Couples' Characteristics and the Correlation of Husbands' and Wives' Health.

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Abstract

Living together creates the conditions for a spouse's health to be inter-related with the health of the other spouse, especially among middle-aged or older couples. The article explores the association between the determinants of a couple's health and a set of biomarkers, through a system of simultaneous equations –one for each spouse, as well as secondary equations for controlling endogeneity– using a dataset of middle-aged adults from Costa Rica. There are positive correlations between the errors of the paired equations, although the size of the correlations is relatively small (around 0.10). Individual and economic variables do not seem to have a strong effect on health, but self-reported stress is related with both own and spouse's health. Female spouse´s self-reported stress is directly associated with male's levels of cholesterol, HDL, and CRP, while male spouse´s stress is positively associated with several female health variables: cholesterol, HDL, HbA1C, and systolic blood pressure.

Introduction

Family dynamics produces behaviors and characteristics that are correlated within the household unit. The dyadic interaction between husbands and wives creates the conditions for their respective health statuses to be interrelated or correlated. This correlation between spouses' health is more evident at late middle-age or old age, where deleterious health is more prevalent and the joint life courses develop similar health statuses. This article explores the correlation between husbands' and wives' health, based on allostatic load biomarkers.

Framework.

Living together for several years enhance the development of common behaviors, attitudes, and conditions. Wilson's (2002) theory of inter-spousal correlation in health status (ISCIHS) argues that the inter-related health status of spouses may be explained by several mechanisms. The first mechanism derives from assortative mating: similar people tend to marry each other. The similarities might refer to health and healthy behaviors, but they might refer to well-documented health determinants, such as socio-economic status (SES). The second and third mechanisms are based on common life styles and common environments due to shared living. Finally, each spouse's health might have direct effects on the other

spouse's health: from the higher incidence of infections within persons that are close to each other, to the impact of deleterious mental health on caretakers.

According to Lewis et al. (2006), the interdependence of spouses' health may come from several paths. They stress that common life may motivate couples to adopt certain habits and behaviors and make decisions that reduce risks towards deleterious health; such habits may be adopted in order to secure the continuation of the relationship. Risk avoidance behavior emerges as an important conscious mechanism used by couples (Smith and Zick, 1994). For Lewis and Butterfield (2007), the establishment of such health behaviors does not arise from a bargaining process, but from a series of interactions in which each spouse try to influence and regulate these behaviors through the reaction of the other spouse. These "social control tactics" may be practiced by one spouse only, or may be tried by both at the same time.

However, rational choices are not the only mechanisms that may explain this health correlation. In a family context, individual choices or events occurred to individuals may affect the health of the people living with these individuals. Cigarette smoking has an expected effect on others' health when a common living environment is shared (Lewis et al., 2006). There has also been some research that links work experiences and timing of retirement of one spouse with the other spouse's well-being (Burke, 1986; Cubbins and Szaflarski, 2001; Jimenez-Martin, Labeaga Azcona, and Martínez-Granado, 2000: Szinovacz and Davey, 2004). Work-related stress may to conflicts within the household. Additionally, the retirement of one of the spouses may be viewed as a disruption with daily life not only for the retiree, but also for the other spouse who might start to share more time with the retiree.

Among older couples, the role of caretaker may have an independent impact on the caretaker's heatlh (Brouwer, van Exel, van Gorp & Redekop, 2006; Amirkhanyan & Wolf, 2006; Rubin & White-Means, 2009). The burden of caregiving may be detrimental for psychological (Amirkhanyan & Wolf, 2003; Arango-Lasprilla et al., 2009; Mitrani et al., 2006; Son et al., 2007) and physical health (Fredman et al., 2010; Roth et al., 2009).

The association between spouses' health may also be determined by the life course trajectories experienced by the couple as a unit. The couple's number of children and household poverty has a similar effect on husbands' and wives' mortality (Lewis et al., 2006). Wilson (2001) finds that each spouse's education level, household income and insurance status have an effect on the joint prevalence of husbands' and wives' health conditions, measured by self-rated health and a scale of disability based on limitations on Activities of Daily Living. However, using longitudinal data, Michaud and van Soest (2008) do not find a causal association of wealth on couples' health; they do find a causal effect of each spouse's health on the household wealth.

