

Implications and expectancies of the “Atahualpa Project”: A population-based survey designed to reduce the burden of stroke and cardiovascular diseases in rural Ecuador

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Rural communities in most South American countries are going through a process called “epidemiologic transition”, where life expectancy increases and cardiovascular risk factors become more prevalent due to changes in dietary habits and lifestyles of the population.^[1] This scenario is increasing the prevalence of noncommunicable diseases – including stroke and ischemic heart disease – to the point that these conditions have been considered as the next epidemics of these regions.^[2] Accurate assessment of cardiovascular risk factors is mandatory to reduce the burden of stroke and ischemic heart disease. Such knowledge must be based on local studies evaluating specific risk factors, rather than in the extrapolation of data from studies performed in the developed world or even in urban centers from the same countries. Indeed, regional epidemiologic surveys may prove highly cost-effective for developing strategies directed to improve the cardiovascular status of a given population or ethnic group. This will lead to more informed decisions on the prioritization of existing sanitary resources which, in rural areas of many low- and middle-income countries, are already stretched to the limits.

Study design

The Atahualpa Project is a multistep, population-based study, primarily designed to evaluate the presence of cardiovascular risk factors and to determine their impact

on the burden of stroke and ischemic heart disease in rural coastal Ecuador.^[3] Atahualpa (2°18’S, 80°46’W) is a closed village located at the sea level that was selected as it is highly representative of the region. More than 95% of the population belongs to the Ecuadorian native/Mestizo ethnic groups, and their diet is rich in fish and carbohydrates, but poor in beef, polyunsaturated fats, and dairy products; there are no fast-food restaurants in the village, and most people eat at home. Most men work as carpenters, farmers, or laborers (blue-collar class), and most women are housewives. Inhabitants mobilize within the village mostly by walking or bicycle riding, as few people own a motor vehicle.

Procedures, methodology, and basal results of the Atahualpa Project are depicted in Figure 1. The first step included a three-phase, cross-sectional, population-based survey (Clinical Trials.gov identifier: NCT01627600). During Phase I, trained field personnel screened all Atahualpa residents aged ≥40 years with validated questionnaires directed to identify persons with suspected stroke and ischemic heart disease, and to evaluate the cardiovascular health (CVH) status of the population according to the American Heart Association (AHA) proposed criteria.^[4] In Phase II, certified neurologists and cardiologists moved to Atahualpa to examine all individuals who screened as suspected cases of stroke and ischemic heart disease, as well as a random sample of individuals who were considered negative during the screening phase to assess possible false-positive and negative cases during the survey. In Phase III, patients with a definitive clinical diagnosis of stroke and ischemic heart disease were invited to undergo further examination in Guayaquil, including brain MRI, MRA of intracranial vessels, 12-lead ECG, transthoracic echocardiogram, Doppler examination of extracranial arteries, and a treadmill test.

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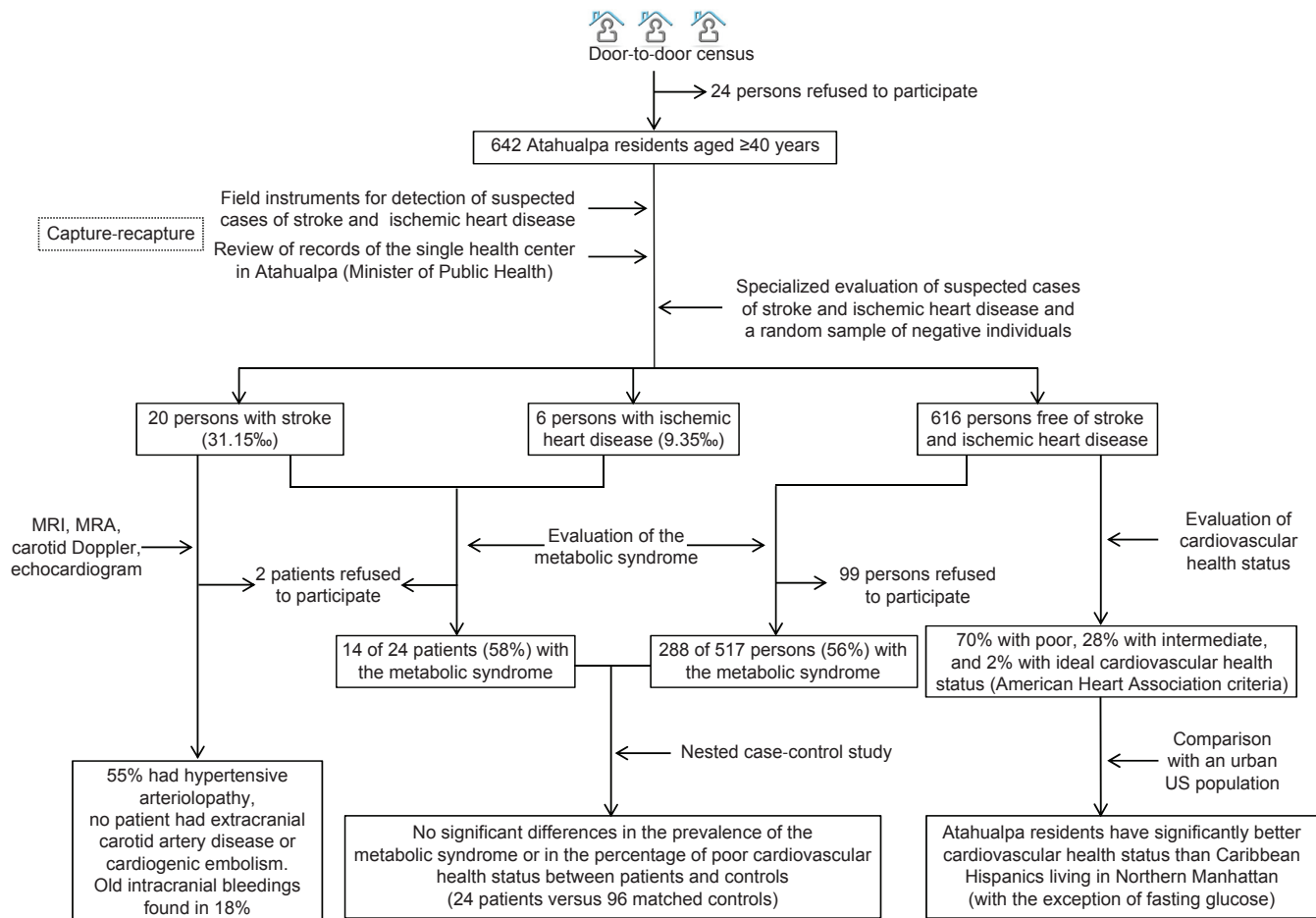


