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Association between Heart Disease and Subjective Health in Ten North, Middle, and South American Countries

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Abstract

Introduction: This study was conducted to compare 10 American countries for the association between self-reported physician diagnosis of heart disease and subjective health above and beyond the effect of socio-economic factors.
Methods: With a cross-sectional design, this study used data from Research on Early Life and Aging Trends and Effects (RELATE). The study included adults from 10 American countries including Costa Rica, Puerto Rico, United States, Mexico, Argentina, Barbados, Brazil, Chile, Cuba, and Uruguay. Outcome was self-rated health, independent variable was self-reported physician diagnosis of heart disease, while age, gender, and socio-economics (education and income) were control variables. Country-specific logistic regressions were used for data analysis.
Results: Although the effects of age, gender, education, and income, were inconsistent, with no exception, in all countries, heart disease was associated with poor subjective health. In Costa Rica, income modified the effect of heart disease on subjective health. In the US, age and gender modified the effect of heart disease on subjective health.
Conclusion: Although the effect of heart disease on well-being was consistent across all north American countries, this effect seemed to depend on various demographic and socio-economic factors in various countries.

Keywords: Cross-Country Study, Well-Being, Socio-Economic Status, Heart Diseases

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1. Introduction

Heart disease may be associated with clinical symptoms such as dyspnoea, tiredness and fatigue and lead to exercise intolerance [1]. As a result, patients with heart disease may experience some degrees of limitations in social and daily living [2]. A considerable proportion of patients with heart disease experiences impaired physical and functional capacity, which may influence quality of life of the patients [3]. Impairment in the quality of life and subjective well-being of patients with heart disease may be secondary to physical symptoms, psychological problems, adverse treatment effects or limitations in social functioning [4]. Symptoms may lead to withdrawal of social activities, which may diminish social relations and social support [5]. Awareness or fear of higher rate of mortality may interfere with mood or sleep, and may cause depression, sleep disturbances, or anxiety [4]. Many other aspects of life such as relationship, eating, and sexual activities also change under the influence of heart disease [4]. All these factors collectively deteriorate the quality of life of patients with different types of heart diseases [5].

Demographic (e.g. age and gender) and socioeconomic factors (e.g. education and income) also influence subjective health and well-being of people [6]. Both cross-sectional and longitudinal studies have shown that chronic medical conditions such as heart disease are associated with functional limitations and reduced health-related quality of life [7]. Heart diseases and comorbid conditions are major causes of global death, and deter economic growth of the societies [8].

Old age is associated with limitation in functions and well-being [9]. Age is closely linked to both physical & mental health [10]. Gender also influences perceived health [11,14]. Low socioeconomic status is closely associated with lower health and well-being [12,15]. Education and income are within most commonly accepted proxies of an individual's socioeconomic status [16], which are associated with subjective health, more chronic disease, and higher mortality [17-21]. Individuals with high educational levels and income report a better quality or life and function [10].

Although literature suggests that heart disease is associated with poor subjective health, the association between heart disease and poor subjective health may differ from one country to another. Unfortunately, very few studies have ever been conducted cross-country differences in association between heart disease and well-being. The current cross-country study has aimed to compare 10 North American countries including Costa Rica, Puerto Rico, United States, Mexico, Argentina, Barbados, Brazil, Chile, Cuba, and Uruguay for the association between heart disease and well-being, and

also the interaction between heart disease and the demographic (e.g. age and gender) and socioeconomic factors (e.g. education and income).

2. Method

2.1. Study Design & Participants

With a cross-sectional design, data came from the Research on Early Life and Aging Trends and Effects (RELATE), a collection of multiple surveys from multiple countries across the world. Countries participating in the RELATE included China, Costa Rica, Puerto Rico, United States, Mexico, Argentina, Barbados, Brazil, Chile, Cuba, Uruguay, India, Ghana, South Africa, and Russia. Countries were selected from North America, South America, Asia, and Africa [22,23]. Above countries also represent a diverse range of national income levels. Ghana represents low income countries, China and India represent lower middle income countries; Argentina, Cuba, Uruguay, Chile, Costa Rica, Brazil, Mexico, and Russia represent upper middle income countries; and the United States, Puerto Rico, and Barbados represent high income countries.

Data were collected anonymously. All the studies have received an approval by the institutional review boards. Informed consent was also provided by all the participants in all the studies.

