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## Short Communication

## Excessive daytime somnolence and cardiovascular health: A population-based study in rural Ecuador

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## ABSTRACT

In a population-based study conducted in rural Ecuador, 635 stroke-free persons aged  $\geq 40$  years were interviewed with the Epworth sleepiness scale and screened to assess their cardiovascular health (CVH) status. Excessive daytime somnolence was present in 22% persons and a poor CVH status in 69%. In a generalized linear model after adjusting for age and sex, excessive daytime somnolence was not associated with a poor CVH status or with any of the individual metrics in the poor range. Excessive daytime somnolence may not be linked to cardiovascular risk factors at the rural level.

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## 1. Introduction

Excessive daytime somnolence (EDS) is an important clinical manifestation of obstructive sleep apnea (OSA), a common disorder that significantly increases the cardiovascular risk of affected individuals [1]. Indeed, EDS has been linked to an increased prevalence of cardiovascular risk factors, and higher rates of vascular outcomes and deaths. Such studies have been conducted in large urban center [2–4]. However, no information exists on the cardiovascular correlates of EDS in underserved rural populations of Latin America. Regional epidemiologic

surveys may prove cost-effective to reduce cardiovascular consequences of sleep disorders in a given population, and will lead to informed decisions on the prioritization of existing resources. We assess EDS and its cardiovascular correlates in a Native/Mestizo population living in rural Ecuador.

## 2. Methods

Methodology of the Atahualpa Project has been detailed elsewhere [5]. After the Institutional Review Board of Hospital-Clinica Kennedy, Guayaquil (FWA 00006867) approved the protocol and

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the informed consent, trained field personnel performed a door-to-door survey to evaluate daytime somnolence and the cardiovascular health (CVH) status of all stroke-free Atahualpa residents aged  $\geq 40$  years.

The CVH status was evaluated by the use of the seven metrics proposed by the American Heart Association, including smoking status, body mass index, physical activity, diet, blood pressure, fasting glucose, and total cholesterol blood levels [6]. Each metric was categorized as ideal, intermediate or poor, and the CVH status was classified as poor if at least one metric was in the poor range. As previously described by our group, smoking status and physical activity were based on self-report; BMI ( $\text{kg}/\text{m}^2$ ) was calculated after obtaining the person's height and weight; diet was assessed by direct interviews with the aid of a food frequency questionnaire; blood pressure was measured using a well-defined protocol; and fasting glucose and total cholesterol levels were measured after obtaining a capillary blood sample, using Accu-chek® Active and Accutrend® Plus devices (Roche Diagnostics, Mannheim, Germany), respectively [7,8].

To recognize – and further exclude – patients with stroke, rural doctors screened all persons with the use of a validated field questionnaire, and then, certified neurologists confirmed the diagnosis as previously described [7,9]. According to the World Health Organization, a stroke was diagnosed in patients who had experienced a rapidly developing event characterized by clinical signs of focal or global disturbance of cerebral function, lasting more than 24 h, with no apparent cause other than vascular [10].

Daytime somnolence was assessed by the use of the Epworth sleepiness scale, which consists of eight questions rated on a four point Likert scale ranging from 0 (no chance of falling asleep) to 3 (high chance of falling asleep) with a maximum total score of 24; a score  $\geq 10$  is considered positive [11].

A generalized linear model was used to assess the relationship between EDS and CVH status and metrics after adjusting for age and sex. All variables were dichotomized and the output of the model was the odds of a given relationship. Statistical analysis was carried out by using STATA version 12 (College Station, TX, USA).

### 3. Results

The door-to-door survey disclosed 688 Atahualpa residents aged  $\geq 40$  years. Of these, 26 refused to participate and 27

were excluded because of a stroke. Therefore, daytime somnolence and CVH status were evaluated in 635 persons (mean age  $59 \pm 12.5$  years; 58% women). Overall, 140 persons (22%) had EDS, defined as a score  $\geq 10$  in the Epworth sleepiness scale. Mean age and the percentage of women were similar across persons with and without EDS. A poor CVH was noticed in 436 persons (68.7%). Persons with a poor CVH were older than those with intermediate/ideal CVH (mean  $\pm$  SD age:  $60.4 \pm 12.7$  versus  $55.9 \pm 11.4$  years,  $p < 0.001$ ), but there were no difference in the percentage of women across both groups (56% versus 61%,  $p = 0.286$ ). In a generalized linear model, after adjusting for age and sex, EDS was not associated with a poor CVH status (OR: 1.03; 95% C.I.: 0.68–1.56). The percentage of some individual metrics in the poor range – mainly physical activity and blood glucose levels – were slightly higher among persons with than in those without EDS; however, such differences did not reach statistical significance (Table 1).

### 4. Discussion

This study shows no association between EDS and a poor CVH status in Natives/Mestizos living in rural Ecuador. This could be partly related to the high number of persons with EDS, a problem that has also been reported from other rural populations [12], and that may not be necessary related to an increased prevalence of OSA, but to the peaceful lifestyle at the rural level, providing a scenario for daytime dozing. In addition, there are limitations with the use of Epworth sleepiness scale as it does not consider circadian variations and induces people to imagine themselves in situations that may not be habitual to them. Furthermore, motivation can supersede EDS at least temporarily and variations in the Epworth sleepiness scale score over time can occur.

As we assessed EDS and CVH status in a cross-sectional survey, we could not evaluate whether incident vascular events are increased among persons with EDS. Longitudinal studies in these underserved populations are warranted to settle the risk of vascular events or vascular death according to the presence of EDS (irrespective of the CVH status). In addition, it is difficult to determine the actual prevalence and severity of OSA on the basis of self-reported EDS, since the latter may be related to a number of different conditions such as metabolic or toxic diseases, or the use of certain drugs [13]. Future studies should include direct measures of sleep architecture that only polysomnography may provide [5].

**Table 1 – Cardiovascular health (CVH) status and metrics in stroke-free Atahualpa residents aged  $\geq 40$  years according to the presence of excessive daytime somnolence (positive Epworth sleepiness scale).**

|  | Total series (n=635) | Epworth positive (n=140) | Epworth negative (n=495) | p Value <sup>a</sup> |
|--|----------------------|--------------------------|--------------------------|----------------------|
| Poor CVH, %                            | 68.7                 | 70                       | 68.3                     | 0.899                |
| Poor smoking status, %                 | 1.9                  | 1.4                      | 2                        | 0.723                |
| Poor body mass index, %                | 24.7                 | 22.1                     | 25.5                     | 0.519                |
| Poor physical activity, %              | 4.7                  | 7.9                      | 3.8                      | 0.135                |
| Poor diet, %                           | 3.6                  | 5                        | 3.2                      | 0.353                |
| Poor blood pressure, %                 | 35.1                 | 34.3                     | 35.4                     | 0.472                |
| Poor blood glucose levels, %           | 28.7                 | 33.6                     | 27.3                     | 0.189                |
| Poor total cholesterol blood levels, % | 11.2                 | 7.9                      | 12.1                     | 0.155                |

<sup>a</sup> Generalized linear model, after adjusting for age and sex.

## Conflicts of interest

Nothing to disclose.

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