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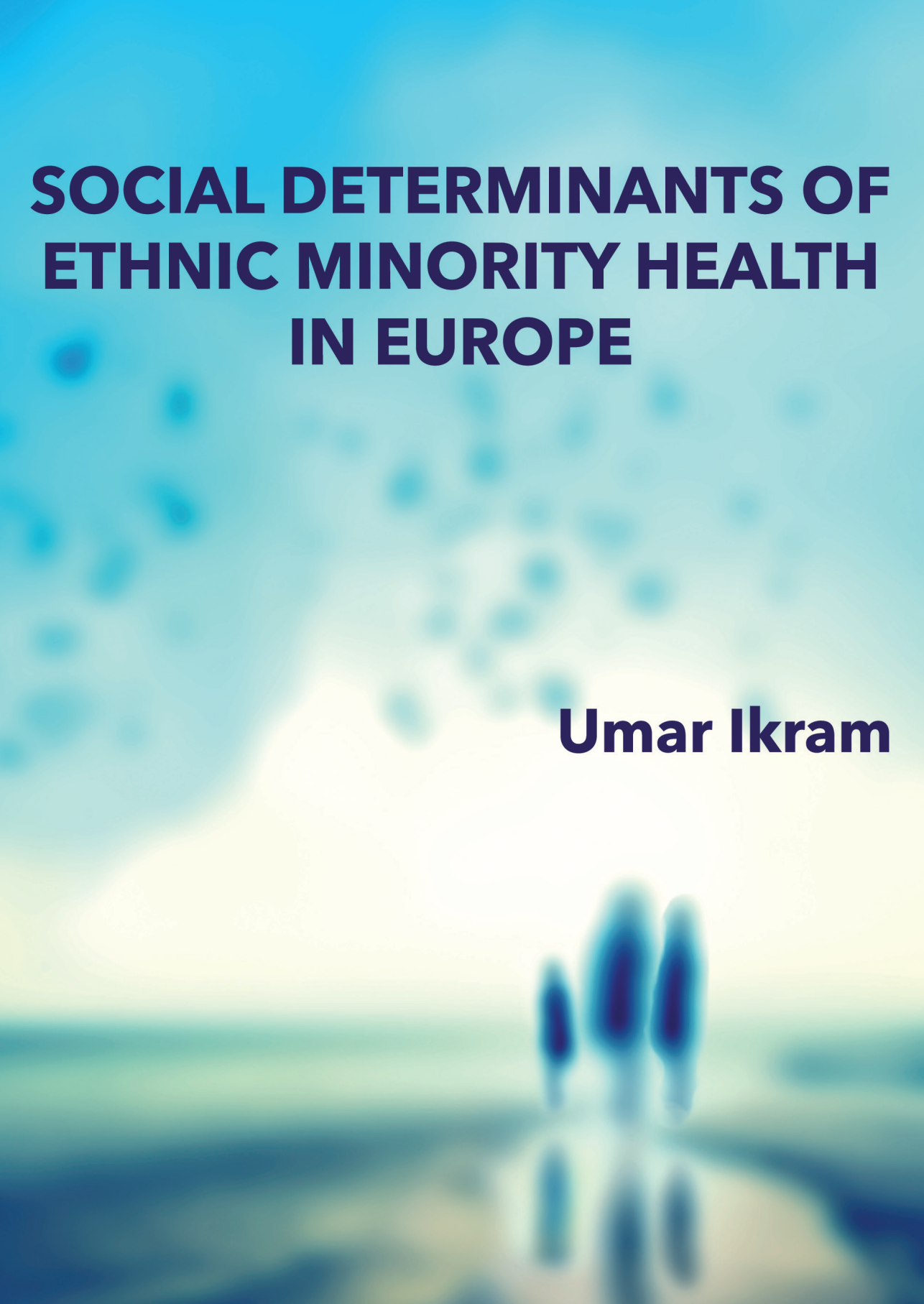
Umar Ikram



SOCIAL DETERMINANTS OF ETHNIC MINORITY HEALTH IN EUROPE

Umar Ikram

Colofon

Social determinants of ethnic minority health in Europe
PhD thesis, Academic Medical Center, University of Amsterdam, the Netherlands

The studies as presented in this thesis were conducted at the Department of Public Health, Academic Medical Center, University of Amsterdam. These studies used data from the Migrant Ethnic Health Observatory (MEHO) project, European Social Survey (ESS) project, and HELIUS study. The MEHO project was funded by the European Commission Directorate General for Health and Consumer Affairs (DG SANCO) and the European Union 7th Framework Programme. ESS is an open access data source, financed by the European Union. The HELIUS study is conducted by the Academic Medical Center Amsterdam and the Public Health Service of Amsterdam; both organisations provided core financial support for the study. The HELIUS study was also funded by the Dutch Heart Foundation, the Netherlands organisation for Health Research and Development (ZonMw), and the European Union 7th Framework Programme.

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SOCIAL DETERMINANTS OF ETHNIC MINORITY HEALTH IN EUROPE

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad van doctor

aan de Universiteit van Amsterdam

op gezag van de Rector Magnificus

prof. dr. ir. K.I.J. Maex

ten overstaan van een door het College voor Promoties ingestelde commissie,

in het openbaar te verdedigen in de Agnietenkapel

op dinsdag 13 december 2016, te 16.00 uur

door Muhammad Umar Zan-Ul Ikram

geboren te Amsterdam

Promotiecommissie

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	Prof. dr. M.L. Bots	Universiteit Utrecht

Faculteit der Geneeskunde

To Daddy and Ammi - for their support, inspiration, and love.

Contents

Part 4: Policy context

CHAPTER 1

General introduction

Demographic change and its public health impact

As European societies are becoming increasingly ethnically diverse, ethnicity is now being considered an important topic for policymakers and researchers[1,2]. Ethnicity is a multi-faceted concept incorporating origin, culture, language, and identity[3]. Bhopal defines ethnicity as a "quality that refers to the group to which people belong, and/or are perceived to belong, as a result of certain shared characteristics, including geographical and ancestral origin, but with particular emphasis on cultural traditions and languages"[3, pp.16]. Studies from the United States (US) generally use self-reported ethnicity or race, whereas in the European context the (parental) country of birth is often used as a proxy for ethnicity[4,5]. Hence in this thesis ethnic minority groups refer to both migrants (i.e. those who move from one country to another for settlement[3,6] and their offspring born in the host country. (If results were derived from migrants only, we will clearly indicate that.)

Currently, around 11% of the total European population is migrant[7,8], and this figure is likely to increase in the following decades, due to the influx of refugees and asylum seekers[9] and family reunification[8]. In Amsterdam, a large multi-ethnic European capital, for example, it has been projected that the proportion of people with ethnic minority background (i.e. migrants and their offspring born in the host country) is expected to increase from 52% in 2016 to 60% in 2035[10].

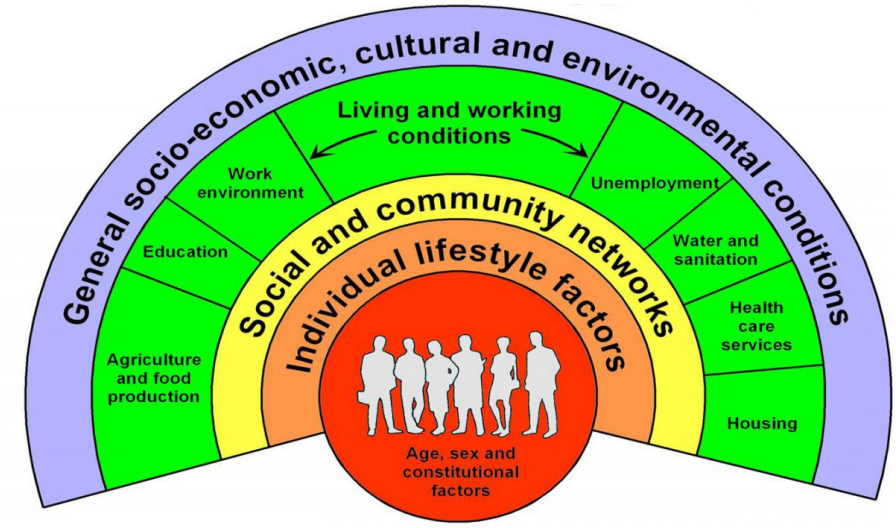
This demographic change has not only societal consequences but also public health and clinical implications. Current research suggests ethnic differences in cardiovascular and mental health outcomes, with ethnic minority groups generally having more unfavourable health outcomes than the host group in different European countries. For example, a 2009 literature review showed that hypertension, diabetes, and obesity are common in migrants of Sub-Sahara African origin in Europe[11]. Using data from the third wave of the European Social Survey, a study showed that depressive symptoms were more prevalent in ethnic minority groups across Europe[12]. It should also be mentioned, however, that for other health outcomes (e.g. cancer mortality[13], life expectancy[14]) some ethnic minority groups tend to fare much better than the host groups in Europe.

To understand the poorer cardiovascular and mental health of ethnic minority groups, several explanatory factors have been put forward. It has been suggested that the poorer health may partly reflect the epidemiological profile of the country of origin (e.g. relatively high hypertension rate in African migrants)[15,16]. Selective processes such as 'healthy migrant effect' (i.e. healthier migrants are more likely to migrate) or 'salmon bias' (i.e. migrants with worse health are more likely to return to the country of origin) may further impact ethnic minority health[17,18], although recent studies have raised doubts on whether these processes are relevant for population health[19,20]. Genetic predisposition to diseases is often mentioned as a potential explanation, but so far the evidence is scarce[21-23]. Unhealthy behaviours, such as higher smoking rates in Turkish migrants[24] and less physical activity in migrants of Sub Sahara African origin[11] may also contribute to the poor cardiovascular health.

Social determinants of ethnic minority health

The health of ethnic minority groups, however, is not only shaped by these proximal factors but also by the more upstream factors – also known as the social determinants[25]. The social determinants occur at a higher level than individual biology and health behaviours, and reflect a wide array of factors varying from individual-level socio-economic status to community-level social networks to national-level policies[26]. Figure 1 shows the model by Dahlgren and Whitehead, which aims to conceptualise the complex influences of different social determinants on the health of an individual[27]. It should be noted that this model was developed to understand the socioeconomic inequalities in health, but given its broad public health approach it may also have relevance for ethnic minority health. To our knowledge, social determinants have so far received relatively little attention in this field (especially in Europe)[28,29], even though they are generally regarded as the structural drivers of ethnic minority health[25,28].