The RELATE data composed of the following national surveys: 1) Wisconsin Longitudinal Study (WLS), 2) Costa Rican Study of Longevity and Healthy Aging (CRELES), 5) Puerto Rican Elderly: Health Conditions (PREHCO), 6) Study of Aging Survey on Health and Well Being of Elders (SABE), and 7) WHO Study on Global Ageing and Adult Health (SAGE) [22, 23].

2.2. Measures

Socio-economic data such as age, gender, education level, and income were measured. Age, education, and income were operationalized as continuous variables, gender as a dichotomous variable, and education as a continuous variable. Income was per capita annual household income, calculated as purchase power parity dollars (PPP$) [24-26].

Presence of self-reported physician diagnosis of heart disease was recorded. Self-reported data on chronic medical conditions are believed to be in agreement with physician diagnosis of conditions (kappa: 0.74-0.92) [27].

Outcome was subjective well-being, measured using a single item measure. Overall perceived health was measured using a five Likert scale (i.e. very bad, bad, moderate, good, and very good). Single items have been frequently used to measure subjective health and well-being [28-34]. The test retests reliability of single items for measuring subjective health range from 0.7 to 0.8 [33]. Results of these single item measures of subjective health are highly correlated with standard scales [34,35]. Single item measures of subjective health have shown high predictive validity for prediction of mortality, even after controlling other risk factors [36].

2.3. Data Analysis

We used SPSS 20.0 for Windows for data analysis. As weights were not applicable to surveys from the United States (Wisconsin), we did not apply sampling weights. *P* less than 0.05 was considered as significant.

Demographics (age and gender), and socio-economics (education, and income) and heart disease were entered into country-specific logistic regressions. In the first step, we tested main effects of demographics (age and gender), socio-economics (education, and income) and heart disease. In the next step, we tested the interaction between heart disease and demographics (age and gender), socio-economics (education, and income) factors. Odds Ratios (ORs) and their 95% confidence intervals (95% CI) were reported.

3. Results

Demographic and socio-economic factors of participants have been reported elsewhere.

With no exception, in all countries, heart disease was associated with higher odds of poor subjective health, above and beyond the effect of age, gender, education, and income. The effects of age, gender, education, and income, however, were inconsistent (Table 1).

In Costa Rica, income modified the effect of heart disease on subjective health. In the US, age and gender modified the effect of heart disease on subjective health. In Urguay, education showed marginally significant interaction with the effect of heart disease on subjective health. In Puerto Rico and Argentina, Barbados, Brazil, Chile, and Cuba, none of the demographic and socio-economic factors modified the effect of heart disease on subjective health (Table 2).

Table 1. Cross-country differences in associations between heart disease and poor subjective health

					95% C.I.for EXP(B)	
	B	S.E.	Sig.	Exp(B)	Lower	Upper
Costa Rica						
Age	-.016	.004	<.001	.985	.977	.993
Female Gender	.101	.084	.231	1.106	.938	1.304
Education	-.375	.068	<.001	.687	.601	.785
Income	-.210	.064	.001	.811	.716	.918
Heart Disease	.679	.125	<.001	1.973	1.543	2.523
Puerto Rico						
Age	-.007	.005	.148	.993	.984	1.002
Female Gender	.506	.076	<.001	1.658	1.428	1.926
Education	-.448	.051	<.001	.639	.578	.706
Income	-.026	.006	<.001	.974	.962	.986

