted for age†	Adjusted for age, smoking, and body mass index‡
Asthma	1.68 (1.45 to 1.94)	1.69 (1.43 to 1.98)
Depression	2.18 (1.78 to 2.67)	2.08 (1.71 to 2.54)
Diabetes	1.70 (1.06 to 2.74)	1.41 (0.87 to 2.26)
Hypertension	1.39 (1.14 to 1.70)	1.32 (1.04 to 1.67)
Ischaemic heart disease	1.29 (0.81 to 2.06)	1.28 (0.78 to 2.11)
Hyperlipidaemia	1.51 (1.21 to 1.88)	1.44 (1.19 to 1.75)
Stroke	1.30 (0.76 to 2.24)	1.21 (0.71 to 2.07)
Peptic ulcer disease	2.08 (1.53 to 2.83)	2.01 (1.48 to 2.73)

†Adjusted for age group of both partners in bands of 10 years (<35, 35-44, 45-54, 55-64, and 65-74 years) and for clustering by general practice.
‡Also adjusted for smoking status (non-smoker, current smoker or former smoker, or not recorded) and body mass index (<20, 20-24.99, 25-29.99, ⩾30, or not recorded) of the woman and her spouse and for clustering by general practice.

peptic ulcer disease if their marital partner had the same disease. The increased risks—at least 70% for asthma, depression, and peptic ulcer disease—could indicate shared environmental causes for diseases, which are distinct from any genetic or distant exposures. Another explanation for our findings is that couples may share healthcare seeking behaviours, although this would not explain the concordance for high blood pressure. The findings could have implications for targeting screening or disease prevention measures at partners of participants with one of these diseases.

Although the results were not surprising for some of these diseases, the findings for hypertension and hyperlipidaemia (after we adjusted for age, smoking, body mass index, and practice) suggest that diet or the pattern of physical exercise shared by couples has an important role in the disease's cause. A consequent association for ischaemic heart disease and stroke might have been expected, but this was not found. The finding for asthma might be due to shared diet or shared exposure to allergens. The failure of diabetes to show a significant concordance for marital partners (although the adjusted odds ratio was 1.41) was unexpected, but it was probably because the prevalence of diabetes was lower than that for most of the other diseases we studied and our study was not sufficiently powered to taken into account this low prevalence.

Strength and weaknesses of the study

A limitation of our study is that we did not obtain consultation data; this means that we could not adjust for the different frequencies at which some groups of patients consult their general practitioner. This could affect patients' chances of being screened for a disease, being diagnosed with a disease, or having a diagnosis recorded on computer. Spouses of affected participants may be more aware of the early symptoms of a particular disease, and this may make them more likely to consult their general practitioner and be screened.

We looked at a large population registered in 10 general practices in Trent. The inclusion of more than 8300 married couples makes it the largest such investigation in the literature. The study's strengths are its large sample size, the quality of data from the general practices, the selection of community participants, and the use of multivariate analysis to adjust for potential confounders. Our method of data collection means that the study is unlikely to be susceptible to selection and recall bias.

The data could be at risk of misclassification bias because disease status may have been falsely classified as negative or falsely classified as positive. Misclassification would have reduced the odds ratio of the factor under investigation.[16] Bias due to missing data is unlikely to have affected our results substantially because our findings were similar when we analysed only patients with complete data. We also reduced the effect of selection bias by including categories for patients with missing data about smoking and obesity.[16]

Previous studies suggested that concordance for some conditions (for example, hypertension) could be due to positive "assortive mating."[9] For example, if obese people are more likely to have obese marital partners, they could share an increased risk of disease due to their obesity or factors related to its development (such as lack of physical activity). If positive assortive mating was present, the association between exposure to a marital partner with a disease and the risk of that disease would have been reduced by the inclusion of body mass index in the multivariate analysis. This was not the case.

Another limitation is that we have no information on the length of time that participants had been couples or on the sequence of events (for example, when the participants married, whether they already had the disease at the time of marriage, how long after the marriage they were given the diagnosis). This could only have been determined by a survey of patient completed questionnaires, because such data are not routinely recorded on general practices' computers. Further studies could try to establish the body mass index and smoking status of the participants at the time the two individuals became a couple. Our study design allowed us to show associations rather than causality.

This study routinely collected data from databases in general practices known to have high levels of completeness and accuracy. Similar databases used for research in general practice, particularly for epidemiological studies of patient morbidity, have been found not to have undue bias.[18 19] Previous validation studies

What is already known on this topic

People whose spouses have hypertension are at increased risk of hypertension

Little is known about the risks of disease for spouses of patients with diseases other than hypertension

What this study adds

People whose marital partner had asthma, depression, and peptic ulcer disease were at increased risk of having the same disease

Shared environmental factors contribute to the risk of diseases

The costs and benefits of screening people for diseases of their spouses needs to be considered

showed that clinical information on databases in general practices is satisfactory for many epidemiological studies.[20–22] Similarly, data on morbidity and repeat prescribing are highly accurate and complete for indicating morbidity for common conditions.[23]

Conclusion

The high increased risks of disease within married couples support the idea that shared environmental factors in addition to genetic or distant exposures contribute to the development of diseases. The costs and benefits of screening spouses for some diseases need to be considered.

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Contributors: JHC and MP initiated and designed the study. JHC did the literature search; designed the data collection; manipulated, analysed, and interpreted the data; and jointly drafted the paper. CC contributed to the design and analysed and interpreted the data. MP interpreted the data and jointly drafted the paper. NC contributed to the study design; wrote the MIQUEST queries; collected, manipulated, and interpreted the data; and organised project meetings. VSH contributed to practice recruitment, project meetings, interpretation of the results, and the literature search. JHC is ruarantor for the paper.

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