

Long-Term Outcomes of a Cohort of Hypertensive Subjects in Rural Ecuador



Juan Moreira^{†,‡}, Monica Marquez Figueroa[‡], Mariella Anselmi[‡], Rosanna Prandi[‡], Cintia Caicedo Montaña[‡], Damon Bell[§], Oscar Betancour^{||}, Fabio Robusto[¶], Tommaso Vannini[#], Fausto Avanzini[#], Gianni Tognoni^{**}, Maria Carla Roncaglioni[#], and the COHEMI Project Study Group*

Esmeraldas, and Quito, Ecuador; and Pescara, and Milan, Italy

ABSTRACT

Background: In contrast with the abundance of global epidemiological descriptive data on cardiovascular diseases and their risk factors, information on the outcomes of real populations prospectively followed up in their life and care settings is much rarer, especially in low-income countries.

Objectives: This study sought to evaluate the feasibility and the overall results of a hypertension control program, based mainly on a network of community nonprofessional health promoters, in the poor rural region of Borbon (Ecuador).

Methods: This is a prospective cohort study describing the results of a program of hypertension diagnosis, treatment and follow-up from 2004 to 2015 in the area, carried out mainly by the health promoters.

Results: The number of hypertensive patients identified and followed over the years increased from 1,024 in 2004 to 1,733 in 2015. The percentage of patients with no visits during a year was reduced to <10%, whereas the proportion of hypertensive subjects attending all 4 scheduled annual checks approached and, in some years, exceeded 50%. From 2004 to 2015, the proportion of patients at high or very high cardiovascular risk progressively decreased from 26.6% in 2004 to 17.5% in 2015 (p for trend <0.01), whereas the proportion of hypertensive patients at low or very low risk increased from 30.4% in 2004 to 45.0% in 2015 (p for trend <0.01).

Conclusions: In a poor, disadvantaged area, a strategy of control mainly based on the involvement and responsibility of community health promoters (with health professionals as supporters more than direct actors) can achieve adequate follow-up of the population of hypertensive patients and improve their global cardiovascular risk level.

The dominant role of the cardiovascular component of the noncommunicable chronic disease burden in high- and low-income countries has received growing attention over the last few years, as documented in regularly updated major global databases [1-3]. Hypertension is increasingly recognized as a major cause of cardiovascular mortality and morbidity in low-income countries [4,5], but little is known about how to face this common risk factor with limited economic and professional resources, particularly in remote rural areas [6].

In contrast with the abundance of global epidemiological descriptive data on cardiovascular diseases and their risk factors, information is definitely much rarer on the outcomes of real populations prospectively followed up in their life and care settings, though regularly advocated as a priority, especially in low-income countries. Locally adjusted and integrated planning and monitoring policies of human as well as economic and structural resources are the only reliable indicators for effective interpretation of top-down guidelines close to real needs.

Following the stimulating early results of a project of diagnosis and treatment of hypertension developed in the 1990s in a rural area of Ecuador [7], we present here its long-term outcomes, expressed by 2 complementary sets of data: 1) the feasibility and overall results of the hypertension control program implemented in the area, based mainly on a network of community nonprofessional “health promoters” [8]; and 2) the prospective epidemiological outcome profile of the initial cohort of hypertensive subjects, whose essential risk stratification compared favorably with that of the World Health Organization [9].