Heart Disease	1.137	.117	<.001	3.116	2.475	3.923
U.S.						
Age	.063	.057	.269	1.065	.952	1.191
Female Gender	.091	.086	.288	1.095	.926	1.295
Education	-.478	.105	<.001	.620	.505	.761
Income	-.009	.002	<.001	.991	.988	.995
Heart Disease	1.540	.088	<.001	4.666	3.925	5.547
Mexico						
Age	.020	.005	<.001	1.020	1.011	1.030
Female Gender	.104	.082	.207	1.109	.944	1.302
Education	-.304	.054	<.001	.738	.663	.821
Income	-.012	.003	<.001	.988	.983	.994
Heart Disease	.417	.126	.001	1.517	1.185	1.940
Argentina						
Age	-.018	.011	.097	.983	.962	1.003
Female Gender	.364	.159	.022	1.439	1.054	1.964
Education	-.784	.107	<.001	.457	.370	.563
Income	-.033	.021	.114	.967	.928	1.008
Heart Disease	1.174	.177	<.001	3.236	2.287	4.580
Barbados						
Age	.039	.007	<.001	1.040	1.025	1.055
Female Gender	.430	.122	<.001	1.538	1.211	1.953
Education	-.295	.101	.004	.745	.611	.908
Income	-.006	.003	.027	.994	.989	.999
Heart Disease	.940	.196	<.001	2.560	1.744	3.756
Brazil						
Age	-.003	.005	.539	.997	.986	1.007
Female Gender	.046	.092	.619	1.047	.874	1.253
Education	-.311	.065	<.001	.733	.645	.832
Income	-.031	.007	<.001	.970	.956	.984
Heart Disease	.940	.118	<.001	2.561	2.034	3.225
Chile						
Age	.002	.008	.825	1.002	.987	1.017
Female Gender	.334	.126	.008	1.397	1.090	1.789
Education	-.325	.063	<.001	.723	.638	.818
Income	.000	.000	.925	1.000	1.000	1.000
Heart Disease	.513	.131	<.001	1.670	1.291	2.159
Cuba						
Age	-.008	.007	.198	.992	.979	1.004
Female Gender	.450	.107	<.001	1.569	1.273	1.934
Education	-.332	.077	<.001	.717	.617	.834
Income	-.019	.012	.126	.981	.958	1.005
Heart Disease	1.418	.148	<.001	4.128	3.089	5.518
Uruguay						
Age	-.007	.008	.425	.993	.977	1.010
Female Gender	.435	.128	.001	1.544	1.202	1.984
Education	-.385	.072	<.001	.680	.591	.784
Income	-.001	.001	.278	.999	.997	1.001
Heart Disease	1.108	.137	<.001	3.029	2.316	3.962

4. Discussion

This study focused on cross-country differences in the link between heart disease and well-being. With no exception, in all countries, heart disease was associated with higher odds of poor subjective health, above and beyond the effect of age, gender, education, and income. The effects of age, gender, education, and income, however were inconsistent. In Costa Rica, income modified the effect of heart disease on subjective health. In the US, age and gender modified the effect of heart disease on subjective health. In Puerto Rico and Argentina, Barbados, Brazil, Chile, and Cuba, none of the demographic and socioeconomic factors did not modify the effect of heart disease on subjective health.

Our finding is in line with the previous studies suggesting the role of heart disease on well-being, quality of life, and disability [1-5]. Interestingly, Kempen and colleagues observed that health perceptions were most affected by heart conditions, followed by asthma/chronic bronchitis, joint complaints, back problems, and diabetes [37]. Another study suggested that heart diseases, musculoskeletal diseases, lung diseases, neurological disorders, diabetes, and cancer explain most of the disability of the population levels [38]. A study showed that the level of psychological distress varied across type of chronic medical condition, and patients with heart disease, as well as patients with hearing impairment, neurological disease, and vision impairment report the highest levels of distress [39].

Table 2. Cross-country differences in interaction between heart disease and demographic and socio-economic factors on poor subjective health