Figure 1: Basal procedures and results of the Atahualpa project

During the second step of the Atahualpa Project, a blood sample for evaluating individual components of the metabolic syndrome was drawn in all persons who signed the informed consent form (Clinical Trials.gov identifier: NCT01770054). The blood sample was drawn after an overnight fast, centrifuged at the field, and then transported to the laboratory (International Laboratory Services, S.A., Guayaquil – Ecuador), and the metabolic syndrome was diagnosed in persons who meet at least three of five individual components of the syndrome as defined in a recent consensus statement.^[5] At this step, a blood sample of consented individuals was storage at -80°C for further genetic testing.

Basal results

Most of the basal results of the Atahualpa project have been already reported. In brief, the census yielded 642 Atahualpa residents aged ≥ 40 years (mean age 59.1 ± 12.6 years, 59% women). Of these, 20 persons had a completed stroke, 6 had ischemic heart disease, and the remaining 616 were free of stroke and ischemic heart disease. Crude prevalence rates for stroke and ischemic heart disease were 31.15 and 9.35 per 1,000 population,

respectively. According to the AHA criteria, 70% of the 616 persons free of stroke and ischemic heart disease had a poor, 28% had an intermediate, and only 2% had an ideal CVH status.^[6] A further comparative study showed that Atahualpa residents have a significantly better CVH status than Caribbean-Hispanic population living in Northern Manhattan, probably as a reflection of a healthier lifestyle in a rural setting.^[7] The metabolic syndrome was present in 56% of 517 stroke-and ischemic heart disease-free persons and in 58% of 24 persons with a stroke or ischemic heart disease (Del Brutto, unpublished data). Most of the stroke patients had subcortical infarctions associated with leukoaraiosis or microbleeds.^[8] Hypertensive arteriopathy was the most likely mechanism underlying strokes (55% patients). Extracranial atherosclerotic lesions or cardiac sources of emboli were not found in any case. Comparison of our findings with a previous survey performed in the same village^[9] showed an alarming increase in stroke prevalence (from 14.08% in 2003 to 31.15% in 2012, $P=0.03$). In contrast, the rather low prevalence of ischemic heart disease (9.35%) that we found in Atahualpa could be related to the high mortality rate of this condition in a

relatively isolated village where the single Health Center is closed at night and during weekends.

Cohort study

The third step of the Atahualpa project will start on June 15, 2013 (one year after the first designed prevalence day). There, prospective incidence of stroke and ischemic heart disease will be assessed by reviewing death certificates and medical records from the single Health Center of Atahualpa (Minister of Public Health) as well as by a new door-to-door census. Definitions, methods, and data presentation will follow standard recommendations to make data reliable and comparable with other registries.^[10] Such evaluation will be carried out every year during five years to evaluate the pattern of incidence of these conditions over the time. As part of this third step, stroke and ischemic heart disease recurrence and mortality will also be assessed and, by the end of the study, it will also be possible to correlate the value of the basal CVH status of the population and the presence of the metabolic syndrome as predictors for the occurrence of vascular outcomes (stroke and ischemic heart disease). In addition, all patients with stroke will be invited to visit Guayaquil for the practice of complementary exams, which will allow precise characterization of stroke subtypes.

The Atahualpa Project also plans to perform a basal MRI and a complete battery of neuropsychological testing in the entire population of persons aged ≥ 60 years to correlate imaging findings with the presence of cognitive impairment in this age group. The same tests will be repeated after five years to evaluate any relationship between cognitive decline and the appearance of new vascular lesions (including white matter disease, microbleeds, or completed strokes) on neuroimaging studies.

During the study years, the Coordinating Center in Atahualpa will be open and staffed with medical and paramedical personnel that will be up to reach the community with information on how to improve health behaviors and how to control vascular risk factors. Trained field personnel will periodically visit the houses to monitor which percentage of the population has followed these advices.

Implications

It is our intention to present a complete report of our findings to health authorities of our country, in order

to let them know on the priorities and basic needs of Atahualpa residents, as well as our suggestions on the best cost-effective ways to improve the CVH of the rural population of coastal Ecuador at large. Methodology and operational definitions used in the Atahualpa Project could also be applied in rural areas of other middle- and low-income countries. As previously noted, this will help health authorities to learn about specific needs of a given population and to implement strategies directed to reduce the burden of stroke and cardiovascular disease in the region.

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