METHODS

The geographic, socioeconomic, and background health organization of the project has been described in previous reports [7-9]. The health region of Borbon, in the province of Esmeraldas in Ecuador, is a territory of 5,000 km² of equatorial forest, with approximately 25,000 inhabitants (85% Afro Ecuadorians, 10% indigenous Amerindian, 5%

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From the †Centro de Epidemiologia Comunitaria y Medicina Tropical, Esmeraldas, Ecuador; ‡Department of Mathematics, Universidad San Francisco de Quito, Quito, Ecuador; ||Fundación Salud, Ambiente y Desarrollo, Quito, Ecuador; ¶Center for Outcomes Research and Clinical Epidemiology, Pescara, Italy; #Laboratory of Cardiovascular Prevention, Istituto di Ricerche Farmacologiche Mario Negri, Istituto di Ricovero e Cura Carattere Scientifico, Milan, Italy; and the **Istituto di Anestesia e Rianimazione, Università degli Studi di Milano, Ospedale Maggiore, Istituto di Ricovero e Cura Carattere Scientifico, Milan, Italy. Correspondence: M. C. Roncaglioni (carla.roncaglioni@marionegri.it).

* COHEMI Project Study Group listed in the [Online Appendix](#).

† Dr. Moreira is deceased.

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whites), dispersed over 129 villages bordering 3 rivers, which are almost the sole communication and transport routes. The socioeconomic situation comprises 84% of poor community dwellers, and 34% of them are very poor.

The health system has a community 20-bed hospital and 12 health centers along the rivers, served mainly by a core group of 50 health promoters, backed by the irregular presence of health professionals (nurses and doctors mainly during their training). Each health center is responsible for part of the population, to ensure education, prevention, control, and care of that population. Each health center's population includes children <5 years of age; pregnant women; and chronic patients with tuberculosis, arterial hypertension, or diabetes mellitus. The inclusion of hypertension among the priority areas of care became mandatory because Afro Ecuadorian descent is associated with a clear excess risk of cerebrovascular events, even among younger people [7].

From 1995 to 2001, as part of community intervention activities, blood pressure was measured in the population >18 years of age. The results of the screening program, which involved 4,284 people in 100 of 129 communities, have been reported elsewhere [7]. Briefly, 36% of the individuals were hypertensive (blood pressure 140/90 mm Hg or more or had been prescribed antihypertensive drugs); about one-tenth of them were being treated with antihypertensive drugs; and <1% were well controlled (blood pressure lower than 140/90 mm Hg).

The organizational and economic restrictions meant there was a need to stratify the level of cardiovascular risk for people identified as hypertensive and to give priority to pharmacological treatment for those at higher risk of complications. A simple "essential" method for risk classification was developed and validated to define the individual cardiovascular risk as very low, low, medium, high, or very high, according to simple variables not requiring laboratory or instrumental tests (i.e., age, sex, blood pressure, smoking, and history of diabetes or cardiovascular disease) [9] (Online Figure S1).

In each community, the health promoters were responsible for keeping a register of births and deaths, as well as the basic data on care delivered to the risk groups. A monthly meeting, with the mandatory participation of the health promoters and the professionals, was dedicated to the discussion and validation of the reported critical, fatal, and nonfatal events (with specific focus on stroke, transient ischemic attack, myocardial infarction, and heart and renal failure) and to planning monitoring programs in the villages. The specific program for hypertension includes periodical community visits by the promoters, together with professionals, when available, to measure blood pressures of known hypertensive patients and update their individual global cardiovascular risk profiles.

After the original survey, new hypertensive patients were identified using the same diagnostic criteria, following an opportunistic screening (blood pressure was measured as part of the routine evaluation of subjects coming to the

attention of the health team for any reason), and entering the follow-up.

All hypertensive patients were encouraged to reduce their salt intake and, if appropriate, their caloric intake. Hypertensive patients at higher risk were candidates for a drug prescription. Diuretics and calcium antagonists were the preferred antihypertensive drugs. Following a long period of drug distribution with the cooperation of a few foreign institutions based on a symbolic monthly payment of US\$1, since 2008 antihypertensive treatments have been free as part of the newly established national health service.