					95% C.I.for EXP(B)	
	B	S.E.	Sig.	Exp (B)	Lower	Upper
Costa Rica						
Age	-.016	.004	.000	.984	.976	.993
Female Gender	.097	.090	.284	1.101	.923	1.315
Education	-.285	.073	<.001	.752	.652	.868
Income	-.438	.086	<.001	.645	.545	.763
Heart Disease	1.391	1.186	.241	4.020	.393	41.068
Heart Disease # Age	-.003	.014	.797	.997	.970	1.023
Heart Disease # Income	.432	.098	<.001	1.541	1.271	1.868
Heart Disease # Female	-.100	.255	.694	.904	.549	1.490
Heart Disease # Education	-.304	.191	.112	.738	.507	1.074
Puerto Rico						
Age	-.006	.005	.205	.994	.984	1.004
Female Gender	.530	.081	<.001	1.700	1.449	1.994
Education	-.462	.054	<.001	.630	.566	.700
Income	-.022	.007	.001	.978	.965	.991
Heart Disease	1.367	1.188	.250	3.924	.382	40.305
Heart Disease # Age	-.003	.014	.820	.997	.969	1.025
Heart Disease # Income	-.031	.019	.111	.969	.933	1.007
Heart Disease # Female	-.222	.239	.352	.801	.502	1.279
Heart Disease # Education	.117	.154	.447	1.124	.831	1.521
U.S.						
Age	-.022	.071	.760	.979	.852	1.124
Female Gender	-.074	.104	.477	.929	.757	1.139
Education	-.453	.128	<.001	.636	.494	.818
Income	-.011	.002	<.001	.989	.985	.994
Heart Disease	-16.199	8.062	.044	.000	.000	.671
Heart Disease # Age	.272	.123	.028	1.312	1.030	1.671
Heart Disease # Income	.005	.003	.108	1.005	.999	1.012
Heart Disease # Female	.509	.181	.005	1.663	1.167	2.370
Heart Disease # Education	-.049	.222	.825	.952	.616	1.470
Mexico						
Age	.020	.005	<.001	1.020	1.010	1.030
Female Gender	.120	.087	.168	1.127	.951	1.337
Education	-.348	.058	<.001	.706	.630	.791
Income	-.013	.003	<.001	.987	.981	.993
Heart Disease	-.332	1.129	.769	.718	.079	6.558
Heart Disease # Age	.000	.014	.988	1.000	.972	1.029
Heart Disease # Income	.008	.007	.264	1.008	.994	1.023
Heart Disease # Female	-.135	.263	.607	.873	.521	1.464
Heart Disease # Education	.374	.171	.029	1.453	1.040	2.031
Argentina						
Age	-.008	.012	.496	.992	.969	1.015
Female Gender	.436	.182	.016	1.547	1.083	2.209
Education	-.805	.124	<.001	.447	.350	.570
Income	-.039	.026	.132	.962	.914	1.012
Heart Disease	4.152	2.027	.041	63.537	1.196	3376.429
Heart Disease # Age	-.040	.025	.117	.961	.914	1.010
Heart Disease # Income	.025	.047	.589	1.026	.936	1.124
Heart Disease # Female	-.280	.399	.482	.756	.346	1.652
Heart Disease # Education	-.015	.260	.954	.985	.592	1.640
Barbados						
Age	.040	.008	<.001	1.041	1.025	1.057
Female Gender	.390	.129	.002	1.477	1.148	1.901
Education	-.278	.108	.010	.757	.613	.937
Income	-.005	.003	.080	.995	.990	1.001
Heart Disease	2.091	2.106	.321	8.092	.130	502.161
Heart Disease # Age	-.015	.026	.575	.985	.936	1.037
Heart Disease # Income	-.004	.007	.528	.996	.983	1.009
Heart Disease # Female	.423	.405	.296	1.527	.690	3.377
Heart Disease # Education	-.117	.307	.702	.889	.487	1.623
Brazil						
Age	.000	.006	.944	1.000	.989	1.012
Female Gender	.071	.102	.487	1.073	.879	1.310
Education	-.307	.073	<.001	.736	.638	.850

Income	-.032	.008	<.001	.969	.953	.985
Heart Disease	2.613	1.204	.030	13.636	1.289	144.278
Heart Disease # Age	-.021	.014	.144	.979	.952	1.007
Heart Disease # Income	.005	.019	.775	1.005	.969	1.043
Heart Disease # Female	-.120	.239	.616	.887	.555	1.417
Heart Disease # Education	-.034	.160	.834	.967	.706	1.324
Chile						
Age	.008	.009	.396	1.008	.990	1.026
Female Gender	.416	.150	.006	1.516	1.129	2.035
Education	-.298	.075	<.001	.742	.640	.860
Income	.000	.000	.924	1.000	.999	1.001
Heart Disease	2.398	1.266	.058	10.999	.919	131.581
Heart Disease # Age	-.021	.017	.210	.979	.948	1.012
Heart Disease # Income	.000	.000	.893	1.000	.999	1.001
Heart Disease # Female	-.277	.281	.323	.758	.437	1.314
Heart Disease # Education	-.100	.140	.475	.904	.687	1.191
Cuba						
Age	-.005	.007	.458	.995	.981	1.009
Female Gender	.466	.115	<.001	1.594	1.271	1.998
Education	-.323	.084	<.001	.724	.614	.854
Income	-.034	.020	.083	.966	.930	1.004
Heart Disease	3.171	1.552	.041	23.839	1.139	499.042
Heart Disease # Age	-.022	.018	.229	.978	.944	1.014
Heart Disease # Income	.109	.067	.104	1.115	.978	1.270
Heart Disease # Female	-.173	.313	.581	.841	.455	1.555
Heart Disease # Education	-.088	.213	.680	.916	.603	1.391
Uruguay						
Age	-.005	.010	.604	.995	.976	1.014
Female Gender	.317	.149	.034	1.373	1.025	1.841
Education	-.465	.087	.000	.628	.530	.744
Income	-.001	.001	.279	.999	.996	1.001
Heart Disease	.604	1.442	.675	1.830	.108	30.872
Heart Disease # Age	-.007	.019	.718	.993	.957	1.030
Heart Disease # Income	.001	.002	.610	1.001	.996	1.006
Heart Disease # Female	.466	.286	.104	1.593	.909	2.791
Heart Disease # Education	.292	.158	.064	1.340	.983	1.826

Another study compared different chronic medical conditions and showed that heart disease may have stronger effects than several other conditions on well-being. After controlling the effect of age, sex, educational level, comorbidities, disability and pain, coronary artery disease and chronic hemodialysis were linked to high levels of depression, while rheumatoid arthritis and hepatitis were linked to highest level of anxiety [40].