Figure 1. Model on social determinants of health



Source: Dahlgren and Whitehead, 1991

Limitations of European studies

Most of the studies on social determinants and ethnic minority health have been conducted in the US and, to lesser extent, in the United Kingdom (UK). And given the important differences in, inter alia, country of origin and migration history between ethnic minority groups in the US and those in Europe, the US findings may not readily be generalised to the European context. Although studies from other Western European countries are relatively scarce, these have shown interesting results. Agyemang et al, for example, found that neighbourhood-level stressors (e.g. nuisance, crime) were associated with blood pressure in Turks and Moroccans living in Amsterdam[30]. In a study from Denmark, it was shown

that socioeconomic position, measured as education, employment status and income, attenuated the differences in self-rated health between seven ethnic minority groups and the Danish host group[31].

Despite this, the European studies on social determinants and ethnic minority health have some limitations. First, in contrast to the US and UK literature, little attention has been given to social determinants that are specific to the lives of ethnic minority groups – which we henceforth refer to as 'ethnic-specific social determinants'. Ethnic-specific social determinants include ethnic discrimination, ethnic identity, and national integration policies, amongst other factors. Assessing these ethnic-specific social determinants may help to better understand the health of ethnic minority groups. It may also help to develop a conceptual model similar to that by Dahlgren & Whitehead[27], but which is more applicable to ethnic minority health.

The second limitation of some current European research is that it fails to appreciate the existing diversity within ethnic minority groups. Specifically, some studies aggregate data derived from various ethnic minority groups and treat them as one group. Other studies, actually more common, focus on two or three groups only. Both issues make it difficult to determine whether the findings are equally relevant for various ethnic minority groups. If it is, for example, found that social support favourably impacts health in a particular group, then it is not self-evident that this applies to another group. This is particularly so for social determinants, as their meaning and their subsequent health impact might differ across the groups. As such, disaggregating data and including different ethnic minority groups may allow assessing whether the associations differ by ethnicity.

Third, few European studies have assessed under which conditions the social determinants are associated with health outcomes in ethnic minority groups. It might be possible that social determinants interact with each other to ameliorate or exacerbate the health impact. In a widely-cited study by Krieger and Sidney, it was shown that racial discrimination was associated higher systolic blood pressure among working-class African Americans who accepted unfair treatment compared to those who challenged unfair treatment[32]. The effect was somewhat stronger in professional African Americans[32]. This study shows a complex interplay of socioeconomic status (SES), racial discrimination and psychological coping, which collectively impacts health[32]. Gaining such knowledge is important as it allows to deepen our understanding on the association between social determinants and ethnic minority health. This in turn may help to develop tailored preventive interventions.

Aim of the thesis

Given these gaps in the literature, the general aim of this thesis was to assess the associations of social determinants (including ethnic-specific social determinants) with health outcomes in various ethnic minority groups in European countries. In line with Dahlgren & Whitehead's model[27], we focused on social determinants at different levels and for each level we considered at least one example.

At the individual level, we considered perceived ethnic discrimination (PED), as the studies from the US indicated that this is a relevant factor for ethnic minority health[33-36]. So far, PED has received very little attention in European public health literature, while official reports indicate that ethnic minority groups commonly experience discrimination in Europe as well[37,38]. The social context, as we define, includes the family, community, and residential environment, and this might possibly prove relevant for the health of ethnic minority groups, given the importance some groups attach to family and community factors[2,39,40]. At the national level, we assessed integration policies at national level, defined as socio-economic and -cultural policies aimed at integrating ethnic minority groups into the host society. Integration policies may play a structural role in shaping the social environment in which ethnic minority groups reside[41], thereby impacting their health.

This thesis may help to assess whether and to what extent (ethnic-specific) social determinants shape migrant and ethnic minority health in Europe. This may in turn may expand and deepen our understanding, which could help to inform policymaking and public health practice for migrant and ethnic minority groups residing in Europe.

Research questions

This thesis specifically addressed the following research questions:

1. What is the health status, as determined by disease burden and mortality, of different ethnic minority groups in Europe in general and Amsterdam in particular?
2. Is perceived ethnic discrimination (PED) associated with mental and cardiovascular health outcomes in ethnic minority groups? Do these associations vary by ethnicity?
3. What are the associations between different aspects of social context and health in different ethnic minority groups? Do these aspects interact with other social determinants to impact health outcomes in the groups?
4. Are different integration policy contexts associated with ethnic minority health in Europe? And through which other social determinants does this association operate?

Outline of this thesis

This thesis is divided into four parts, in line with the research questions. The first part provides an overview of ethnic minority health in Europe. More specifically, we determined the disease burden of various ethnic minority groups in Amsterdam (the Netherlands) in 2011 and made projections for 2030. We also provide data on all-cause and cause-specific mortality for different migrant groups living in six European countries. The second part addresses the associations between PED and mental and cardiovascular health outcomes (but also risk factors) in ethnic minority groups residing in Amsterdam, the Netherlands. The third part covers the social context in relation to the health of ethnic minority groups. We specifically considered family influences such as parental smoking, community factors

(e.g. ethnic social network), and ethnic density at residential level. The fourth part touches on the integration policy contexts and migrant health in Europe. We used various policy contexts and assessed how migrants fared in terms of health in the differential contexts. This thesis concludes with a general discussion on the main findings, the presentation of a comprehensive model to understand ethnic minority health, and the implications for research and policymaking.

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PART 1

Overview of ethnic minority health

CHAPTER 2

The disease burden across different ethnic groups in Amsterdam, Netherlands, 2011-2030

Published

Umar Z. Ikram, Anton E. Kunst, Madja Lamkaddem, Karien Stronks. The disease burden across different ethnic groups in Amsterdam, the Netherlands, 2011-2030. Eur J Public Health 2013;24:600-605

Abstract

Background: Current disease burden estimates do not provide evidence across different ethnic groups. This study aims to assess the disease burden as measured by the disability-adjusted life years (DALYs) for six ethnic groups in Amsterdam, the Netherlands, for 2011 and 2030.

Methods: The DALYs were calculated by combining three components: disease-/sex-/age-specific DALYs per person; disease-specific relative risks (RRs) by ethnicity; and sex-/age-specific population sizes by ethnicity in Amsterdam in 2011 and 2030. Disease-specific DALYs were derived from the National Institute of Public Health. The RRs were obtained through a systematic review of studies published in 1997-2008. The population figures were gathered from the Statistics Netherlands and municipality of Amsterdam.

Results: The findings suggest that cardiovascular diseases and anxiety and depressive disorders dominate disease burden in all ethnic groups in 2011 and 2030. In most of the non-Western ethnic minorities, diabetes mellitus is the strongest contributor to the disease burden. The total disease burden will increase more strongly in non-Western ethnic minorities than ethnic Dutch. The 2030 disease burden is estimated to be highest among Surinamese and Antilleans.

Conclusion: In ethnic minorities, diabetes plays an important role in the disease burden and the total disease burden will grow stronger than ethnic Dutch, resulting in a higher total disease burden for some ethnic groups in 2030. We encourage researchers to estimate the disease burden by ethnicity so that health priorities can be set in the fields of policy, health care and research.

Introduction

The recent Global Burden of Disease study showed that important differences in the disease burden exist across various regions[1]. The differences were, however, not only observed between developed and developing regions but also among developed regions. In order to gain detailed understanding of the regional disease burden, Murray et al suggested to estimate the disease burden by national level and ethnicity[1]. Some countries have already published data on national disease burden such as the US[2], Australia[3], England[4], and Spain[5]. In the Netherlands, The National Institute of Public Health and the Environment (RIVM) regularly publishes the disease burden for the general Dutch population[6].

It should, however, be noted that these national disease burdens are often based on the general population. And there are two reasons why such data may not represent the population health of any metropolitan area in Europe. First, in metropolitan areas (e.g., London, Berlin, Paris) the population sizes of ethnic minorities are increasing strongly[7], thus their population composition may considerably differ from the general population. In the Netherlands, for example, ethnic minorities comprised 20% of the Dutch population in 2011[8] and this figure will likely increase to 25-30% in 2030[9]. In Amsterdam, however, the demographic change is even more pronounced as in 2030 55.7% of its population will have an ethnic minority background[10]. More tangibly, –based on their socio-economic and historical differences with ethnic Dutch, ethnic minorities in the Netherlands are divided into Western (i.e., immigrants from an European country, North-America, Japan and Indonesia) and non-Western (i.e., immigrants from, say, Asia, Africa or Latin American)[8]–, the ratio of ethnic Dutch to non-Western ethnic minorities in Amsterdam in 2011 was 100:70 whereas in 2030 this will likely be 100:84 (i.e., for every 100 ethnic Dutch there will be 84 non-Western ethnic minorities)[10].

Second, extensive evidence shows that ethnic minorities overall have poorer health outcomes than native European populations, and that among ethnic minorities important health inequalities exist (e.g.,[11;12;13]). Dutch studies show that the prevalence of cardiovascular diseases is much higher in Surinamese[14;15] and that mental disorders are more common in Turkish and Moroccans[16] than ethnic Dutch. This evidence indicates that not only the relative disease burden may differ across various ethnic groups but also that the distribution of diseases within each ethnic group. It is also interesting to observe how the ageing among ethnic minorities[8] will affect the disease burden across ethnic groups in the future. Thus, we argue that by estimating the disease burden for the general population, one misses vital information on the health status of different ethnic groups living in a multi-ethnic population. So far, only a very few international studies have investigated the disease burden across ethnic groups2.

Therefore, we aim to estimate the disease burden for the six largest ethnic groups living in Amsterdam in 2011 and 2030, using the Disability-adjusted Life Years (DALYs). This study will provide an overview on which diseases contribute to the disease burden within each ethnic group, enabling us to understand what the most important diseases are by ethnicity and how the disease burden will develop over time.

Methods

Definitions

Disease burden was measured as the DALYs that conceptually consist of two components[2]. The first component considers the impact on life expectancy that is defined as the years of life lost due to early death by disease, and the second component captures the impact on health, being defined as the years of life spent in poor health due to disease (i.e., disability)2. According to Kominski and colleagues, the DALYs measures could be best conceptualized as 'years of healthy life lost'[17]. As we calculated the DALYs per 1000 persons, we interpreted the figures as the numbers of years per 1000 healthy years lost due to a certain disease.