In the follow-up of hypertensive subjects, each member of the health team was assigned a specific task. Physicians prescribed antihypertensive treatments on the basis of cardiovascular risk, blood pressure, diseases, complications, and/or side effects, with the aim to bring blood pressure <140/90 mm Hg. Health promoters and ancillary nurses organized educational activities, dispensed antihypertensive drugs, measured and recorded blood pressure, and assessed cardiovascular risk in the epidemiological workbook [8]. The role of health promoters, all well-known members of the local life and care setting, was the key element of continuity, as home visits and recalls when needed could be ensured. Their role was also essential for creating constant dialog with the community; to do so, they used several tools: discussion of life histories of deaths and serious cases; educational talks providing information on the cardiovascular risk of the community, illustrating the individual and the community changes in the cardiovascular risk over time (Online Figure S2); and meetings with focus groups to understand why hypertensive patients were not willing to take their tablets.

A target of at least 4 control visits each year for all hypertensive subjects was recommended as an educational tool on the need for prompt intervention for severe cases, and an opportunity to create a habit of compliance to healthy lifestyles and antihypertensive treatment. Patients who did not attend follow-up visits were seen at home. A yearly community-wide report served for collective discussion of the program and for shared decisions on individual and community priorities.

This study describes the results of the program of hypertension diagnosis, treatment, and follow-up in the region of Borbon from 2004 to 2015.

Data analysis and statistics

Age was divided into 3 groups: <40; 40 to 59; and ≥60 years. Cardiovascular risk was grouped in 6 classes: very high; high; moderate; low; very low; and unknown (in case of no visits in the year or missing data for the calculation of cardiovascular risk). Follow-up was defined as the time between the 2004 assessment of cardiovascular risk and the last visit or an event. Proportions of patients for each cardiovascular risk level were computed from yearly 2004 to 2015. The Cochrane-Armitage test was used to plot the trend of risk levels over the years.

The rates of the outcomes (fatal events, fatal cardiovascular events, nonfatal cardiovascular events, and a combined outcome of fatal and nonfatal cardiovascular events) were computed for each risk level as the number per 1,000 patient-years and their incidences were plotted using Kaplan-Meier estimates; the significance of cardiovascular risk level differences was assessed with a log-rank test. A 2-sided value of $p < 0.05$ was considered significant. Analyses were done with Stata version 13.0 (Stata Corp LP, College Station, TX), and SAS software version 9.4 (SAS Institute, Cary, NC).

RESULTS

Table 1 shows the number of hypertensive patients followed and the number of control visits per year from 2004 to 2015. The size of the hypertensive groups for each year is the sum of known and new patients who entered the program minus those who left the area (mostly migrations within and outside the country). The number of hypertensive patients followed over the years increased from just over 1,000 in 2004 to over 1,700 in 2015. Despite the increasing numbers of subjects to follow, <10% of patients had no checks during the last years while the proportion of hypertensive subjects attending all 4 scheduled annual checks approached and, in some years, exceeded 50%.

Even more informative for documenting the profiles of care of the index cohort are the data in Figure 1, which illustrate the patterns of risk stratification of the hypertensive populations from 2004 to 2015. Over the years, the proportion of patients whose overall cardiovascular risk was not known fell progressively, from 18.2% in 2004 to 8.2% in 2015 (p for trend <0.01). From 2004 to 2015, the proportion of patients at high or very high cardiovascular risk decreased from 26.6% in 2004 to 17.5% in 2015 (p for trend <0.01), whereas the proportion at low or very low risk rose from 30.4% in 2004 to 45% in 2015 (p for trend <0.01).

To further test the predictive value of the “essential” risk stratification, we examined the long-term outcomes of the initial cohort of hypertensive patients known in 2004, whose baseline characteristics are summarized in Table 2. Almost all the hypertensive patients were black (961 of 1,024, 94%). The majority were women (652 vs. 372 men, 74% vs. 26%). There were 22% under the age of 40, 44% between 40 and 59, and 34% 60 years or more. A quarter (24.6%) were at high or very high cardiovascular risk. In a median follow-up of 7.3 ± 2.7 years in this cohort of 1,024 hypertensive patients, there were 213 deaths, 87 (41%) due to cardiovascular causes (54 strokes, 20 heart failures, 8 myocardial infarctions, 3 sudden deaths, and 2 renal failures) and 108 nonfatal cardiovascular events (69 strokes, 37 heart failures, 22 transitory ischemic attacks, 4 other events). Figure 2 and Table 3 show the higher incidence of outcomes in hypertensive patients at high risk.