Data

The analysis uses the first wave of interviews to the new cohort of the CRELES study: CRELES-2010. The acronym CRELES stands for "Costa Rica: Estudio de Longevidad y Envejecimiento Saludable": Costa Rican Study of Longevity and Healthy Aging. The study has been developed by researchers at the Central American Center for Population (CCP) and the University of California-Berkeley. The CRELES-

2010 dataset is an on-going longitudinal study that targets the Costa Rican population born between 1945 and 1955, aged 55 to 65 at baseline, and residing in the country in 2010-2011. The first wave has a sample size of 2803 main informants. It has also interviewed 1395 co-resident spouses regardless of their year of birth. The sample was drawn using a three-stage probabilistic sampling procedure selected with "probability proportional to size" (PPS). In the first stage, the primary sampling units (PSUs=Primary Sampling Units) are defined as pseudo-census tracts. Most of the pseudo-census tracts are pairs of census tracts, which were joined to have at least 15 houses with people born between 1945 and 1955. Two-hundred twenty two pseudo-census tracts were originally selected. Only two-hundred remained in the study because twenty two pseudo-census tracts are located in dangerous neighborhoods (due to crime) and hence were avoided because of safety concerns for the fieldworkers. For the second stage, the project selects all the houses with at least one person with the target age. For the third stage, the project randomly selects one person from the total persons living in the housing unit who were born between 1945 and 1955. The sampling frame used for the sampling design is the 2000 Costa Rican Population Census dataset, corrected with estimated survival ratios.

For the purpose of the analysis and excluding subjects with spouses that were not interviewed as well as cases with missing values, we have a sample size of 1096 couples. All the analyses take sampling weights into account.

All field data are collected using Personal Digital Assistants (PDAs), with software applications developed by CCP for this study. All data and specimens in the study were collected at the participants' homes. After finding the selected person, the fieldworker makes one visit for interview, anthropometric measurement, and collection of blood specimens. Participants have to sign the informed consent form at the beginning of the interview. Blood samples are collected by venipuncture: 1 EDTA purple top tube (for 3-4 ml. of whole blood) and 2 serum separating tubes (SST), with a clot activator (for 10-12 ml. of blood, to obtain 4-6 ml. of serum); however, participants do not need to be fasting given that the biomarkers analyzed by CRELES-2010 are not sensible to whether the person was fasting or not: total cholesterol, High Density Lipoprotein (HD), C-reactive protein (CRP), and glycated hemoglobin (HbA1C). All biomarkers were processed by the Health Services Laboratory of the University of Costa Rica. This laboratory is accredited at the national and Inter-American level. Systolic and diastolic blood pressure is measured twice by interviewers during the interview process, using a standard digital blood pressure device.

Explanatory variables are classified into five groups: Couple´s marital variables (absolute age difference, number of children ever born, number of children living at home, and cohabiting vs. being married), individual variables (own age, and binary variables about having more than 6 years of education, having ever smoked and absence of work experience), economic variables (self-rated financial situation by main informant, home ownership, number of rooms in the house, and number of vehicles owned), stress variables (own and spouse´s self-reported satisfaction with life, as well as perceived stress derived from answers to a battery of structured questions: "In today's society, some people feel stressed or anxious, but others do not. I will mention a few problems. For each, please tell me if it currently makes you feel stressed or anxious: own health, own financial status, family problems, and health of relatives and others.

Does this make you feel stressed or anxious?"), and control covariates (self-reported diagnosis of hypercholesterolemia, diabetes mellitus, and hypertension).

