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Incidence of acute myocardial infarction in first and second generation minority groups: Does the second generation converge towards the majority population?

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ABSTRACT

Background: Differences in acute myocardial infarction (AMI) incidence between ethnic minority and migrant groups (henceforth, minority groups) and the majority population have been reported. Health differences may converge towards the majority population over generations. We assessed whether AMI incidence differences between minority groups living in the Netherlands and the Dutch majority population exist, and whether the incidence converges towards the majority population over generations.

Methods: A nationwide register-based cohort study was conducted from 1997 to 2007. Using Cox Proportional Hazard Models AMI incidence differences between minorities and the majority population were estimated. When possible, analyses were stratified by generation.

Results: AMI incidence differences between minorities and the majority population depended on the country of origin, and often varied between minorities originating from the same geographical region. For example, among North African and Mediterranean minorities, incidence was higher in Turkish (Hazard Ratio (HR): 1.34; 95% Confidence Interval (95% CI): 1.28–1.41), but lower in Moroccans (HR: 0.46; 95% CI: 0.40–0.52) compared with the majority population. Most minorities had a similar or lower incidence than the majority population, which remained similar or converged towards the incidence of the majority population over generations. In contrast, among minorities from the former Dutch colonies (Suriname, Indonesia, Netherlands Antilles) beneficial intergenerational changes were observed.

Conclusions: Health care professionals and policy makers should be aware of substantial AMI incidence differences between minority groups and the majority population, and the often unbeneficial change over generations. Future research should be cautious when clustering minority groups based on geographical region of the country of origin.

1. Introduction

The Netherlands is an ethnically diverse country; 10 to 20 percent of the population is of foreign origin. Of all ethnic minority and migrant groups (henceforth, minority groups) residing in the Netherlands more than half originates from non-Western countries, mainly from Turkey, Morocco, Suriname, Indonesia and the Netherlands Antilles. Of the Western minorities, about one third originates from countries surrounding the Netherlands (Germany, Belgium, and the United Kingdom). In addition, there is a variety of smaller groups from all over the world.

Previous research in several Western countries reported differences in coronary heart disease (CHD) between minority groups and the majority population [1,2]. However, evidence is scarce and often related to mortality instead of incidence [3]. Studies regarding incidence differences mainly reported a higher CHD incidence in minority groups compared to the majority population [4–9]. Factors that cohere with immigration (stress, poverty, low socioeconomic status (SES), language barriers), preservation of an unfavorable risk factor profile, and genetics have been suggested as potential factors that may underlie this higher incidence [10]. Yet, in some minority groups CHD incidence was lower [6,8]. The 'healthy migrant effect', characterized by superior health and financial status of migrant populations relative to populations that stay behind, is often seen as the underlying explanatory factor [11].

It has been suggested that health differences between minority groups and the majority population might be more profound in those who migrated than in their offspring due to acculturation towards the majority population [12]. Factors that coincide with immigration and the healthy migrant effect diminish over time and generations. To our knowledge, only one study investigated this trend over generations with respect to CHD incidence. Results showed that the higher incidence in first generation minorities converged towards the incidence of the majority population in the second generation, but in women only [8]. Unfortunately, analyses were limited to European minorities and, because of small numbers, minority groups from different countries of origin were merged which complicates interpretation of results.

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In the present follow-up study, nationwide registers were used to determine the incidence of acute myocardial infarction (AMI) in the Dutch majority population and in a wide range of minority groups living in the Netherlands from all over the world. The first aim was to investigate AMI incidence differences between minority groups and the Dutch majority population. The second aim was to investigate whether incidence differences seen in first generation minorities converge towards the Dutch majority population over generations.

2. Methods

2.1. Cohort enrolment

A nationwide register-based cohort study was conducted. The Population Register (PR), Hospital Discharge Register (HDR), Cause of Death Register (CDR), and Regional Income Survey (RIO) were used to obtain information regarding demographic factors, AMI hospitalizations, fatal AMI events, and co-morbidities. The registers are described in detail previously [13]. The overall quality of Dutch national registers proved to be high [14].

By linking previous registers with a personal identifier a cohort was build, starting at January 1st 1997. On January 1st 1997, 15,045,392 Dutch citizens (16.4% migrants) with no previous hospital admission for AMI (ICD-9-code 410) or old AMI (ICD-9-code 412) during 1995 and 1996 were registered in the PR. Only persons registered during the whole period between January 1st 1995 and January 1st 1997 were included to ensure a minimal residing period in the Netherlands of two years, and to enable taking medical history data into account for every person under study. Due to the absence of a personal identifier in the HDR, the PR and HDR could only be linked via the combination of date of birth, sex and four digits of the postal code as identifying key. In case of multiple persons with an identical identifying key (non-uniqueness), PR and HDR could not be validly linked. Persons who were not present or not unique in the PR between January 1st 1995 and January 1st 1997 were excluded (3,071,969 persons, 24.2% migrants). As interest is in AMI, persons younger than 30 years of age were excluded (4,371,638 persons, 17.3% migrants). The final cohort comprised 7,601,785 persons.