Ethnicity is defined according to the country of birth of the individual as well as that of his/her parents[18]. Specifically, an individual is considered non-ethnic Dutch if he fulfils either of the following criteria: 1) he was born abroad and has at least one of his parents who was born abroad; or 2) he was born in the Netherlands but at least one of his parents was born abroad[18]. In most European countries, the place of birth is commonly used to determine ethnicity[19]. It should however be noted that in other countries ethnicity is defined differently; for example, in the US and UK self-assigned ethnicity is used.

Databases

In this study, we assessed the disease burden for 57 diseases, which were considered by the RIVM as the diseases that cause the highest disease burden in the general Dutch population[20]. The following six ethnic groups were included: ethnic Dutch, Surinamese, Antilleans, Turkish, Moroccans and other non-Western migrants.

We employed a different strategy to calculate the DALYs, as compared to other studies. The disease-specific DALYs by ethnicity and sex were a function of three components: 1) disease-specific DALYs per person by sex and age group; 2) disease-specific relative risks (RRs) by ethnicity; and 3) sex-/age-specific population sizes of the ethnic groups in Amsterdam in 2011 or 2030 (each of the three components will be discussed in more detail below). Specifically, the following formula was used:

$$\begin{aligned}&\text{Disease-specific DALYs}_{\text{ethnicity, sex}} = \\ &((\text{disease-specific DALYs}_{\text{sex, age group}} \text{ per person}) \\ &\quad \times (\text{disease-specific RR}_{\text{ethnicity}})) \\ &\quad \times (\text{sex- and age-specific population sizes}_{\text{ethnicity}} \\ &\qquad \text{in Amsterdam in 2011 or 2030}).\end{aligned}$$

Disease-specific DALYs per person by sex and age group (0-14, 15-24, 25-44, 45-64, 65-74, and 75+ years) were derived from the RIVM, which were used to calculate the DALY estimates for the Public Health Forecast 2006 report (see the RIVM website [www.rivm.nl] or see the 2006 report [20]).

Ethnic-specific RRs were obtained through a systematic review of studies focusing on ethnic inequalities in various diseases in the Netherlands (unpublished report entitled 'Overzicht

en evaluatie van resultaten van wetenschappelijk onderzoek naar etnische verschillen in gezondheid, gezondheidsrisico's en zorggebruik in Nederland'). Both national and international databases were used to find studies. As the review was conducted in 2008, only studies published in 1997–2008 were assessed. The initial search resulted in more than 1000 studies, and based on the title and abstract 300 studies were selected for further assessment. Preference was given to studies that included sex-/age-adjusted prevalence/ incidence of various diseases in ethnic groups and studies that presented sex-/age-adjusted RRs of ethnic minorities compared to ethnic Dutch. This selection process eventually resulted in 150 studies which were used to obtain the RRs for the diseases studied in this study. We also used some studies with other relative measures, such as the Odds Ratios (ORs) in case of prevalence studies. (The quality of evidence by disease and the ethnicity-/sex-specific RRs by disease can be found in the report.) Despite the relatively large amount of Dutch studies, it should be noted that important gaps in the Dutch literature on ethnic health inequalities remain. Consequently, for some diseases the RRs were fragmentary whereas for some other diseases the RRs had to be obtained from studies with uncertain validity.

Ethnic-/sex-/age-specific population sizes for Amsterdam in 2011 and the population projections for 2030 were obtained from the database of the municipality of Amsterdam. These projections are computed using complex probability modelling, which takes into account the following demographic assumptions (sex-/age-/ethnicity-specific): 1. Number of births in the last three years to calculate the annual total fertility rate; 2. Number of deaths in the last three years to determine the average annual mortality; 3. Number of people that emigrated from Amsterdam in the last three years to assess the average annual outflow; 4. Number of people that immigrated to Amsterdam in the last three years to determine the average annual inflow. It should be noted that other agencies (i.e., Statistics Netherlands and Primos) also make population projections. Although they use different modelling, the results do not differ considerably from those from the municipality of Amsterdam.

Analysis

Excel database was used for data analysis. Based on the calculated DALYs, the diseases were ranked in each ethnic group, with the disease with the highest DALYs ranking first and the disease with the lowest DALYs ranking last.

Results

Figure 1 illustrates that the population growth from 55 years and above tends to be relatively stronger in Surinamese, Antilleans, Turkish, Moroccans and other non-Western migrants than ethnic Dutch – though the absolute numbers of non-Western migrants are much smaller. This may suggest that ageing is more pronounced in these ethnic minorities.

Table 1 shows the leading causes of DALYs per 1000 for men in 2011 and 2030. Cardiovascular diseases (e.g., ischemic heart disease and cerebrovascular disease) were a major contributor to the DALYs across all ethnic groups in 2011 and 2030. In contrast to ethnic Dutch, DALYs due to diabetes are much higher in the ethnic minorities, with diabetes ranking first in most cases. In 2011, Surinamese had lost 30.8 years of 1000 healthy years due to diabetes,

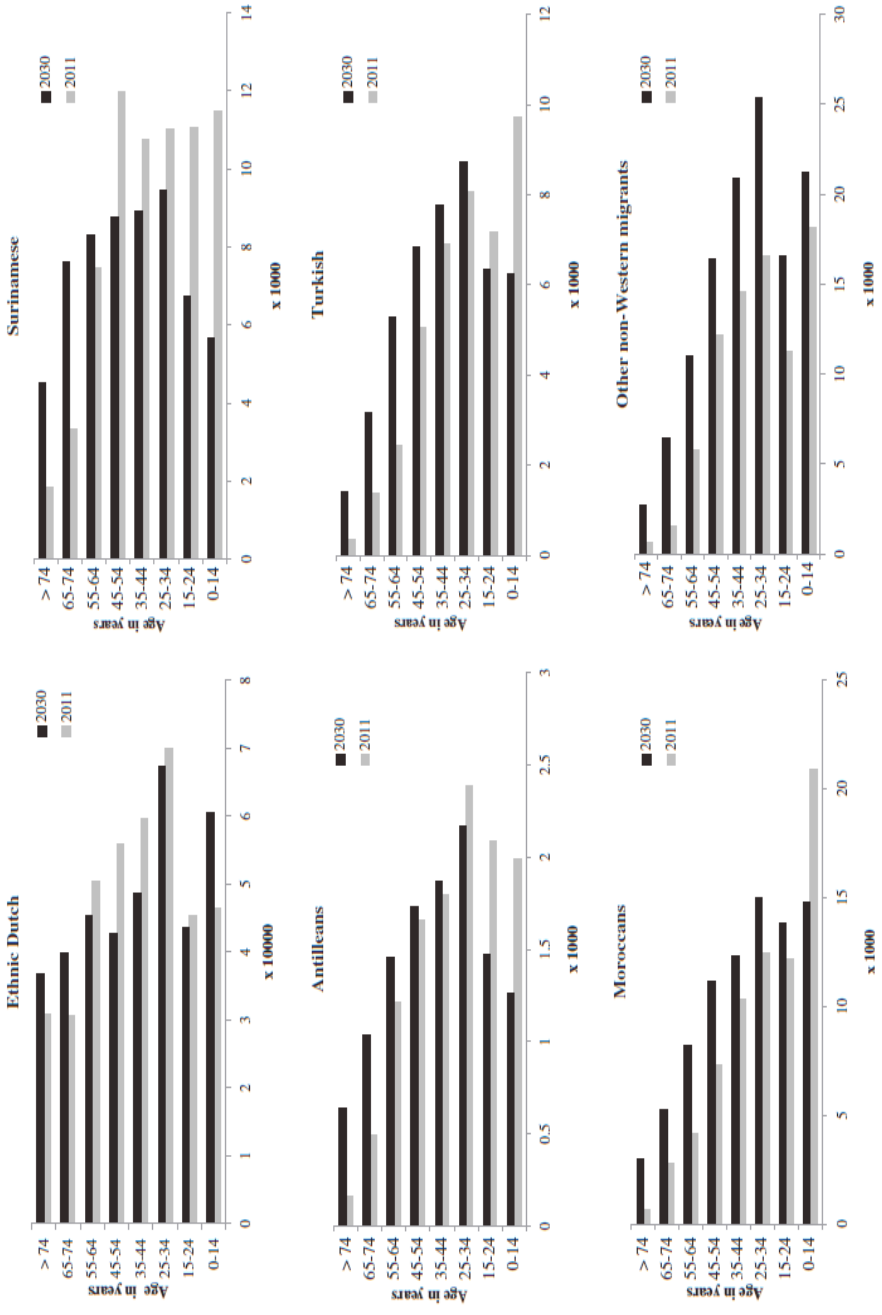

Figure 1. Population of Amsterdam by ethnicity and age (note: the x-axes in ethnic Dutch are in ten thousands but in ethnic minorities in thousands)

Table 1. Leading causes of DALYs (per 1000 persons) for men in Amsterdam in 2011 and 2030, by ethnicity

