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# Frequency of cardiovascular diseases and risk factors treated in France according to social deprivation and residence in an overseas territory ☆

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ABSTRACT

*Background:* The frequencies of treated cardiovascular disease (CVD) and their associated risk factors (CVRF) may vary according to socioeconomic and territorial characteristics.
*Methods:* These frequencies have been described for 48 million policyholders of the French general health insurance scheme, according to a metropolitan geographical deprivation index in five quintiles (from the least to the most deprived: Q1 to Q5), the existence of universal complementary health cover (CMUC) in individuals under the age of 60, and residence in a French overseas territory (FOT). The information system (SNIIRAM) was used to identify CVDs and anti-diabetic, anti-hypertensive or lipid-lowering treatments by three reimbursements in 2010.
*Results:* After age- and sex-specific adjustment, the inhabitants of the most deprived areas more often suffered from distal arterial disease (Q5/Q1 = 1.5), coronary artery disease (1.2) and cerebral vascular accident (1.1), as did the CMUC beneficiaries compared to non-beneficiaries (ratios of 1.7, 1.3 and 1.5), and the FOT residents in comparison to the most deprived metropolitan quintile (Q1), with the exception of coronary artery disease (1.2, 0.6 and 1.2). Inhabitants of the most deprived areas more often received anti-diabetic and anti-hypertensive treatment (Q5/Q1 = 1.4 and 1.2), as did the people on the CMUC (2.0 and 1.2) and the FOT inhabitants (FOT/Q1 = 2.4 and 1.3). These ratios were of 1.1, 1.0 and 0.8 for lipid-lowering drugs.
*Conclusion:* These results pinpoint populations for which specific preventative initiatives could be supported. While health care service utilisation is facilitated (CMUC), it is probably not yet effective enough in view of the persistent increased cardiovascular risk.



## 1. Introduction

Cardiovascular disease (CVD) is a major cause of morbidity, mortality and health expenses. While the number of patients is increasing for some CVDs owing to demographic changes, the adjusted mortality and morbidity rates have been falling in industrialised countries since the 70s. This evolution is attributed to improved patient treatment, invasive treatment of diseases, and also screening of cardiovascular risk factors (CVRF) and their prevention [1–5]. However, there are still socioeconomic inequalities of frequency and time evolution of CVDs, particularly for coronary artery disease, stroke and arterial disease of the lower limbs [6–10]. Socioeconomic inequalities have also been noted in the frequency and treatment of CVRF such as diabetes, arterial hypertension (AHT), lipid abnormalities, obesity and smoking [11–17].

Despite improved screening and the intensification of treatments in many countries, discrepancies between socioeconomic levels are increasing, stabilising or, more rarely, falling. Thus, in the United States, these discrepancies persist for the frequency of AHT and hypercholesterolemia, and an increase in smoking and diabetes has been noted among the most deprived [11,12]. In England, these discrepancies in frequency remain for hospitalisations for coronary disease, are rising in women for smoking and AHT, but are falling in men for hypercholesterolemia and AHT [10,13].

This study, conducted among policyholders of the general health insurance scheme in 2010 i.e. almost 75% of the French population,

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reports the frequencies of three CVDs, blood lipid and glycaemia assays, treatments for diabetes, hyperlipidaemia and AHT, according to the level of social deprivation. To achieve this, two social deprivation markers were used: the existence of universal complementary medical cover (CMUC) in people under the age of 60 in France as a whole, and a metropolitan geographic index of social deprivation. The French overseas territories (FOTs) were individualised, given their socio-demographic and epidemiological specificities.

## 2. Methods

### 2.1. Population and data

In 2010, the general health insurance scheme, excluding local mutual sections, covered almost 44 million people over the whole of France. The national health insurance inter-scheme information system (SNIIRAM) includes an individualised and anonymous database which exhaustively records all healthcare consumption, carried out as outpatients or in external consultation, reimbursed by health insurance, with an anteriority limited to three years plus the current year. Other information is available, such as the town of residence and the existence of 100% reimbursement for care for some long-term illnesses (LTI) awarded after ruling by a medical advisor of the health insurance fund. All of this information can be merged to that collected upon hospitalisation by the French hospital discharge database (PMSI: programme de médicalisation des systèmes d'information). The diagnoses are coded in accordance with the International Classification of Diseases, 10th version (ICD-10).

#### 2.1.1. Definitions

A social deprivation index in quintiles was used [18]. It was constructed at the commune scale (smallest administrative unit, 36,000 units in mainland France) according to the four factors resulting from data published by the INSEE (Institut National de la Statistique et des études économiques [National Institute For Statistics And Economic Studies]): average household income, the percentage of bachelors (school leavers in France who have passed the Baccalaureate exam) among inhabitants aged 15 and over, the percentage of blue-collar workers in the active population and unemployment levels. The index could not be calculated for FOTs and all policyholders of the general scheme in Guadeloupe, Martinique, French Guyana and La Réunion were studied specifically.

Another deprivation marker used was the existence, or lack thereof, of a universal complementary health cover (CMUC), which is granted for one year subject to a stable and regular residence in France for over three months and a low income. In 2010, the income limit was 8000 euros per annum for a single person, and it increased according to the number of people in the household. This limit is below the poverty threshold defined at 50% of the median income, being 9540 euros in 2009. The household may include the applicant, his/her spouse, partner and children. The CMUC covers some of the expenses not covered by the Health Insurance and enables beneficiaries to access treatment without advancing costs and without exceeding reimbursed costs with a reimbursement of 100%. The analysis of CMUC beneficiaries was limited to people under the age of 60, as other social grants are available after this age.