Methods

The purpose of the article is to analyze jointly male and female's health variables. Under the hypothesis that spouses' health is inter-related, we need to consider the correlation between the errors of each equation. We estimate a system of four equations using a three-stage Generalized Least Squares estimation algorithm (Greene, 2008). The first two equations refer to each spouse's health biomarkers. A third equation control for endogeneity produced by having the variable "stress due to health status" as an independent variable; a linear probability model is estimated in which this endogenous variable is regressed on covariates referring to the diagnosis of several chronic diseases. A four equation tries to control the endogeneity of the variable "stress due to economic problems"; another linear probability model is estimated in which this variable is regressed on several socio-economic covariates[1]. The system of equations can be represented in matrix notation:

$$\mathbf{y} = \mathbf{Z}\,\mathbf{B} + \varepsilon$$

where:

y	:	Vector of dependent variables
Z	:	Matrix of independent endogenous and exogenous variables
B	:	Vector of covariates
ε	:	Vector of error terms

and:

$$E(\varepsilon\varepsilon') = \Sigma$$

where the off-diagonal elements can be different from zero to allow correlation across errors.

In the first stage of estimation, endogenous covariates are estimated using exogenous variables only:

$$\hat{z}_i = X(X'X)^{-1}X'z$$

In the first stage, the vector of coefficients is estimated by:

$$\hat{B} = \left\{\hat{Z}'\left(\Sigma^{-1}\otimes I\right)\hat{Z}\right\}^{-1}\hat{Z}'\left(\Sigma^{-1}\otimes\right)y$$

[1] The last two equations are not presented in the tables.

The variance-covariance matrix $\widehat{\Sigma}$ is consistently estimated by:

$$\widehat{\Sigma} = \frac{E'E}{n}$$

where n is the sample size.

This estimate of the variance-covariance matrix is "plugged" into the previous equation as the third stage of the algorithm. The variance covariance matrix for $\hat{B}$ is:

$$V_{\hat{B}} = \left\{\hat{Z}'\left(\Sigma^{-1} \otimes I\right)\hat{Z}\right\}^{-1}$$

Results

Male spouses´ biomarker levels are directly associated with their female spouses and significantly different from zero (α=0.05), although the size of the correlation is relatively low (all the Pearson correlation coefficients are under 0.15). The size of the correlation of the error terms in the simultaneous equation sets is also relatively low and, as expected, very similar to the size of the coefficients of the Pearson coefficient (Table 1).

A general overview of the results of the 6 pairs of simultaneous equations suggests that the couple´s marital variables and the stress variables have significant effects on health. On the contrary, the coefficients of the economic variables were seldom significant. Two health variables refer to hyperlipidemia: total cholesterol and HDL (the so-called "good cholesterol"). In the total cholesterol equations, higher positive coefficients indicate worse health; the contrary is true for the HDL equations. According to Table 2, age difference and spouse´s stress due to health problems increase the average cholesterol levels among men, but number of children living at home and years of schooling decrease it. Among females, the coefficient for the satisfaction scale is significant: greater satisfaction decreases mean cholesterol levels. Regarding HDL levels among males, smoking history predicts lower HDL, and among females, age difference and number of children ever born have this effect. For women, better education, having never worked, and number of vehicles owned by the household increases HDL. This is the only equation in which people with higher SES proxy variables show better health.

Stress variables and HDL have contradictory associations. Among males, if their spouses have higher satisfaction with life, HDL levels decrease; but if their spouses report being stressed because of family problems, their HDL levels rise; men reporting stress due to health have lower levels, but those with work-related stress have higher mean HDL levels. Women that have spouses stressed because of health problems have lower HDL levels, but those with spouses stressed due to economic problems have higher HDL.

CRP is a sensitive biomarker of inflammation. Age difference, cohabiting and having no work experience increase inflammation levels among men. On the contrary, higher SES –as measured by home ownership and the number of rooms in the house– is associated with lower CRP. For women, only the absence of work history is associated with lower CRP. Male spouse´s satisfaction with life decreases both men´s and women´s inflammation levels. No stress variable is related to women´s CRP, but male´s stress due to health, and their spouses' stress due to economic and work related problems increase mean CRP levels among men. Work related problems decrease CRP levels among men.

Glycated hemoglobin –HbA1C, a marker of diabetes mellitus– is weakly associated with individuals' and couples' information aside from disease history. Among males, smoking history is directly associated with HbA1C. Women married to men who are stressed by economic problems have higher levels of HbA1C, but those married to men stressed by work related problems have lower levels. Besides, among females, the satisfaction scale is inversely related to this marker.