TABLE 1. Numbers of follow-up visits per year for hypertensive subjects from 2004 to 2015

Year	Hypertensives	Follow-Up Visits per Year		
		0	1–3	≥4
2004	1,024	150 (14.7)	454 (44.3)	420 (41.0)
2005	1,122	230 (20.5)	481 (42.9)	411 (36.6)
2006	1,107	141 (12.7)	696 (62.9)	270 (24.4)
2007	1,346	199 (14.8)	937 (69.6)	210 (15.6)
2008	1,410	199 (14.1)	798 (56.6)	413 (29.3)
2009	1,503	180 (12.0)	780 (51.9)	543 (36.1)
2010	1,571	157 (10.0)	736 (46.8)	678 (43.2)
2011	1,611	160 (9.9)	667 (41.4)	784 (48.7)
2012	1,667	118 (7.1)	665 (39.9)	884 (53.0)
2013	1,726	139 (8.1)	777 (45.0)	810 (46.9)
2014	1,757	199 (11.3)	679 (38.7)	879 (50.0)
2015	1,733	142 (8.2)	544 (31.4)	1,047 (60.4)

Values are n or n (%).

DISCUSSION

The first take-home message of this report (Figure 1, Table 1) can be summarized as follows: in a poor disadvantaged area, a strategy of hypertension control based mainly on the involvement and responsibility of community health promoters (with health professionals backing them for quality control more than direct actors) is capable of ensuring compliance to the recommended protocol in the long term.

The possibility of describing the long-term outcome of the initial cohort of hypertensive patients in terms of fatal and nonfatal events (Figure 2) in relation to the baseline risk stratification (Table 2) is certainly indicative of an effective follow-up and in this setting this is the decisive factor for good quality of care in chronic conditions; it is very likely the result of the acknowledged alliance between

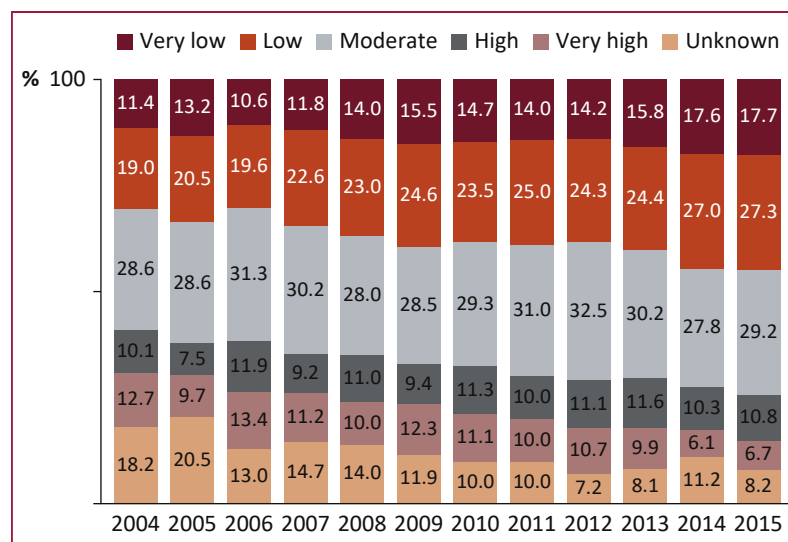


FIGURE 1. Cardiovascular risk profile of the overall hypertensive population during the follow-up (% of the yearly cohorts).