Chronic conditions such as heart disease and diabetes have been shown to be associated with limitation in ADL [10,11,41]. For instance, individuals with diabetes are more likely to experience restrictions in the ADL, along with reduced mobility and role functioning [42,44]. Across the 8 countries examined, a variety of chronic conditions showed an association with ADL after the effect of demographic factors and health behaviors were controlled.

Based on a study among general population, heart disease was not consistently linked to activities of daily living, when the effect of socio-economic status, health behaviors, and other chronic conditions were controlled [45]. Based on that study, stroke was the only chronic medical condition that was consistently associated with ADL limitation across all 8 countries. Interestingly, while other factors (socio-economic status, health behaviors, and other chronic conditions) were controlled, hypertension was not linked to disability in any of the countries [45].

There are very few cross-country studies on the effect of socio-economics, chronic conditions on well-being and disability. Findings of a recent study revealed that countries are largely different in contributors of ADL limitation. We found considerable cross-country effects for the relationship between age and ADL. For instance, contribution of age and gender in explaining ADLs were very high in China and Cuba, respectively. More variation was seen in the effect of education than income as factors contributing to ADL in different countries. Health behaviors such as exercise and also chronic conditions (in general) consistently made significant contributions to explaining ADL across all 8 countries included in this study [45].

Based on our study, the effect of age on well-being was not consistent across countries. Age is known to be negatively associated with ADL [46,47]. In a study, age explained some of the variance in activities of daily living. The most notable contribution of age to activities of daily living, however, was for China where 24.6% of the variance of the outcome was accounted for by age. In this country, contribution of chronic medical conditions was small [45].

The effect of gender was also not-consistent. Although male gender is known to be associated with more life threatening chronic diseases, overall, women report higher rates of

chronic diseases [14,48] and mental health related conditions [14,49]. As such, women report lower levels of quality of life even though men have lower mortality [50,52]. In a study, the amount of variance explained by gender ranged between 1-3%. [45].

4.1. Education & Income

In line with previous studies, the current study also suggests cross-country differences in the contribution of level of education and income to well-being. Only in Mexico, Brazil, Chile, and Cuba were individual's levels of education associated with their ADL [45]. Education level is directly related to health and ADL [53-55], and indirectly so as lower levels of education often mean fewer reports of illness and limitations in health [53,56,57].

Assari tested possible cross-country differences in determinants of well-being among patients with diabetes in seven countries including China, Mexico, Barbados, Brazil, Chile, Cuba, and Uruguay. He showed that heart disease was the only factor which was consistently associated with poor perceived health [58].

4.2. Implication

This information may have implications for cardiologists in different countries. Based on the current study, clinicians may need to consider demographic and socio-economic factors to better estimate the effect of heart disease on well-being of their patients. Heart disease may be more disabling among the low income in Costa Rica, and old and women in the U.S. Different policies and programs may also be needed in each country to reduce burdens associated with heart disease. We argue that locally designed health interventions may be superior to universal programs if promotion of well-being of patients with heart disease is the goal. In all countries, however, well-being may be improved if heart disease is screened, diagnosed, and appropriately treated. As a result, heart disease may universally need attention health promotion in all countries.

The current study had several limitations. The design was a cross-sectional design and causative inferences are implausible. Subjective well-being was measured using a single item measure, and cross-country differences in validity of our single item measure are not known. Health behaviors such as smoking, drinking and exercise were not measured. Other chronic medical conditions were also not included in this study [59].

5. Conclusion

Although heart disease consistently reduces well-being in all countries, there are several factors that modify the burden associated with heart disease. Findings on cross-country differences in the effect of heart disease on well-being may help with the promotion of the quality of life of patients with heart disease across different countries.

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Authors' Contributions

Assari and Moghani Lankarani were involved in the study design, data analysis and result interpretation.

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