Systolic and diastolic blood pressure is not related with self-reported stress, except women with spouses stressed by economic problem, because they have higher diastolic blood pressure. Satisfaction with life also decreases systolic and diastolic blood pressure among women, but men who report to be more satisfied with life have higher systolic blood pressure and their spouses have higher diastolic blood pressure. Age difference decreases blood pressure among women but increases systolic blood pressure among men. Finally, women who have never worked have, on average, lower blood pressure than women with work experience. Female cohabiters have lower blood pressure, too.

As a summary, people´s traits may affect their health as well as their spouses´. People who report to be more satisfied with life or who are married with more optimistic spouses have on average better health markers than unsatisfied persons. When husbands are stressed due to economic problems, their wives show worse levels of HbA1C and diastolic blood pressure, but better HDL levels. When wives are stressed due to health problems, their husbands have higher cholesterol; and when wives are stressed due to economic or work related problems, their spouses have worse CRP levels.

Besides, the selected SES variables seldom have any effect on health markers. Only CRP has a clearly inverse association with SES variables. However, women that have never worked show better health: higher HDL levels, and lower CRP and blood pressure. Additionally, cohabiting men have worse inflammation marker, but cohabiting women have lower blood pressure.

Conclusions

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Table 1. Costa Rica: Correlation between male and female spouse's health variables, among Costa Ricans in union, born 1945-1955.

Health variable	Correlation	p-value[1/]
Bivariate Pearson correlation		
Total cholesterol (in mg/dl)	0.072	0.0148
HDL cholesterol (in mg/dl)	0.113	0.0001
C-Reactive Protein CRP (in mg/dl)	0.101	0.0006
Glycated Hemoglobin HbA1C (in mg/dl)	0.127	0.0000
Mean diastolic blood pressure in (mm/Hg)	0.052	0.0645
Mean systolic blood pressure in (mm/Hg)	0.058	0.0379
Error correlation in system of simultaneous equations of male and female spouse's health variables		
Total cholesterol (in mg/dl)	0.074	0.0135
HDL cholesterol (in mg/dl)	0.116	0.0001
C-Reactive Protein CRP (in mg/dl)	0.088	0.0037
Glycated Hemoglobin HbA1C (in mg/dl)	0.152	0.0000
Mean diastolic blood pressure in (mm/Hg)	0.057	0.0443
Mean systolic blood pressure in (mm/Hg)	0.071	0.0122

Note: 1/ P-value from Breusch-Pagan test of error independence for error correlation.

Table 2. Costa Rica: Regression coefficients of main explanatory variables in system of equations of male and female spouse's cholesterol levels, among Costa Ricans in union, born 1945-1955.

Explanatory variables	Male		Female	
Couple's marital variables				
-Absolute age difference	0.360	*	-0.142	
-Number of children ever born	-0.545		-0.227	
-Number of children living at home	-3.793	**	0.379	
-Cohabiting (vs. married)	-0.572		-3.110	
Individual variables				
-More than 6 yrs. educ (Ref:< 7 yrs.)	-3.443	*	-1.734	
-Ever smoked (Ref: Never smoked)	2.900		-6.497	
-Never worked (Ref: ever worked)	-4.702		-1.426	
Economic variables				
-Self rated financial situation	-1.720		-1.833	
-Home owners (Ref: no home owners)	1.991		0.382	
-Number of rooms at home	0.707		1.152	
-Number of vehicles owned	2.282		0.188	
Stress variables				
-Male spouse's satisfaction with life scale	-1.138		-1.276	
-Female spouse's satisfaction with life scale	2.692		-6.116	*
-Male spouse's sf stress due to:				
--health problems	-1.356		-4.504	
--economic problems	4.786		2.837	
--work related problems	-0.202		-2.266	
--family problems	2.998		3.687	
-Female spouse's sf stress due to:				
--health problems	4.904	*	3.951	
--economic problems	0.187		-2.276	
--work related problems	-1.414		-5.402	
--family problems	0.921		0.865	

Note: 1/All models control for prevalence of age, hypertension, diabetes, and cholesterol

Table 3. Costa Rica: Regression coefficients of main explanatory variables in system of equations of male and female spouse's HDL levels, among Costa Ricans in union, born 1945-1955.

