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Clinical short communication

Stroke risk factors in couples. A population-based study in community-dwelling adults living in a remote rural setting (the Atahualpa Project)

Oscar H. Del Brutto[a,*], Robertino M. Mera[b]

[a] School of Medicine, Universidad Espíritu Santo – Ecuador, Guayaquil, Ecuador
[b] Department of Epidemiology, Gilead Sciences, Inc., Foster City, CA, USA

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ABSTRACT

Purpose: By the use of a population-based design, this study aimed to evaluate the presence of similar stroke risk factors in couples living in a remote rural setting (Atahualpa).
Methods: Atahualpa residents aged ≥40 years were identified by means of door-to-door surveys, and those who signed a comprehensive consent form were enrolled in the Atahualpa Project. Baselines interviews and procedures, aimed to assess stroke risk factors, were collected at the time of admission in all participants.
Results: We identified 268 couples among 898 individuals aged ≥40 years enrolled in the Atahualpa Project. Traditional risk factors were defined according to the American Heart Association criteria. Generalized estimating equations, adjusted for age, showed that being married to a spouse with poor physical activity ($p = 0.027$) and a poor diet ($p < 0.001$) were associated with the presence of these risk factors in the other partner.
Conclusions: Intervention strategies directed to couples are needed to improve poor healthy styles leading to stroke in underserved populations.

1. Introduction

Living together (as a couple) make individuals to share health styles and risk factors, which may result in the occurrence of the same disease or condition in both partners [1,2]. Most studies addressing the presence of similar stroke risk factors in couples have been conducted in industrialized nations (mostly in Urban Centers) [3–6], where living conditions are different than in rural areas of the developing world. Regional epidemiologic surveys may prove cost-effective for developing strategies directed to improve stroke risk factors in populations where the burden of stroke is on the rise due to increased life expectancy and changes in lifestyles [7]. By the use of the Atahualpa Project cohort, we aimed to assess whether the same stroke risk factors coexist among couples living in a remote setting.

2. Materials and methods

2.1. Study population

Atahualpa is a rural Ecuadorian village where previous epidemiological studies on stroke risk factors have been conducted [8]. The population is homogeneous regarding race/ethnicity, socioeconomic status and lifestyle. As detailed elsewhere, > 95% of the population are Ecuadorian natives or mestizos, and their diet is rich in fish and carbohydrates but poor in other polyunsaturated fats, red meat, and dairy products. There are no fast-food restaurants in the village, and most people eat at home. Most men work as carpenters and most women are homemakers. Atahualpa is a relatively isolated and closed village. Inhabitants do not migrate, and a sizable proportion of them have even never visited large urban centers (such as Guayaquil), which are > 100 km apart. Inhabitants mobilize within the village mainly by walking or bicycle riding, as very few people own a motor vehicle [9].

Starting in 2012, the Atahualpa Project aimed to collect information on stroke risk factors and other conditions of interest in all Atahualpa residents aged ≥40 years. Eligible candidates were identified by means of door-to-door surveys and those who signed the informed consent form were enrolled. The study was approved by the I.R.B. of Hospital-Clínica Kennedy, Guayaquil (FWA 00006867).

2.2. Study design

This study focused on the identification of married and unmarried partners (common-law marriage) in the study population, who have been living together for at least five years at the time of enrollment.

* Corresponding author at: Air Center 3542, PO Box 522970, Miami, Fl 33152-2970, Ecuador.
E-mail address: oscardelbrutto@hotmail.com (O.H. Del Brutto).

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Table 1
Cardiovascular health metrics according to criteria proposed by the American Heart Association (*Lloyd-Jones et al, Circulation 2010;121:586-613*).