The prevalence of CVDs over the whole of the study population was estimated by the presence of an LTI with a specific ICD-10 code before or during the year 2010, and/or the existence of short-term hospitalisation in 2010 with the specific ICD-10 code as main or associated diagnosis. The selected diseases were coronary artery disease and myocardial infarction (I20 to I25, 162,000 people), stroke (I61 to I64, I69, G45, 337,000 people) and atherosclerosis of arteries of extremities (I70.2, 260,000 people). Among all people, or those without CVD, the existence of a treatment for each of the CVRF selected was estimated by the existence of three or more reimbursements (with the exception of large quantities, with two reimbursements) for an indicated drug. These were identified in the SNIIRAM by the ATC (Anatomical Therapeutic Chemical Classification System) classes and the corresponding CIP codes (Presentation ID Code). For hyperlipidaemia, this was class A10 (fibrates and statins). Anti-hypertensive drugs were those whose marketing authorisation mentions an indication for treatment of AHT, being classes C02: anti-hypertensive drugs, C03: diuretics, C07: beta-blockers, C08: calcium channel blockers, and C09: drugs acting on the angiotensin renin system. For diabetes, class C10 was used. Among the people without CVD or treated CVRF, at least one reimbursement in the year 2010 of an assay in a local laboratory for glycaemia, BhA1c and lipids (cholesterol and triglycerides) was taken into account.

### 2.2. Statistical analysis

Depending on the group studied, rates were adjusted to age and sex using the population of policyholders on 1 January 2011. The results were presented in the form of ratios between the adjusted frequencies of two categories. For metropolitan France, this was the ratio between the quintiles of the least and most deprived quintiles (Q5/Q1). For the FOTs, it was the ratio of their frequency to that of the quintile of the least (FOT/Q1) or the most (FOT/Q5) deprived metropolitan French towns. For people under the age of 60 on the CMUC, the ratio was calculated between the groups with or without CMUC over the whole of France. The analyses were conducted using the SAS Enterprise Guide 4.3, SAS Institute inc Cary, NC software.

## 3. Results

The total size of the target population was 48.1 million (average age 38, 53% women) (Table 1). The study on geographic social deprivation in metropolitan France concerned 46.7 million people (average age 38, 53% women). For the FOTs, the number was 1.4 million (average age 34, 55% women) and for CMUC beneficiaries under the age of 60 it was 4.5 million (average age 24, 55% women).

After age-specific adjustment, the frequencies of each CVD selected were higher in men than in women for all quintiles of social deprivation in metropolitan France, existence of a CMUC and residency in a FOT (Table 2). The same applied for the highest age categories, after sex-specific adjustment.

### 3.1. Social deprivation in metropolitan France

Stroke was slightly more common in inhabitants of the most deprived areas (Q5/Q1 = 1.1) as was coronary artery disease (Q5/Q1 = 1.2), and particularly atherosclerosis of the distal arteries (Q5/Q1 =

**Table 1**
Characteristics and frequencies of cardiovascular disease according to quintiles of a geographic index of social deprivation in metropolitan France, residence in a FOT, and existence of universal supplementary medical cover (CMUC).

| | Metropolitan France | | | | | | FOTs | CMUC (age <60) | | Ratios | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | Q1[a] | Q2 | Q3 | Q4 | Q5[a] | | Yes | No | Q5/Q1 | FOT/Q1 | FOT/Q5 | CMUC/Non CMUC |
| Number of policyholders (million) | 46.7 | 14.2 | 9.4 | 7.0 | 7.7 | 8.5 | 1.4 | 4.5 | 33.6 | | | | |
| Average age (years) | | | | | | | | | | | | | |
| Total | 38.2 | 38.0 | 38.3 | 38.8 | 38.7 | 37.6 | 33.7 | 24.1 | 29.8 | | | | |
| Women | 39.7 | 39.4 | 39.9 | 40.4 | 40.3 | 39.0 | 35.0 | 25.2 | 30.5 | | | | |
| Men | 36.6 | 36.5 | 36.6 | 37.0 | 36.9 | 36.0 | 32.1 | 22.7 | 29.2 | | | | |
| Women (%) | 53.2 | 53.1 | 53.3 | 53.4 | 53.4 | 52.9 | 55.0 | 55.1 | 51.2 | | | | |
| *Raw frequency (%)* | | | | | | | | | | | | | |
| CMU-C (%) | 8.8 | 5.8 | 8.6 | 8.3 | 10.2 | 13.7 | 42.1 | 100.0 | 0.0 | | | | |
| Stroke (%) | 0.7 | 0.6 | 0.7 | 0.7 | 0.8 | 0.7 | 0.6 | 0.19 | 0.19 | | | | |
| Coronary artery disease (%) | 0.3 | 0.3 | 0.3 | 0.4 | 0.4 | 0.4 | 0.2 | 0.12 | 0.15 | | | | |
| Distal atherosclerosis (%) | 0.5 | 0.4 | 0.5 | 0.6 | 0.6 | 0.6 | 0.4 | 0.14 | 0.14 | | | | |
| *Frequency adjusted to age and sex (%)* | | | | | | | | | | | | | |
| Stroke (%) | 0.74 | 0.70 | 0.73 | 0.75 | 0.75 | 0.79 | 0.87 | 0.22 | 0.15 | 1.1 | 1.2 | 1.1 | 1.5 |
| Coronary artery disease (%) | 0.36 | 0.33 | 0.35 | 0.36 | 0.37 | 0.41 | 0.21 | 0.16 | 0.12 | 1.2 | 0.6 | 0.5 | 1.3 |
| Distal atherosclerosis (%) | 0.57 | 0.47 | 0.57 | 0.61 | 0.61 | 0.69 | 0.57 | 0.19 | 0.11 | 1.5 | 1.2 | 0.8 | 1.7 |

FOTs: French overseas territories.
[a] Q1: least deprived quintile, Q5: most deprived quintile.