Explanatory variables	Male		Female	
Couple's marital variables				
-Absolute age difference	0.031		-0.109	*
-Number of children ever born	-0.075		-0.326	*
-Number of children living at home	-0.427		-0.574	
-Cohabiting (vs. married)	-0.072		-0.537	
Individual variables				
-More than 6 yrs. educ (Ref:< 7 yrs.)	-0.407		2.010	*
-Ever smoked (Ref: Never smoked)	-1.797	**	-0.991	
-Never worked (Ref: ever worked)	1.208		1.719	*
Economic variables				
-Self rated financial situation	-0.309		-0.423	
-Home owners (Ref: no home owners)	-1.337		-0.714	
-Number of rooms at home	-0.207		-0.142	
-Number of vehicles owned	0.275		1.884	**
Stress variables				
-Male spouse's satisfaction with life scale	0.287		-0.018	
-Female spouse's satisfaction with life scale	-1.184	*	-0.563	
-Male spouse's sf stress due to:				
--health problems	-2.227	**	-2.951	**
--economic problems	0.436		2.243	*
--work related problems	1.790	*	-0.932	
--family problems	0.611		1.006	
-Female spouse's sf stress due to:				
--health problems	-0.518		0.108	
--economic problems	-1.009		-1.404	
--work related problems	0.978		1.188	
--family problems	1.444	*	-1.246	

Note: 1/All models control for prevalence of age, hypertension, diabetes, and cholesterol

Table 4. Costa Rica: Regression coefficients of main explanatory variables in system of equations of male and female spouse's CRP levels, among Costa Ricans in union, born 1945-1955.

Explanatory variables	Male		Female	
Couple's marital variables				
-Absolute age difference	0.129	**	0.032	
-Number of children ever born	-0.094		-0.054	
-Number of children living at home	0.130		-0.111	
-Cohabiting (vs. married)	1.714	*	1.092	
Individual variables				
-More than 6 yrs. educ (Ref:< 7 yrs.)	-0.391		0.324	
-Ever smoked (Ref: Never smoked)	0.747		0.798	
-Never worked (Ref: ever worked)	2.824	**	-0.064	**
Economic variables				
-Self rated financial situation	-0.296		-0.342	
-Home owners (Ref: no home owners)	-1.683	*	0.757	
-Number of rooms at home	-0.751	**	-0.058	
-Number of vehicles owned	0.102		-0.013	
Stress variables				
-Male spouse's satisfaction with life scale	-1.161	**	-2.524	**
-Female spouse's satisfaction with life scale	0.309		-0.569	
-Male spouse's sf stress due to:				
--health problems	2.106	**	-0.686	
--economic problems	-0.180		0.929	
--work related problems	-1.825	**	-0.688	
--family problems	-1.504		0.067	
-Female spouse's sf stress due to:				
--health problems	-0.477		0.798	
--economic problems	1.511	**	0.293	
--work related problems	1.590	*	0.206	
--family problems	-0.394		-0.776	

Note: 1/All models control for prevalence of age, hypertension, diabetes, and cholesterol

Table 5. Costa Rica: Regression coefficients of main explanatory variables in system of equations of male and female spouse's HbA1C levels, among Costa Ricans in union, born 1945-1955.