TABLE 2. Baseline characteristics of the initial cohort of 1,024 hypertensive subjects according to their level of cardiovascular risk

Cardiovascular Risk	Very High	High	Moderate	Low	Very Low	Unknown
Subjects	130 (12.7)	122 (11.9)	274 (26.8)	195 (19.0)	117 (11.4)	186 (18.2)
Afro Ecuadorian	124 (95.4)	115 (94.3)	259 (94.5)	186 (95.4)	111 (94.9)	166 (89.2)
Female	68 (52.3)	95 (77.9)	169 (61.7)	137 (70.3)	82 (70.1)	101 (64.3)
Age, yrs						
<40	4 (3.1)	27 (22.1)	28 (10.2)	59 (30.3)	59 (50.4)	48 (25.8)
40–59	42 (32.3)	72 (59.0)	118 (43.1)	74 (37.9)	55 (47.0)	88 (47.3)
≥60	84 (64.6)	23 (18.9)	128 (46.7)	62 (31.8)	3 (2.6)	50 (26.9)

Values are n (%).

patients and their community carers. A culture of participation—so often preached more than practiced in “developed” societies—is especially important in low- and middle-income countries, provided it involves shared understanding of what is essential. The decisive role of health promoters who belong to the community and share its behavior more than just notions is clear.

Comparing the outcomes of our cohort with those of “similar” cohorts would at first sight be interesting even if not needed. A reliable comparison, however, would be impossible and probably inappropriate, not only because of the rarity of field studies with comparable designs [10–13], but even more because the unavoidable variability of the nonmedical variables and the settings of care weigh

more and are closer to reality than measures standardized and imposed in a formal comparative protocol. The parallel work in Ecuador on the incoherence and irrelevance for Latin America of protocols recommended by international groups based on E.U. and/or U.S. care contexts is highly instructive [14].

The main positive result on hypertension control is that noncommunicable chronic diseases, often presented as a new and/or different challenge for low- and middle-income countries, can be considered in close continuity with the strategies adopted in the same area for other “chronic” conditions such as pediatric malnutrition, infectious diseases (onchocerciasis, yaws, tuberculosis, malaria), or mental health [15–17]. The main thing is to ensure the