	Ethnic Dutch				Surinamese				Antilleans			
Rank 2011	Disease	DALYs 2011	DALYs 2030	Rank 2030	Disease	DALYs 2011	DALYs 2030	Rank 2030	Disease	DALYs 2011	DALYs 2030	Rank 2030
1	Ischaemic heart disease	29.9	31.8	1	Diabetes mellitus	30.8	48.8	1	Diabetes mellitus	20.2	32.5	1
2	Cerebrovascular disease	14.6	16.8	2	Ischaemic heart disease	23.4	40.0	3	Ischaemic heart disease	13.2	23.4	3
3	Alcohol use	12.0	10.9	5	Cerebrovascular disease	22.2	43.7	2	Cerebrovascular disease	11.1	23.5	2
4	COPD	11.6	13.3	3	Self-inflicted injuries	9.9	12.9	4	Asthma	9.6	9.0	5
5	Lung cancer	11.6	12.3	4	Alcohol use	7.3	6.7	9	Alcohol use	9.2	8.3	7
6	Anxiety disorders	10.2	9.5	7	Suicide	6.6	6.6	10	COPD	7.4	15.4	4
7	Diabetes mellitus	9.6	9.8	6	Asthma	6.3	5.8	12	Road traffic injuries	7.2	7.1	9
8	Major depression	8.0	7.2	8	COPD	5.3	10.5	5	Self-inflicted injuries	6.8	8.8	6
9	Road traffic injuries	5.7	5.6	13	Road traffic injuries	5.3	5.4	17	Contact eczema	6.3	6.6	11
10	Self-inflicted injuries	5.5	5.9	10	Major depression	5.2	5.6	15	Suicide	6.0	6.1	13
	Turkish				**Moroccans**				**Other non-Western Migrants**			
Rank 2011	Disease	DALYs 2011	DALYs 2030	Rank 2030	Disease	DALYs 2011	DALYs 2030	Rank 2030	Disease	DALYs 2011	DALYs 2030	Rank 2030
1	Anxiety disorders	19.5	21.9	3	Diabetes mellitus	17.1	24.3	1	Diabetes mellitus	18.1	24.3	1
2	Diabetes mellitus	14.1	22.3	2	Anxiety disorders	8.0	9.0	3	Ischaemic heart disease	12.3	17.7	2
3	Ischaemic heart disease	13.7	23.2	1	Major depression	7.5	8.8	4	Anxiety disorders	10.8	11.6	4
4	Major depression	9.6	10.9	6	Self-inflicted injuries	6.8	7.9	6	Cerebrovascular disease	8.4	13.9	3
5	Cerebrovascular disease	7.0	12.9	4	Ischaemic heart disease	6.8	10.2	2	Major depression	7.9	8.0	6
6	Self-inflicted injuries	6.5	7.8	7	Cerebrovascular disease	5.3	8.6	5	Self-inflicted injuries	7.3	8.2	5
7	COPD	6.2	11.2	5	Road traffic injuries	5.0	5.4	11	Road traffic injuries	5.2	5.4	9
8	Road traffic injuries	5.2	5.4	12	Schizophrenia	4.7	5.4	10	Alcohol use	4.6	4.6	12
9	Arthritis	4.6	7.6	8	Arthritis	4.2	6.3	8	COPD	4.3	7.3	7
10	Rheumatoid arthritis	4.5	6.1	11	Facial disorders	4.0	7.0	7	Suicide	4.3	4.3	14

Table 2. Leading causes of DALYs (per 1000 persons) for women in Amsterdam in 2011 and 2030, by ethnicity

	Ethnic Dutch				Surinamese				Antilleans			
Rank 2011	Disease	DALYs 2011	DALYs 2030	Rank 2030	Disease	DALYs 2011	DALYs 2030	Rank 2030	Disease	DALYs 2011	DALYs 2030	Rank 2030
1	Anxiety disorders	20.1	19.4	2	Diabetes mellitus	30.4	54.0	1	Diabetes mellitus	18.5	31.1	1
2	Ischaemic heart disease	18.2	19.5	1	Cerebrovascular disease	20.7	40.0	2	Asthma	11.6	11.5	4
3	Cerebrovascular disease	16.8	18.0	3	Ischaemic heart disease	15.4	30.6	3	Cerebrovascular disease	11.3	21.5	2
4	Major depression	14.9	14.2	4	Anxiety disorders	10.7	11.4	7	Anxiety disorders	10.6	11.2	5
5	Dementia	10.9	11.9	5	Major depression	10.4	10.7	8	Contact eczema	10.3	10.3	8
6	Breast cancer	10.9	10.5	8	Self-inflicted injuries	8.4	14.0	5	Major depression	10.1	10.7	6
7	Diabetes mellitus	10.4	11.0	6	Arthritis	8.0	15.4	4	Ischaemic heart disease	8.6	16.4	3
8	Arthritis	10.2	10.9	7	Asthma	7.6	7.4	14	Breast cancer	6.7	8.7	10
9	COPD	8.8	9.3	9	Facial disorders	6.0	13.3	6	COPD	6.4	10.7	7
10	Self-inflicted injuries	7.0	7.4	10	Rheumatoid arthritis	5.9	8.4	10	Self-inflicted injuries	4.9	7.4	12
	Turkish				**Moroccans**				**Other non-Western Migrants**			
Rank 2011	Disease	DALYs 2011	DALYs 2030	Rank 2030	Disease	DALYs 2011	DALYs 2030	Rank 2030	Disease	DALYs 2011	DALYs 2030	Rank 2030
1	Anxiety disorders	38.7	43.0	1	Anxiety disorders	15.8	18.1	2	Anxiety disorders	20.8	22.0	1
2	Major depression	18.8	21.0	2	Major depression	15.0	17.3	3	Major depression	14.6	15.3	3
3	Diabetes mellitus	11.3	20.6	3	Diabetes mellitus	11.1	21.6	1	Diabetes mellitus	13.3	20.1	2
4	Arthritis	5.8	12.0	4	Cerebrovascular disease	4.7	10.0	4	Cerebrovascular disease	7.2	11.3	4
5	Rheumatoid arthritis	5.4	8.4	7	Arthritis	4.2	9.4	5	Ischaemic heart disease	5.3	9.0	5
6	Cerebrovascular disease	5.1	9.9	5	Rheumatoid arthritis	4.1	6.6	8	Asthma	5.0	5.1	11
7	Ischaemic heart disease	4.7	9.9	6	Self-inflicted injuries	3.7	5.9	9	Rheumatoid arthritis	4.5	5.8	8
8	COPD	4.6	8.3	9	Ischaemic heart disease	3.5	8.0	6	Breast cancer	4.5	5.5	10
9	Self-inflicted injuries	4.0	6.2	10	Asthma	3.1	3.1	15	Arthritis	4.4	7.5	6
10	Dorsopathy	3.7	4.5	13	Schizophrenia	3.0	4.0	12	Self-inflicted injuries	4.4	5.8	7

Antilleans 20.2 years, Turkish 14.1 years, Moroccans 17.1 years and non-Western migrants 18.1 years, vs. 9.6 years in ethnic Dutch. The DALYs due to diabetes will strongly increase among non-Western migrants in 2030, especially among Surinamese and Antilleans who are predicted to lose 48.8 years and 32.5 years of 1000 healthy years, respectively. Psychiatric diseases (e.g., anxiety and depressive disorders) played an important role in the 2011 disease burden in Turkish and Moroccans, resulting in 29.1 years and 24.6 years of 1000 healthy years lost, respectively, vs. 18.2 years in ethnic Dutch.

Among women, psychiatric diseases contributed considerably to the 2011 and 2030 DALYs across all ethnic groups (Table 2), with anxiety disorders consistently ranking first or second in all ethnic groups, except in Surinamese and Antilleans. Cardiovascular diseases also played an important role in the disease burden in all ethnic groups, though not as important as in men. As similar to men, diabetes led to more loss of healthy years in the ethnic minorities than ethnic Dutch. In 2011, Surinamese women lost 30.4 years of 1000 healthy years due to diabetes, Antillean 18.5 years, Turkish 11.3 years, Moroccan 11.1 years, other non-Western migrants 13.3 years, vs. 10.4 years in ethnic Dutch. In 2030, these figures will likely increase to 54.0 years lost of 1000 healthy years in Surinamese women, 31.1 years in Antilleans, 20.6 years in Turkish, 21.6 years in Moroccan and 20.1 years among non-Western women, vs. 11.0 years in ethnic Dutch.

The total disease burden in 2011-2030 will increase much stronger among the ethnic minorities than ethnic Dutch, with the strongest increase being observed in Antillean, Turkish, Moroccan women (Table 3). Surinamese and Antillean men tend to have a higher total DALYs in 2030 (293.6 and 240.7, respectively, vs. 203.6 in ethnic Dutch men), with a similar pattern among women (249.9, 226.1, 209.1, respectively).

Table 3. Total DALYs (per 1000 persons) of all causes for 2011 and 2030, by ethnicity

		2011	2030	% increase 2011-2030
Men	Ethnic Dutch	194.8	203.6	4.5
	Surinamese	195.8	293.6	49.9
	Antilleans	167.3	240.7	43.9
	Turkish	148.9	203.1	36.4
	Moroccans	121.8	157.1	29.0
	Other non-Western migrants	146.5	182.0	24.2
Women	Ethnic Dutch	204.1	209.1	2.4
	Surinamese	186.7	249.9	33.9
	Antilleans	159.2	226.1	42.0
	Turkish	150.1	208.5	38.9
	Moroccans	109.8	163.9	49.3
	Other non-Western migrants	133.2	167.5	25.8

Discussion

This study demonstrates that cardiovascular and psychiatric diseases play an important role in the 2011 and 2030 disease burden in all ethnic groups. Diabetes is the strongest contributor to the disease burden in most of the ethnic minorities studied. The total burden of disease in 2011-2030 will likely increase stronger in the ethnic minorities as compared to ethnic Dutch, with even in some ethnic minorities a higher total disease burden than ethnic Dutch.

A few limitations should be acknowledged. First, we employed a different strategy to calculate the DALYs, compared to other studies. The DALYs are normally calculated by the sum of years of life lost due to death) and years of life lost due to disability2, whereas we calculated the DALYS by multiplying the disease-/sex-/age-specific DALYs per person, ethnic-specific RRs and sex-/age-specific population sizes in 2011 and 2030. Since our strategy has only been used in this study, questions may arise on its reliability. We argue that research is needed in which DALYs are calculated using the traditional and our strategy to test the reliability.

Second, one could argue that the diseases assessed may not fully capture the disease burden of ethnic minorities. For example, sickle cell disease and vitamin D deficiency were not included. Though these diseases have a relatively high prevalence in ethnic groups[21;22], in absolute terms these diseases contribute little to the total disease burden in ethnic minorities, in contrast to ischemic heart disease and diabetes.

A third limitation is that the validity of DALY estimates for some diseases and the total disease burdens could be doubted, since for some diseases no or uncertain estimates of the ethnic-specific RRs were used. Further, the RRs were based on studies published in 1997-2008. It should however be noted that diseases with the highest contributions (e.g., diabetes, cardiovascular diseases) had a strong evidence base and that the recent Dutch literature does not show any important differences with the studies from 1997-2008[23-25].