Explanatory variables	Male		Female	
Couple's marital variables				
-Absolute age difference	0.001		-0.003	
-Number of children ever born	0.012		0.013	
-Number of children living at home	0.001		0.014	
-Cohabiting (vs. married)	-0.133		-0.108	
Individual variables				
-More than 6 yrs. educ (Ref:< 7 yrs.)	0.049		0.063	
-Ever smoked (Ref: Never smoked)	0.143	*	0.027	
-Never worked (Ref: ever worked)	-0.052		0.100	
Economic variables				
-Self rated financial situation	-0.031		-0.012	
-Home owners (Ref: no home owners)	-0.123		-0.101	
-Number of rooms at home	-0.021		0.011	
-Number of vehicles owned	0.050		-0.013	
Stress variables				
-Male spouse's satisfaction with life scale	-0.075		0.093	
-Female spouse's satisfaction with life scale	-0.064		-0.178	**
-Male spouse's sf stress due to:				
--health problems	0.009		0.031	
--economic problems	0.002		0.227	*
--work related problems	0.093		-0.196	*
--family problems	0.065		0.021	
-Female spouse's sf stress due to:				
--health problems	0.011		-0.025	
--economic problems	-0.137		-0.060	
--work related problems	-0.078		0.067	
--family problems	-0.117		0.043	

Note: 1/All models control for prevalence of age, hypertension, diabetes, and cholesterol

Table 6. Costa Rica: Regression coefficients of main explanatory variables in system of equations of male and female spouse's systolic blood pressure levels, among Costa Ricans in union, born 1945-1955.

Explanatory variables	Male		Female	
Couple's marital variables				
-Absolute age difference	0.091		-0.299	**
-Number of children ever born	0.174		0.428	
-Number of children living at home	0.280		0.893	
-Cohabiting (vs. married)	-0.214		-3.535	*
Individual variables				
-More than 6 yrs. educ (Ref:< 7 yrs.)	-1.828	*	-2.228	
-Ever smoked (Ref: Never smoked)	0.963		0.760	
-Never worked (Ref: ever worked)	-0.683		-4.095	**
Economic variables				
-Self rated financial situation	-0.343		0.003	
-Home owners (Ref: no home owners)	-0.342		0.207	
-Number of rooms at home	-0.763		-0.928	
-Number of vehicles owned	-0.560		-1.062	
Stress variables				
-Male spouse's satisfaction with life scale	0.756		3.001	**
-Female spouse's satisfaction with life scale	1.199		-2.948	**
-Male spouse's sf stress due to:				
--health problems	-1.556		1.463	
--economic problems	0.410		2.127	
--work related problems	-1.257		-0.125	
--family problems	-0.719		-0.139	
-Female spouse's sf stress due to:				
--health problems	1.209		-0.383	
--economic problems	-0.331		-2.701	
--work related problems	-0.260		-1.962	
--family problems	0.257		1.364	

Note: 1/All models control for prevalence of age, hypertension, diabetes, and cholesterol

Table 7. Costa Rica: Regression coefficients of main explanatory variables in system of equations of male and female spouse's systolic blood pressure levels, among Costa Ricans in union, born 1945-1955.

Explanatory variables	Male		Female	
Couple's marital variables				
-Absolute age difference	0.099	*	-0.093	*
-Number of children ever born	-0.074		0.082	
-Number of children living at home	0.341		0.267	
-Cohabiting (vs. married)	-1.384		-0.168	
Individual variables				
-More than 6 yrs. educ (Ref:< 7 yrs.)	0.037		-0.279	
-Ever smoked (Ref: Never smoked)	0.411		0.228	
-Never worked (Ref: ever worked)	-2.822	**	-1.518	*
Economic variables				
-Self rated financial situation	-0.471		0.093	
-Home owners (Ref: no home owners)	-2.099		-0.797	
-Number of rooms at home	-0.658		-0.125	
-Number of vehicles owned	0.325		-0.421	
Stress variables				
-Male spouse's satisfaction with life scale	1.244	*	1.050	
-Female spouse's satisfaction with life scale	0.820		-2.437	**
-Male spouse's sf stress due to:				
--health problems	-0.256		-0.586	
--economic problems	1.233		2.420	**
--work related problems	0.044		0.567	
--family problems	-0.118		-0.356	
-Female spouse's sf stress due to:				
--health problems	0.862		-0.056	
--economic problems	-0.464		-1.376	
--work related problems	0.578		-0.201	
--family problems	-0.246		1.365	

Note: 1/All models control for prevalence of age, hypertension, diabetes, and cholesterol