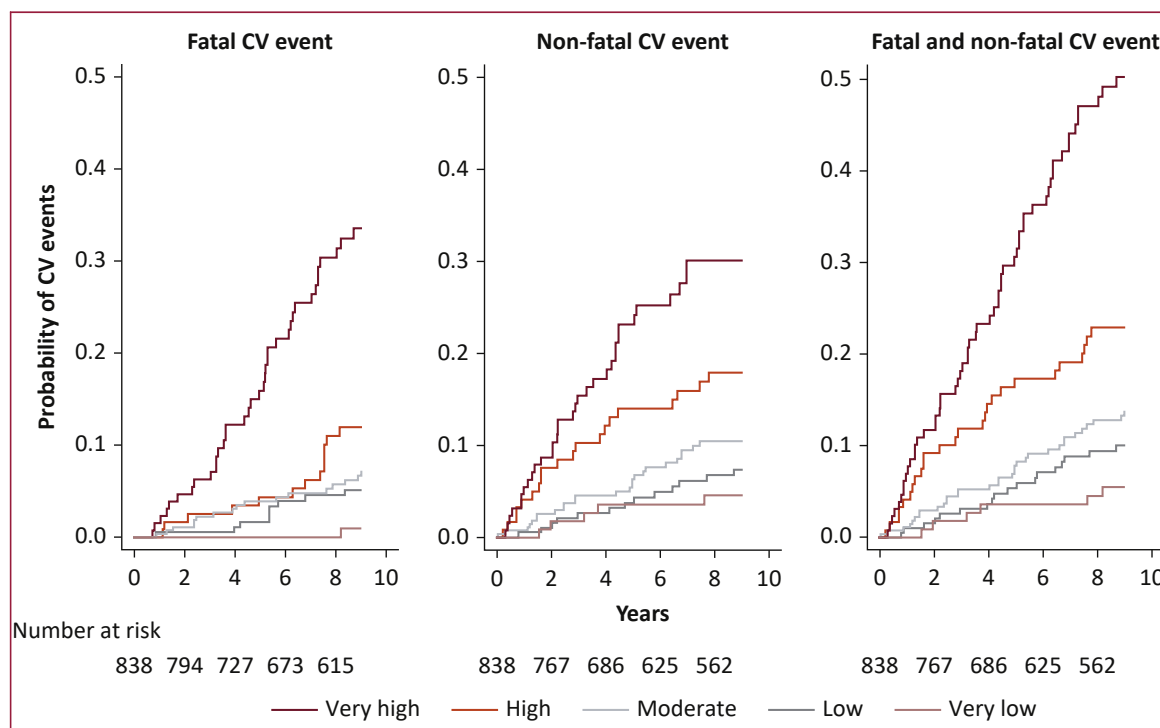


FIGURE 2. Time to first nonfatal and fatal cardiovascular (CV) event in the initial cohort of hypertensive subjects, by level of cardiovascular risk.

TABLE 3. Outcomes from 2004 to 2014 of the initial cohort of 1,024 hypertensive subjects

Cardiovascular Risk	Very High (n = 130)	High (n = 122)	Moderate (n = 274)	Low (n = 195)	Very Low (n = 117)	Unknown (n = 186)
Fatal events	57 (65.9)	24 (25.1)	63 (30.2)	31 (19.1)	5 (5.1)	33 (17.7)
Fatal cardiovascular events	37 (42.8)	13 (13.6)	17 (8.1)	9 (5.7)	1 (1.0)	10 (5.4)
Nonfatal cardiovascular events	33 (44.4)	21 (23.1)	25 (12.4)	13 (8.4)	5 (5.2)	11 (5.9)
Fatal or nonfatal cardiovascular events	57 (76.7)	26 (30.0)	33 (16.4)	18 (11.7)	6 (6.3)	19 (10.2)

Values are n (rate per 1,000 patient-years).

same habits of continuous attention and participation by the community and to adopt tailored target strategies for each problem.

Hypertension, like the emerging problem of diabetes, could certainly be seen as a question of access to and compliance with pharmacological treatments. This goal (at present formally ensured in Ecuador) will not be reached, however, if drugs remain the most important tool guaranteeing successful intervention, rather than long-term faith in risk control where knowledge is a shared component of reciprocal trust.

A last note—methodological and cultural—touches a sensitive issue in relation the ascertainment of events on which planning and intervention measures are assessed in terms of quality and yields before and after. The procedure adopted in community epidemiology over the years with the same criteria for all events, independently of the underlying or suspected cause and/or disease, involves formal reporting such as a “verbal autopsy.” The collective context-oriented interpretation of this technique of event qualification is increasingly recognized [18]. Training promoters to collect, report, judge, and verify cases, basing their narratives on facts, in regular dialog with a professional provides strong backing for their responsibility and accuracy in pursuing what is most likely and plausible and/or needs confirmation.

CONCLUSIONS

Like many low- and middle-income countries, Ecuador today faces the challenge of implementing the principles and mandates of its Constitution, which clearly indicates health as a fundamental human right. The model prescribed, in the framework of the sustainable development goals, coincides with the strategies promoted by Universal Health Coverage, which have professionals as the core of the system, whereas health promoters are excluded from autonomous roles in delivery of care and responsibility. Central planning of peripheral activities depends on professional nurses and doctors, who rarely have the time and the flexibility to tailor their activities to the highly variable and unpredictable needs of dispersed communities. This study indicates that in a poor, disadvantaged area, a strategy of control mainly calling on the involvement and responsibility of community health

promoters can achieve adequate follow-up of the population of hypertensive subjects and improve their global cardiovascular risk level.

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