Finally, for both the 2011 and 2030 estimates similar RRs were used. One could however argue that over time a convergence of risk for developing diseases might occur across ethnic groups in the Netherlands, and that ethnic minorities, as such, will have a health status more or less similar to that of ethnic Dutch. If so, the 2030 disease burden in this study might have been overestimated. Conversely, one could also suggest that ethnic health inequalities will remain steady or actually increase over generations, as it is the case for the second and third generation Hispanic Americans26. Thus, given the ambiguity surrounding the future risk for developing diseases among ethnic minorities, we felt justified to use the current RRs.

This study showed that important differences exist in the distribution of disease burden across ethnic groups. For example, psychiatric diseases cause higher disease burden in Turkish and Moroccans than Surinamese and Antilleans. Since these ethnic minorities share a rather similar socioeconomic status (SES)[8], this finding may suggest that there are other factors that make Turkish and Moroccans more vulnerable for psychiatric diseases (e.g.,

acculturation, discrimination, and migration history)[16;27]. This finding clearly suggests that ethnic minorities cannot be taken as a whole but should rather be studied separately to test new hypotheses and elucidate the underlying causes of disease.

Another important finding is that diabetes mellitus is the strongest contributor to the disease burden in the ethnic minorities. The increased risk may be due to obesity, insulin resistance, sedentary lifestyle and unhealthy diet[28]. As ethnic minorities are disproportionally affected by these risk factors, this may indicate that other underlying factors may provide an explanation. The lower SES may play a role as, for example, living in poor neighbourhoods may expose one to harmful psychosocial factors (e.g., crime and nuisance) and unhealthy lifestyle (e.g., lack of grocery stores)[29]. Epigenetic processes could also provide an explanation[30]. Given the stronger increase in cardiovascular diseases in ethnic minorities than ethnic Dutch in 2030, it is particularly worrisome that diabetes, which is a risk factor for cardiovascular events, causes such a high disease burden.

The results also indicated that the total disease burden in the ethnic minorities will increase more profoundly than ethnic Dutch. In fact, the 2030 total disease burden is higher in Surinamese and Antilleans as compared to ethnic Dutch. This is probably due to the strong ageing process in the ethnic minorities.

We argue that the findings of a specific ethnic group could potentially be generalized to other European cities which have a large population of that group (e.g., Frankfurt with a large Turkish community)[31]. The MEHO Project, for example, showed that mortality due to cardiovascular diseases and diabetes was similar among Turkish people living in different European cities[19]. We encourage researchers from other multi-ethnic European cities to conduct similar analysis.

Given the ongoing demographic changes in Europe, especially in large European cities such as Amsterdam, this study provides a starting point for setting health priorities in three specific domains. The first domain is the health care: service providers who serve patients from a particular ethnic group could focus more on diseases that cause a high disease burden within that group.

Second, systematic health monitoring of the distribution of disease burden across different ethnic groups is needed. This might help to identify the major health problems within different ethnic groups.

Finally, the findings may help the scientific community to focus on diseases that cause a high disease burden across different ethnic groups. Moreover, we encourage researchers to delve deeper into the findings of this study, for example: why does diabetes cause such a high disease burden among ethnic minorities; why do cardiovascular diseases dominate the ranking of disease burden in both ethnic Dutch and ethnic minorities; are the causes the same or is there a convergence? Longitudinal studies consisting of various ethnic groups may provide a fruitful basis.

In conclusion, this study shows that the disease burden may vary considerably among ethnic

groups, and that diabetes plays a pivotal role in the disease burden of ethnic minorities. It further demonstrates that the total disease burden will increase much stronger in ethnic minorities, with even a higher total burden in Surinamese and Antilleans, as compared to ethnic Dutch. As such, the findings indicate that more research on the disease burden by ethnicity is needed in order to adequately assess the disease burden of multi-ethnic European populations, so that adequate health priorities can be set.

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CHAPTER 3

All-cause and cause-specific mortality of different migrant populations in Europe

Published

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Abstract

Background: Currently there is no data on mortality for different migrants groups in Europe. This study aimed to examine differences in all-cause mortality and main causes of death among migrant and local-born groups living in six European countries.

Methods: We used data from population and mortality registers from Denmark, England & Wales, France, Netherlands, Scotland, and Spain. We calculated age-standardized mortality rates for men and women aged 0-69 years. Country-specific data were pooled to assess weighted mortality rate ratios (MRRs) using Poisson regression. Analyses were stratified by age group, country of destination, and main cause of death.

Results: In six countries combined, all-cause mortality was lower for men and women from East Asia (MRRs 0.66; 95% confidence interval 0.62-0.71 & 0.76; 0.69-0.82, respectively), and Other Latin America (0.44; 0.42-0.46 & 0.56; 0.54-0.59, respectively) than local-born populations. Mortality rates were similar for those from Turkey. All-cause mortality was higher in men and women from North Africa (1.09; 1.08-1.11 & 1.19; 1.17-1.22, respectively) and Eastern Europe (1.30; 1.27-1.33 & 1.05; 1.01-1.08, respectively), and women from Sub-Saharan Africa (1.34; 1.30-1.38). The pattern differed by age group and country of destination. Most migrants had higher mortality due to infectious diseases and homicide while cancer mortality and suicide were lower. CVD mortality differed by migrant population.

Conclusion: Mortality patterns varied in migrant groups in European countries. Future research should focus both on migrant groups with favourable and less favourable mortality pattern, in order to understand this heterogeneity and to drive policy at the European level.

Introduction

Europe is becoming increasingly ethnically diverse, with currently around 9% of its total populations comprising migrants [1]. The recent Lancet series "Health in Europe" specifically addressed the vulnerable health of migrants and the substantial inequalities, arguing that political attention is needed at the European level [2].

Country-level analyses from several European countries have demonstrated differences in all-cause mortality between migrant and local-born populations. For example, a comprehensive Dutch study showed that almost all migrant populations have higher all-cause mortality than local-Dutch [3]. However, such country-level studies provide an incomplete picture of migrant health in Europe. It has been shown that migrants originating from specific countries settle across different European countries [1]. Further, each European country has its own unique mix of migrants in terms of country of birth [1].

Cross-national overviews may capture migrant mortality in Europe more comprehensively, and are therefore needed to drive policy at the European level. To fill this gap in the literature, the Migrant and Ethnic Health Observatory (MEHO) project collected cross-national data on specific mortality causes across migrant populations living in Europe [4]. It showed that circulatory disease mortality varied by country of birth in each of the six European countries, with some populations having an excess mortality (e.g., South Asians and Eastern Europeans) [5]. This project also found that diabetes mortality was higher in migrant populations than the local-born populations, especially among migrants from low-income countries, suggesting that socioeconomic change might play a role [6]. Another study showed that cancer mortality was consistently lower in Turkish compared with the local-born populations in four European countries [7].

The present study builds on this work by assessing all-cause mortality and main causes of death for different migrant populations living in six European countries using data from the MEHO project. Such overviews are lacking in Europe so far. This overview helps identify which migrant populations have higher mortality risk and which ones have lower risk in Europe. This could be useful for setting priorities in research and health policy, so that health equity can be achieved in a diverse Europe.

Methods

Study design

We used data from the MEHO project. Full details on the data acquisition of this project have been reported elsewhere [4].

We obtained all-cause and cause-specific mortality data by country of birth, sex, and age. Data were drawn from six European countries: Denmark, England & Wales (E&W), France, Netherlands, Scotland, and Spain. For Denmark and the Netherlands, data was derived using linkages between records of the population register and subsequent mortality data.

Since an open cohort design was used, participants could enter and exit the study at any point in time during the follow-up period. For E&W, France, Scotland, and Spain, unlinked data was used. We derived numbers of deaths by country of birth, sex, and age from the national mortality registers, and calculated the corresponding person-years at risk (PYR) using population census information. Time periods of data collection varied across countries of destination (see Table 1). Data was anonymised, so no ethical approval was needed.

Variables

All-cause mortality data was defined as death from any cause. Depending on the country of destination, we employed either the 9th or 10th revision of International Classification of Diseases (ICD). For main causes of death, we included only the causes that constituted at least 1% of the total deaths in the majority of the migrant populations (see Online Resource 1 for the prevalence rates of the causes of death by region of birth). We chose the following major groupings (ICD codes in brackets): infectious diseases (ICD-9 279.5, 001-139; ICD-10 B20-B24, A00-B99), cancer (ICD-9 140-239; ICD-10 C00-D48), cardiovascular diseases (CVD) (ICD-9 390-459; ICD-10 I00-I99), diabetes (ICD-9 250; ICD-10 E10-E14), and injuries (ICD-9 E800-999; ICD-10 V01-Y98). Given the expected heterogeneity within these groupings, we examined specific causes of death within the cancer and injuries, and infectious diseases groupings. Specific causes of deaths within CVD have been studied earlier [4, 8, 5]. We examined the following causes of cancer mortality (ICD codes in brackets): oesophagus and oral cavity (ICD-9 140-150; ICD-10 C00-C15), stomach (ICD-9 151; ICD-10 C16), colon/rectum (ICD-9 153-154; ICD-10 C18-C21), liver (ICD-9 155; ICD-10 C22.0-C22.1), breast (ICD-9 174-175; ICD-10 C50), Hodgkin's disease and leukaemia (ICD-9 201, 204-208; ICD-10 C81, C91-95), and lung and bronchus (ICD-9 161-163, 165; ICD-10 C30-34, C39). For injury-related mortality, the following causes were assessed: unintentional injuries (ICD-9 E800-E915; ICD-10 V01-V99, W00-X59), suicide (ICD-9 E950-959; ICD-10 X60-X84, Y87.0), and homicide (ICD-9 E960-E969; ICD-10 X85-Y09, Y87.1). For infectious diseases, we assessed TB (ICD-9 279.5 and HIV/AIDS (B20-B24).

We focused on migrant populations originating from outside Western Europe and the OECD countries. Given the different migration and colonial history, the size of populations by country of birth differed across European countries. Hence, we categorized the migrant populations into larger geographical regions of birth, to make the findings comparable across countries. This classification was based on the Global Burden of Diseases 2010 study.[9] The following region-of-origin groupings were included: North-Africa, Sub-Saharan Africa, the Caribbean, Other Latin America, South Asia, East Asia, Eastern Europe, and Turkey. Since Turkey cannot be easily confined to a particular region (due to its geographical location and historical links with Europe), it was not included as part of a larger regional grouping but was analysed separately. The local-born population of each European country was also included. Region-of-origin groupings with very few deaths and a relatively low PYR (<3,000) were excluded from analysis.