1. Smoking: ideal (never or quit > 1 year), intermediate (quit ≤1 year) and poor (current smoker).
2. Physical activity: ideal (≥150 minutes/week moderate intensity or ≥75 minutes/week vigorous intensity or equivalent combination), intermediate (1-149 minutes/week moderate intensity or 1-74 minutes/week vigorous intensity or equivalent combination) and poor (no moderate and vigorous activity).
3. Diet: ideal (4-5 healthy components), intermediate (2-3 healthy components) and poor (0-1 healthy component); based on 5 health dietary components (≥4.5 cups fruits and vegetables/day, ≥two 3.5-oz servings fish/week, ≥three 1-oz equivalent servings fiber-rich whole grains/day, < 1,500 mg sodium/day, and ≤450 kcal sugar-sweetened beverages/week).
4. Body mass index: ideal (< 25 kg/m^2), intermediate (25 to < 30 kg/m^2) and poor (≥30 kg/m^2).
5. Blood pressure: ideal (untreated and < 120/ < 80 mmHg), intermediate (treated to < 120/ < 80 mmHg or 120-139/80-89 mmHg) and poor (≥140/90 mmHg).
6. Fasting glucose: ideal (untreated and < 100 mg/dL), intermediate (treated to < 100 mg/dL or 100-125/mg/dL) and poor (≥126 mg/dL).
7. Total cholesterol levels: ideal (untreated and < 200 mg/dL), intermediate (treated to < 200 mg/dL or 200-239 mg/dL) and poor (≥240mg/dL).

Both husband and wife had to be aged ≥40 years for inclusion. We used baseline information to assess the presence of stroke risk factors among both partners.

2.3. Stroke risk factors

These risk factors were measured by means of interviews and procedures previously described in the Atahualpa Project [9], according to the seven metrics proposed by the American Heart Association (AHA), including smoking status, physical activity, diet, the body mass index (BMI), blood pressure, fasting glucose, and total cholesterol levels [10]. In brief, the AHA stratified each of these risk factors (or cardiovascular health metrics) in ideal, intermediate or poor according to well-defined cutoffs, as detailed in Table 1. For this study, each metric in the poor range was considered to be an individual risk factor.

2.4. Statistical analysis

Data analyses are carried out by using STATA version 15 (College Station, TX, USA). In univariate analyses, we evaluated differences in CVH metrics in the poor range between husbands (used as cases) and wives (controls), by the use of the McNemar test for correlated proportions. Generalized estimating equations (GEE) were used to calculate the Odds of a spouse's having a CVH metric in the poor range given than the other spouse's status on the same metric, after adjusting for age.

3. Results

A total of 268 couples were found among 898 individuals enrolled in the Atahualpa Project up to June 2018. Since stroke risk factors were assessed at the time of enrollment, none of the identified individuals refused to participate in this study. The mean age of these 536 individuals was 60.3 ± 11.8 years, with a significant difference across men and women (61.5 ± 11.8 *versus* 51.2 ± 11.6 years, $p < 0.001$). Regarding individual risk factors in the poor range, 20 (3.7%) individuals were current smokers, 22 (4.1%) had a poor diet, 40 (7.5%) had poor physical activity, 152 (28.4%) had a body mass index ≥30 Kg/m^2, 164 (30.6%) had blood pressure levels ≥140/90 mmHg, 150 (28%) had fasting glucose levels ≥126 mg/dL, and 55 (10.3%) had total cholesterol blood levels ≥240 mg/dL.

Table 2 shows characteristics of participants according to risk factors in the poor range. Smoking status was not included in these analyses because all current smokers ($n = 20$) were men. As noticed in the

Table 2
Characteristics of couples living in Atahualpa (both partners aged ≥40 years) according to individual stroke risk factors (cardiovascular health metrics in the poor range). In univariate analyses, the McNemar tests was used to evaluate differences in CVH metrics in the poor range between husbands (used as cases) and wives (controls). Generalized estimating equations were then used to calculate the Odds of a spouse's having a CVH metric in the poor range given the other spouse's status on the same metric, after adjusting for age. Smoking was not included in these analyses because all current smokers ($n = 20$) were men.