2.2. Follow-up

From January 1st 1997 persons were followed until their first AMI event, comprising a hospital admission with AMI as primary or secondary diagnosis (ICD-9-code 410), or an out-of-hospital death with AMI as primary or secondary cause (ICD-10 code I21). The validity of these ICD-codes proved to be good [15]. Persons were censored in case of death, non-uniqueness, emigration, or the end of the study period at December 31st 2007, whichever came first.

2.3. Determinants

2.3.1. Minority groups

Minority groups were constructed based on the country of birth of the resident and his/her parents, according to the definition of Statistics Netherlands [16]. A person is considered a minority if he/she was born abroad and at least one of the parents was born abroad (first generation minority), or if he/she was born in the Netherlands with at least one of the parents born abroad (second generation minority). A person belongs to the majority population when both parents were born in the Netherlands.

2.3.2. Explanatory variables

2.3.2.1. Areal income. Areal income was based on income data registered in the RIO [17]. The RIO started in 1994, when a representative sample of 1.9 million Dutch residents was selected. Every year, the sample was corrected for emigration and mortality on one hand, and immigration and birth on the other hand. All residents belonging to the households of the sample population (about 5 million residents) were included in the RIO. Mean disposable income of the residents with income data available in each neighborhood was calculated for 1997, and assigned to all persons living in that neighborhood on January 1st 1997. Areal income was divided in tertiles, with the first tertile representing the lowest income group.

2.3.2.2. Co-morbidity. Presence and extent of co-morbidity were determined with the Charlson Index Score based on previous hospital admissions [18], which proved to be a reliable and valid method to measure co-morbidity in clinical research [19]. The Charlson Index ranges from zero to six (cut-off value), with zero representing no co-morbidity.

2.4. Statistical methods

In order to perform the analyses with sufficient power, only the majority population and minority groups with at least 10 events were included ($n = 7{,}570{,}510$). In minority groups with at least 10 events per generation, analyses were stratified by generation ($n = 944{,}280$). Baseline characteristics (age, sex, generation, areal income, Charlson Index) were analysed on January 1st 1997 for the majority population, for minorities in total, and for first and second generation minorities separately. Using Cox proportional hazard regression analyses, adjusted for age at baseline and sex, AMI incidence differences between minority groups and the majority population (reference) were investigated. Additionally, adjustments were made for areal income and co-morbidity. Using the same procedure but now stratified by generation, the AMI incidence differences with the majority population were investigated for first and second generation minority groups separately. To determine whether the change in AMI incidence over generations was statistically significant, a Cox proportional hazard model was built comparing second generation minorities with first generation minorities (reference). When the confidence interval did not incorporate one, the intergenerational change was considered statistically significant.

Three additional analyses were performed. First, because of possible sex differences in the relations under study, analyses were stratified by sex (only in minority groups with ≥10 in both sexes). Second, to get insight into potential selection bias due to the exclusion of non-unique persons, the relation between country of origin and uniqueness and between AMI mortality and uniqueness were addressed using logistic regression analyses. Third, as in minorities' elderly are less well represented, adjustment for age only may not be enough to remove age effects. A lower AMI incidence in minority groups compared with the majority population may be provoked by their young age distribution. In the minority groups with a lower HR compared with the majority population, analyses were stratified by age (<55 years, ≥55 years) to explore whether relations remained.

Log-minus-log plots showed no violation of the proportional hazards assumption. Results were expressed as hazard ratios (HR) with accompanying 95% confidence intervals (95% CI).We used SPSS software, version 14.0 (SPSS Inc., Chicago, Illinois, USA). All analyses were performed in accordance with privacy legislation Netherlands. The author(s) of this manuscript have certified that they comply with the Principles of Ethical Publishing in the International Journal of Cardiology.

3. Results

3.1. Baseline characteristics

After exclusion of non-unique persons, the final cohort comprised 7,570,510 unique persons, of which 944,280 (12.5%) minorities (Table 1). Non-uniqueness was related to both minority status (minorities were less often unique) and AMI mortality (those who

Table 1
Baseline characteristics of minorities and the majority population in the Netherlands 1997–2007.

	Majority population	Minorities	First generation minorities	Second generation minorities
N	6,626,230	944,280	375,168	384,408
Person-years at risk	56,012,604	7,726,074	2,973,570	3,280,809
N AMI events	241,074	28,980	13,360	12,292
Incidence rate[a]	244	238	241	241
Mean age in years (sd)	53.07 (15.59)	50.10 (14.19)	52.97 (15.32)	50.28 (13.52)
% men	48.0	47.5	42.5	49.2
% first generation	–	58.7	–	–
% areal income tertile				
Tertile 1	30.1	41.8	42.4	31.8
Tertile 2	34.4	29.4	27.9	34.2
Tertile 3	35.5	28.7	29.6	34.0
Mean Charlson Index Score (sd)	0.66 (1.38)	0.55 (1.28)	0.63 (1.38)	0.58 (1.30)
% Charlson Index score > 0	27.3	23.4	26.0	24.7

[a]age-standardized incidence rate per 100,000 person-years at risk.