Age was categorized into five-year age groups. We restricted the analysis to those aged 0-69 years because there were very few deaths at age 70+ years for most migrant populations. In the linked data (i.e., longitudinal), the age of participants was recorded at baseline, and

participants were followed for the duration of the study, irrespective of their age at baseline. Hence, the participants were not censored according to age. In the unlinked data (i.e., cross-sectional), age was recorded in the mortality registry as the age of death; all deaths among people of 70+ years were excluded.

Data analysis

We calculated the age-standardized mortality rates (ASMR) based on direct standardisation using the WHO World Standard Population [10].

To assess the differences in all-cause mortality between migrant and local-born populations in Europe, we pooled the data from the six countries. We created region-of-origin-, sex-specific weights which were inversely proportionate to the number of PYR of each region of origin and sex. These weights were assigned to the individual observations based on the region of origin and sex. Weighted mortality rate ratios (MRRs) were computed using Poisson regression, with the local-born populations as the reference group. All models used numbers of deaths (all-cause or cause-specific) as the dependent variable, with five-year age groups, sex, and region of origin as the independent variables, and PYR as the offset variable. MRRs were considered significant at p-value <0.05.

We first used sex-specific models to assess differences in all-cause mortality in six European countries combined. We then stratified the analyses by age group (0-19, 20-44, and 45-69), country of destination, and main causes of death. However, because of small numbers of deaths for some populations, cause-specific models were not stratified by sex. We used IBM SPSS version 21.0 for analysis.

Results

Table 1 presents the total deaths and ASMRs by sex, country of destination, and region of origin. Overall, ASMRs for men were between 108.3-607.0 and for women between 71.5-324.7. For example, Turkish men and women in Denmark had ASMRs of 607.0 and 324.7, respectively, and those in France had ASMRs of 186.2 and 84.0, respectively. For men and women from North Africa the ASMRs varied between 212.9-545.0 and 103.9-293.8, respectively.

Table 2 shows the MRRs in all-cause mortality by region of origin and sex in six countries combined, compared with the local-born populations. MRRs were lower in men and women from East Asia (0.66; 95% confidence interval [CI] 0.62-0.71 and MRR 0.76; 95% CI 0.69-0.82, respectively), and Other Latin America (0.44; 0.42-0.46 and 0.56; 0.54-0.59, respectively). Conversely, higher all-cause mortality was observed in women from Sub-Saharan Africa (1.34; 1.30-1.38), and men and women from North Africa (1.09; 1.08-1.11 and 1.19; 1.17-1.22, respectively) and Eastern Europe (1.30; 1.27-1.33 and 1.05; 1.01-1.08 respectively).

Table 1. Person-years at risk (PYR), total deaths, and age-standardized mortality rate (ASMR) by region of origin in six European countries

Country of destination / Region of origin	PYR		Total deaths (n)		ASMR (per 100,000 PY)	
	Men	Women	Men	Women	Men	Women
Denmark, linked data, 1992-2001						
Local-born	23 746 475	23 180 331	104 682	69 666	347.7	221.4
North Africa[1]	28 302	22 682	79	19	545.0	190.5
Sub-Saharan Africa[2]	59 569	55 858	63	47	263.2	119.7
South Asia[3]	94 702	84 447	299	131	562.6	297.8
East Asia[4]	64 856	104 051	132	122	308.3	214.6
Eastern Europe[5]	220 385	226 249	638	456	484.9	257.7
Turkey	182 159	161 540	522	227	607.0	324.7
England & Wales, unlinked data, 1999-2003						
Local-born	102 407 760	102 284 340	338 241	215 470	258.4	157.8
North Africa	158 157	108 510	555	261	298.9	178.5
Sub-Saharan Africa	1 641 200	1 715 870	4524	2872	255.1	160.6
Caribbean6	492 580	605 262	3692	2483	308.4	175.4
South Asia	2 271 330	2 259 465	9405	5303	255.3	155.4
Eastern Europe	285 077	421 770	1317	906	325.7	146.8
France, unlinked data, 2005-2007						
Local-born	71 477 377	72 170 529	245 568	114 830	280.5	123.0
North Africa	3 445 897	3 184 913	15 900	6676	212.9	103.9
Sub-Saharan Africa	1 171 073	1 179 280	3481	1894	241.5	161.5
Caribbean	47 279	57 864	84	63	182.4	99.0
Other Latin America[7]	155 728	201 026	235	157	171.2	81.6
South Asia	53 573	49 359	134	49	235.2	132.3
East Asia	373 526	418 176	1183	599	192.2	96.2
Eastern Europe	374 582	484 253	1783	842	331.0	127.8
Turkey	372 175	317 687	755	250	186.2	84.0
The Netherlands, linked data, 1996-2006						
Local-born	65 253 814	63 575 710	215 125	135 367	249.3	155.7
North Africa	1 612 176	1 431 578	2702	1267	207.6	136.5
Caribbean	2 227 202	2 347 797	5540	3412	337.1	185.5
Turkey	1 848 426	1 690 786	3851	1618	295.7	147.7
Scotland, unlinked data, 1999-2003						
Local-born	10 677 105	10 955 370	51 270	32 223	364.3	208.2
North Africa	8210	4690	34	16	459.6	293.8
Sub-Saharan Africa	44 995	44 920	122	82	350.8	223.1
Caribbean	3515	4510	11	11	239.8	160.6
Other Latin America	5 985	7 540	8	9	108.3	87.8

South Asia	80 925	80 355	289	173	240.0	159.0
East Asia	28 695	30 265	72	38	214.5	124.5
Eastern Europe	8 080	11 765	47	24	558.8	183.4
Spain, unlinked data, 2001-2005						
Local-born	86 293 659	85 302 035	297 428	126 250	264.8	109.8
North Africa	1 504 571	781 205	3421	1230	298.5	169.9
Sub-Saharan Africa	358 120	167 478	872	259	412.1	210.1
Caribbean	304 863	469 072	537	432	210.6	100.6
Other Latin America	2 506 164	2 831 886	2941	1869	170.7	89.1
East Asia	137 002	124 429	130	64	120.8	71.5
Eastern Europe	885 962	774 551	2017	697	318.5	143.1

[1] Including migrants from Algeria, Morocco, Tunisia, and other Northern Africa.
[2] Ivory Coast, Democratic Republic Congo, Madagascar, Mail, Cameroun, Congo, Senegal, Somalia, South Africa, East Africa, West Africa, Central Southern Africa, and other Africa.
[3] Pakistan, Sri Lanka, India, Indian & Southern Oceans, and Bangladesh.
[4] South Eastern Asia, Cambodia, China, Japan, Thailand, and Vietnam.
[5] Albania, Bosnia-Herzegoniva, Serbia and Montenegro, Yugoslavia, Romania, Bulgaria, Poland, Russia, Ukraine, and other East Europe.
[6] The Caribbean countries and Haiti.
[7] Brazil, South America, Central-South America, Central America, and other Latin America.

PYR=Person-years at risk. ASMR=age-standardized mortality rate.

Table 2. Mortality rate ratios (MRRs) for all-cause mortality in six European countries combined, by region of origin and sex

	MRRs* (local-born=1, ref.)			
Region of origin	Men	95% CI	Women	95% CI
North Africa	**1.09**	**1.08–1.11**	**1.19**	**1.17–1.22**
Sub-Saharan Africa	0.98	0.95–1.00	**1.34**	**1.30–1.38**
Caribbean	**0.85**	**0.83–0.87**	0.97	0.94–1.00
Other Latin America	**0.44**	**0.42–0.46**	**0.56**	**0.54–0.59**
South Asia	**0.91**	**0.89–0.94**	**0.93**	**0.90–0.96**
East Asia	**0.66**	**0.62–0.71**	**0.76**	**0.69–0.82**
Eastern Europe	**1.30**	**1.27–1.33**	**1.05**	**1.01–1.08**
Turkey	**0.96**	**0.93–0.99**	0.96	0.91–1.01

* Adjusted for age and country of destination.
Bold indicates statistical significance at p<0.05.

Table 3. Mortality rate ratios (MRRs) in six European countries combined, by region of origin, age group and sex

	MRRs* (95% CI) (local-born =1, ref.)					
	Men			Women		
Region of origin	0-19 years	20-44 years	45-69 years	0-19 years	20-44 years	45-69 years
North Africa	**2.20 (2.09-2.31)**	**1.06 (1.03-1.09)**	**1.03 (1.01-1.05)**	**1.11 (1.02-1.20)**	**1.57 (1.50-1.63)**	**1.09 (1.07-1.12)**
Sub-Saharan Africa	1.01 (0.91-1.11)	1.00 (0.97-1.04)	**0.94 (0.92-0.97)**	**1.45 (1.31-1.60)**	**1.59 (1.52-1.67)**	**1.19 (1.15-1.24)**
Caribbean	**0.49 (0.40-0.61)**	**0.98 (0.94-1.03)**	**0.82 (0.80-0.84)**	**0.27 (0.18-0.40)**	**1.26 (1.18-1.34)**	**0.92 (0.89-0.95)**
Other Latin America	**0.54 (0.44-0.65)**	**0.60 (0.56-0.65)**	**0.38 (0.36-0.40)**	**0.23 (0.15-0.36)**	**0.82 (0.76-0.89)**	**0.49 (0.47-0.52)**
South Asia	**1.62 (1.45-1.82)**	**0.84 (0.80-0.89)**	**0.91 (0.89-0.94)**	**1.40 (1.20-1.63)**	**0.92 (0.85-0.99)**	**0.91 (0.87-0.95)**
East Asia	1.00 (0.75-1.35)	**0.60 (0.52-0.69)**	**0.67 (0.61-0.73)**	0.71 (0.49-1.01)	**0.75 (0.64-0.88)**	**0.77 (0.70-0.86)**
Eastern Europe	1.01 (0.88-1.16)	**1.59 (1.51-1.67)**	**1.24 (1.21-1.28)**	0.92 (0.78-1.09)	**1.09 (1.02-1.16)**	1.03 (1.00-1.07)
Turkey	**1.62 (1.46-1.79)**	**0.69 (0.64-0.74)**	1.01 (0.97-1.05)	**1.48 (1.30-1.69)**	**0.77 (0.69-0.86)**	0.98 (0.92-1.05)

Stratified by age groups

In Table 3 age-specific analyses are presented for different migrant populations, compared with local-born populations of the same age group. Those from North Africa, South Asia, and Turkey had higher all-cause mortality in the age group 0-19 years, in contrast to the other age groups. Specifically, those from South Asia mortality had higher in the age group 0-19 years but lower in the other age groups. For women from Sub-Saharan Africa, all-cause mortality was higher in all age groups, while for men mortality was more or less similar in all age groups. Those from Eastern Europe (especially men) had higher mortality in the age groups 20-44 and less so in 45-69 years, with no differences in the youngest age group.