	Total series ($n = 536$)	Wives ($n = 268$)	Husbands ($n = 268$)	Discordant pairs (n)	Pairs with only the husband exposed	Pairs with only the wife exposed	Pairs with both partners exposed	McNemar test (univariate analyses)	Generalized estimating equations (adjusted by age)
Poor physical activity, n (%)	40 (7.5)	27 (10.1)	13 (4.9)	32	9	23	4	OR: 0.39 95% C.I.: 0.16–0.88 $p = 0.020$[a]	OR: 4.27 95% C.I.: 1.18–15.5 $p = 0.027$[a]
Poor diet, n (%)	22 (4.1)	8 (3)	14 (5.2)	14	10	4	4	OR: 2.5 95% C.I.: 0.72–10.9 $p = 0.179$	OR: 21.5 95% C.I.: 4.5–101.6 $p < 0.001$[a]
Body mass index ≥30 Kg/m^2, n (%)	152 (28.4)	88 (32.8)	64 (23.9)	102	39	63	25	OR: 0.62 95% C.I.: 0.40–0.94 $p = 0.022$[a]	OR: 1.43 95% C.I.: 0.78–2.61 $p = 0.245$
Blood pressure ≥140/90 mmHg, n (%)	164 (30.6)	71 (26.5)	93 (34.7)	102	62	40	31	OR: 1.55 95% C.I.: 1.03–2.37 $p = 0.029$[a]	OR: 1.09 95% C.I.: 0.59–2.01 $p = 0.778$
Fasting glucose ≥126 mg/dL, n (%)	150 (28)	74 (27.6)	76 (28.4)	98	50	48	26	OR: 1.04 95% C.I.: 0.89–1.58 $p = 0.839$	OR: 1.6 95% C.I.: 0.90–2.98 $p = 0.108$
Total cholesterol ≥240 mg/dL, n (%)	55 (10.3)	34 (12.7)	21 (7.8)	47	17	30	4	OR: 0.57 95% C.I.: 0.29–1.06 $p = 0.058$	OR: 1.75 95% C.I.: 0.55–5.58 $p = 0.346$

[a] Statistically significant result.

Table, univariate analyses revealed that poor physical activity ($p = 0.020$) and a BMI ≥ 30 Kg/m^2 ($p = 0.022$) were significantly more common in women, while blood pressure levels $\geq 140/90$ mmHg ($p = 0.029$) was more common in men. After adjusting for age, GEE showed that the Odds of a spouse's having poor physical activity ($p = 0.027$) and a poor diet ($p < 0.001$) were significantly higher given than the other spouse's had poor physical activity and a poor diet.

4. Discussion

This study shows that, in this remote rural setting, poor physical activity and obesity were more common in women, while arterial hypertension was more common in men. After adjusting for age, GEE show that being married to a spouse with poor physical activity and a poor diet significantly were associated with the presence of these risk factors in the other partner. Obesity and arterial hypertension were discordant among couples after adjusting for age probably because men were older than women, and the BMI tend to diminish with age while arterial hypertension tend to be more common. Fasting glucose and total cholesterol in the poor range were not related in either univariate or GGE models, probably due to genetic factors implicated in the development of diabetes mellitus and hyperlipidemia, which may not be necessarily shared by partners.

A single study in Ireland evaluated couple concordance of ideal stroke risk factors by the use of AHA criteria [11]. Results of that study (conducted in an urban developed setting) showed couple concordance for smoking, diet, blood pressure, glucose and total cholesterol. Such results differed from the present study. To our knowledge, no study has been conducted in remote rural settings to address the simultaneous presence of stroke risk factors in couples by the use of the risk factors proposed by the AHA. This, together with the population-based design and the unbiased inclusion of participants are major strengths of the present study. A limitation is its cross-sectional design. A longitudinal study is underway to assess whether incident stroke in both partners is more common among couples with similar risk factors.

5. Conclusion

This study shows that adults couples living in a remote rural setting share some stroke risk factors. Intervention strategies directed to couples is needed to improve poor healthy styles that may underlie stroke in underserved populations.

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Conflict of interest

The authors have no financial interest related to this study.

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