Stratified by country of destination

Compared to the local-born populations, the mortality pattern in different migrant populations varied by country of destination (Figures 1a and 1b). For men, Eastern Europeans had higher mortality in all European countries. South Asian men had higher mortality in Denmark, similar in E&W, and lower in France and Scotland. For women, those from North Africa tended to have higher mortality in Spain, Scotland and E&W, similar in Denmark, and lower in the Netherlands and France. East Asian women had lower mortality in Spain, Scotland and France, and similar in Denmark.

Stratified by causes of death

Cause-specific analyses are shown in Table 4 (see also Supplementary Material), combined for men and women and for six countries. Compared to local-born populations, mortality due to infectious diseases was higher for most migrant populations, but similar for those from East Asia, Eastern Europe and Turkey. The most important causes were TB and HIV/AIDS, with variations between migrant populations. Cancer mortality was generally lower for the migrant populations, but the pattern varied by cancer site. Mortality due to oesophagus/oral cavity, colon/rectum, and lung/bronchus cancer was lower in the migrant populations. Liver cancer mortality was higher for those from North Africa, Sub-Saharan Africa, and especially East Asia. Mortality due to stomach cancer was higher among those from North Africa, Caribbean, Eastern Europe and Turkey. CVD and diabetes mortality tended be higher for most migrant populations, but consistently lower for those from East Asia and Other Latin America. For injury-related mortality a contrasting picture emerged: for most migrant populations suicide was lower, while homicide was higher.

Figure 1a. Age-adjusted mortality rate ratios (MRRs) in men by region of origin and country of destination, with local-born as reference population

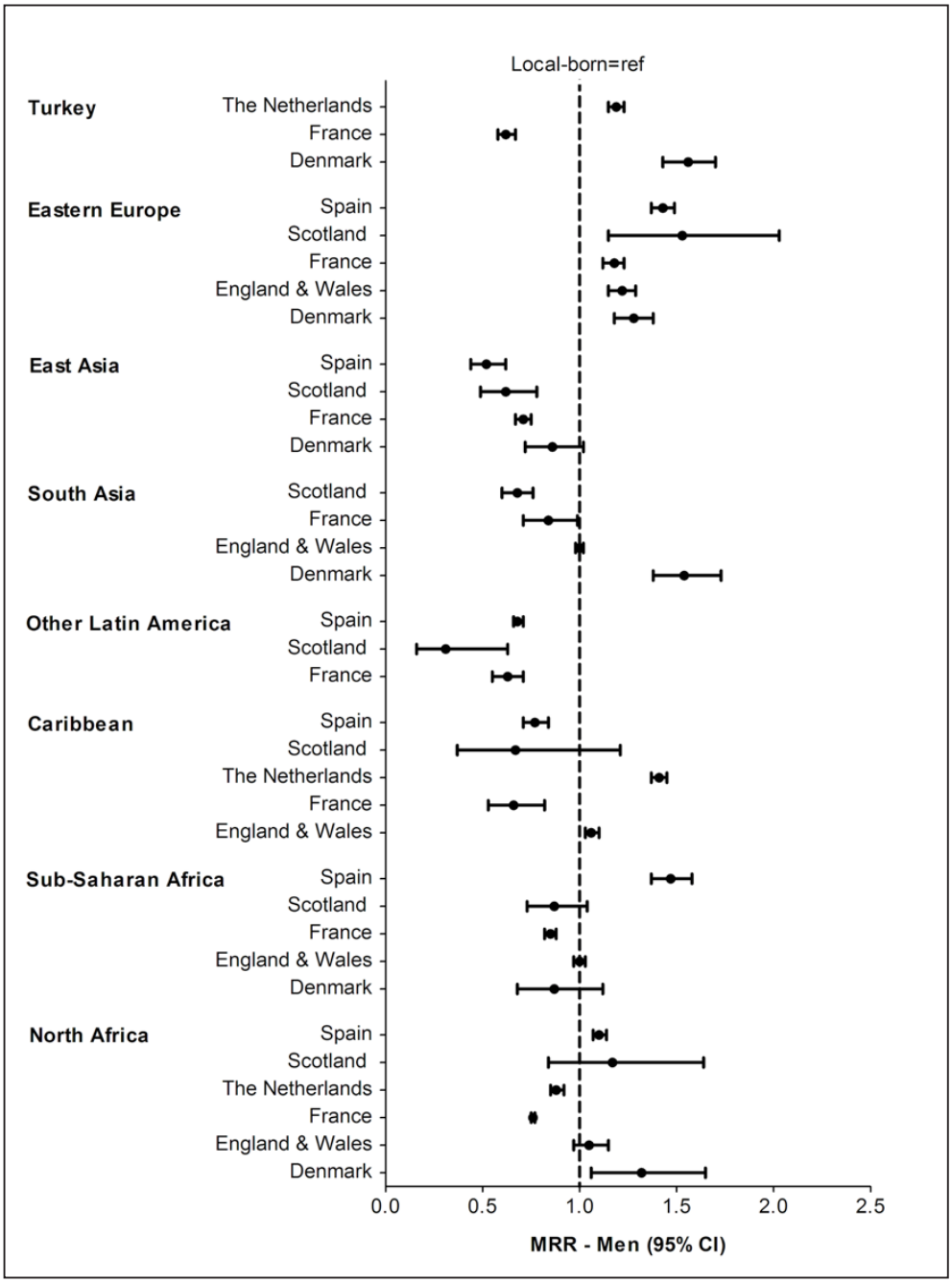

Figure 1b. Age-adjusted mortality rate ratios (MRRs) in women by region of origin and country of destination, with local-born as reference population

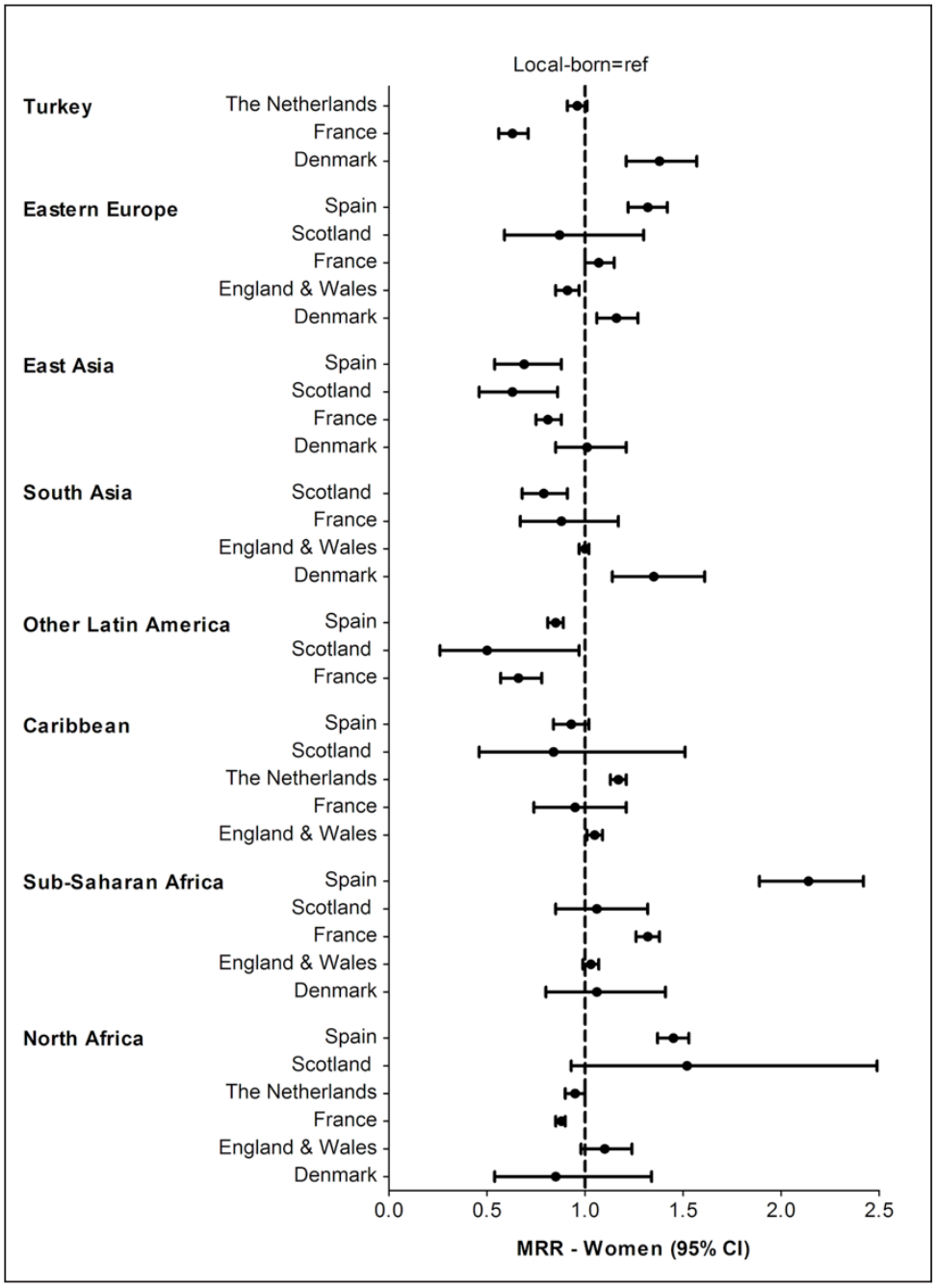

Table 4. Mortality rate ratios (MRRs)* combined for men and women and for six European countries, by region of origin and cause of death

Cause of death	Region of origin (local-born =1, ref.)							
	North Africa	Sub-Saharan Africa	Caribbean	Other Latin America	South Asia	East Asia	Eastern Europe	Turkey
	MRR (95% CI)	MRR (95% CI)	MRR (95% CI)	MRR (95% CI)	MRR (95% CI)	MRR (95% CI)	MRR (95% CI)	MRR (95% CI)
Infectious diseases	2.55 (2.39-2.71)	4.60 (4.34-4.67)	2.48 (2.20-2.79)	1.42 (1.24-1.63)	2.06 (1.85-2.29)	1.04 (0.77-1.41)	0.84 (0.69-1.02)	0.92 (0.75-1.13)
TB	2.73 (2.09-3.57)	9.41 (7.52-11.76)	1.25 (0.69-2.27)	23.05 (19.10-27.81)	19.05 (15.81-22.97)	0.56 (0.08-3.98)	2.28 (1.37-3.79)	3.22 (1.72-6.01)
HIV/AIDS	0.45 (0.37-0.55)	5.52 (5.12-5.94)	9.28 (8.19-10.52)	1.00 (0.72-1.40)	0.71 (0.53-0.94)	0.28 (0.13-0.42)	0.35 (0.22-0.57)	0.24 (0.14-0.42)
Cancer	0.80 (0.78-0.82)	0.95 (0.92-0.99)	0.77 (0.74-0.80)	0.47 (0.44-0.49)	0.53 (0.51-0.56)	0.80 (0.73-0.88)	1.05 (1.01-1.09)	0.67 (0.63-0.71)
Oesophagus and oral cavity	0.33 (0.29-0.38)	0.61 (0.53-0.70)	0.32 (0.27-0.38)	0.04 (0.02-0.08)	0.42 (0.35-0.51)	0.96 (0.69-1.34)	0.70 (0.60-0.82)	0.34 (0.25-0.45)
Stomach	1.44 (1.31-1.59)	1.01 (0.84-1.21)	2.15 (1.95-2.36)	0.28 (0.20-0.40)	0.95 (0.78-1.15)	0.80 (0.50-1.29)	1.97 (1.71-2.27)	1.88 (1.51-2.33)
Colon/rectum	0.64 (0.58-0.70)	0.75 (0.66-0.85)	0.82 (0.74-0.90)	0.74 (0.64-0.85)	0.44 (0.37-0.52)	0.67 (0.48-0.92)	0.76 (0.66-0.86)	0.60 (0.49-0.74)
Liver	2.17 (1.92-2.45)	2.96 (2.68-3.27)	0.96 (0.78-1.19)	0.61 (0.47-0.80)	1.04 (0.84-1.29)	5.09 (3.94-6.57)	0.76 (0.58-0.99)	0.89 (0.69-1.15)
Breast	0.90 (0.84-0.97)	1.45 (1.33-1.58)	0.67 (0.61-0.74)	0.52 (0.45-0.60)	0.61 (0.53-0.71)	0.27 (0.17-0.44)	0.86 (0.78-0.96)	0.41 (0.32-0.52)
Hodgkin's disease and leukaemia	1.55 (1.41-1.70)	0.86 (0.72-1.03)	1.72 (1.53-1.94)	0.75 (0.59-0.94)	0.43 (0.32-0.58)	1.16 (0.78-1.72)	1.61 (1.39-1.87)	1.47 (1.20-1.80)
Lung and bronchus	0.71 (0.67-0.74)	0.70 (0.65-0.76)	0.73 (0.69-0.78)	0.36 (0.32-0.40)	0.43 (0.39-0.47)	0.69 (0.57-0.84)	1.08 (1.01-1.16)	0.67 (0.60-0.75)
CVD	1.25 (1.22-1.28)	1.15 (1.10-1.20)	0.78 (0.75-0.81)	0.39 (0.36-0.42)	1.25 (1.21-1.30)	0.63 (0.55-0.71)	1.27 (1.22-1.32)	1.29 (1.21-1.37)
Diabetes	2.12 (1.96-2.29)	1.25 (1.07-1.46)	1.44 (1.27-1.63)	0.27 (0.19-0.38)	1.89 (1.66-2.15)	0.33 (0.17-0.66)	1.25 (1.06-1.47)	1.96 (1.65-2.33)
Injury-related	1.06 (1.02-1.09)	0.79 (0.75-0.82)	1.05 (1.00-1.10)	0.68 (0.63-0.72)	0.61 (0.57-0.65)	0.74 (0.65-0.84)	1.90 (1.82-1.98)	0.52 (0.48-0.57)
Unintentional injuries	1.22 (1.17-1.27)	0.86 (0.81-0.91)	1.43 (1.35-1.52)	0.94 (0.87-1.01)	0.60 (0.55-0.66)	0.77 (0.66-0.91)	2.25 (2.13-2.37)	0.52 (0.47-0.58)
Suicide	0.60 (0.56-0.64)	0.57 (0.52-0.62)	0.52 (0.46-0.58)	0.36 (0.32-0.42)	0.55 (0.49-0.62)	0.51 (0.39-0.67)	1.42 (1.31-1.54)	0.43 (0.37-0.50)
Homicide	2.83 (2.56-3.14)	1.78 (1.51-2.10)	0.84 (0.62-1.13)	0.39 (0.26-0.59)	1.35 (1.08-1.68)	1.89 (1.44-2.48)	1.52 (1.18-1.96)	1.89 (1.44-2.47)

TB=tuberculosis. HIV=human immunodeficiency virus. AIDS=acquired immune deficiency syndrome. CVD=cardiovascular diseases.

*MRRs were adjusted for sex, age, and country of destination.

Discussion

This overview showed a heterogeneous pattern in differences in all-cause mortality between migrant and local-born populations in six European countries. Some migrant populations had lower mortality than local-born populations (e.g. those from East Asia), while others had similar (e.g. Turkey) or higher mortality (e.g. Eastern Europe). The pattern varied importantly by age group, country of destination, and main cause of death. Those from South Asia and Turkey had higher mortality only in the age group 0-19 years, while those from Eastern Europe had higher mortality particularly in the age group 20-69 years. Eastern European men had higher mortality in all European countries, but other migrant populations had a diverse mortality pattern across countries of destination. Generally, most migrant populations had higher mortality due to infectious diseases, and homicide, but lower mortality due to cancer and suicide. CVD mortality differed by migrant population.

This study is the first to assess difference in all-cause mortality and main causes of death between migrant and local-born populations across Europe. It provides a detailed picture of mortality differences among migrant populations living in European countries. However, there are several limitations. First, data collection methods differed across countries, with some using linked data and others unlinked. Arguably, unlinked data are prone for numerator/denominator bias due to differences in the recording of the country of origin between the mortality register (numerator) and the population census (denominator) [6]. This bias may also arise when migrants are included in population censuses but not in mortality registers, or vice versa. This might occur especially in countries where migrants have no incentives to register themselves in population censuses but are recorded when they die. Such bias may depend on incentives to register; for example, being eligible for primary care and preventive services. As such, this bias may differ across countries of destination, and its strength may differ according to age, sex, and migrant population.

Second, the time periods for data collection varied. More specifically, both the length of the time-periods and the time when the data was collected varied. Third, the death registration systems (including death certification, coding practices, ICD coding version, etc.) differed by country of destination, potentially leading to differences in the classification of some causes of death (e.g. diabetes). Finally, because of return migration to their country of birth [11], under-registration of deaths among some migrant populations might have occurred, thereby resulting in an underestimation of all-cause mortality.

An important question is how much of the observed differences in mortality could be attributed to socio-economic position of migrants. While it is unlikely that socio-economic factors are responsible for the lower mortality rates that are observed for migrant populations and for several causes of death, they may have contributed to higher mortality [12, 13]. Unfortunately, we could not assess the role of such factors because individual-level socio-economic variables were not available in a comparable way in the data for the different countries.

Our findings are consistent with previous European country-level studies, which found that all-cause mortality differed across migrant populations. For example, in the Netherlands, all-cause mortality was higher for those from the Caribbean and Turkey, and lower for those from Morocco [3]. In E&W, a similar diverse pattern was observed, with some migrant populations having higher mortality (e.g., Indian women) and others lower (e.g., East Asian men) [14, 15]. Our study is not consistent with research from the United States, which consistently shows that migrant populations have lower all-cause mortality. For example, a recent meta-analysis using 58 longitudinal studies found that Hispanics had nearly 18% lower all-cause mortality risk than white Americans [16]. Two other large studies showed that black (not African Americans), Hispanic and Chinese migrants had lower all-cause mortality than local-born whites [17, 18].

This overview showed that for the same migrant population the relative mortality level varied by country of destination. Apart from data artefacts, such cross-country difference may reflect differences in the composition of that specific migrant population. For example, Caribbeans settled in E&W are mainly from the English-speaking Caribbean, those in France from Haiti, while those in the Netherlands originate from Antilles and Suriname. Additionally, the reason for migration for migrant populations differs by country of destination. Generally, most migrants from Sub-Saharan Africa residing in the E&W arrived as students (or as highly-skilled migrants), while those living in Spain entered Europe as refugees [1].

There were important differences in the mortality pattern across countries of destination. We observed that most migrant populations (particularly men) had lower all-cause mortality than the local-born population in France. In contrast, in Denmark four (out of six) migrant populations among men had higher mortality, a finding that is particularly interesting as the mortality rate of the local-born population is among the highest when compared to other local-born populations. These disparate findings might be explained by differences in measurement (e.g., study period, data collection method) but also by differences in migrant history, socioeconomic position and the extent of salmon bias. Indeed, a recent study showed that the possible effect of salmon bias is small in Denmark [11].

We found that Eastern Europeans (especially middle-aged men) consistently had higher all-cause mortality than local-born populations in Europe. It could be argued that the “healthy migrant effect” (i.e., individuals with relatively “good” health are more likely to migrate) might be less relevant for Eastern Europeans. Indeed, given the free labour movement across the European Union (EU) and the geographical proximity to Western European countries, migration from Eastern Europe is relatively easier and therefore possibly less selective, compared to other regions. The higher all-cause mortality among Eastern Europeans is mainly driven by the higher CVD and injury-related mortality – the latter is possibly linked with hazardous jobs. A Dutch report, for example, showed that Eastern Europeans mainly work in the construction industry with temporary contracts [19]. If this also applies to other Western European countries, then arguably the higher injury-related mortality could be due to a higher exposure to hazardous work environments. Further, as mortality due to alcohol consumption and smoking is relatively high in Eastern Europe [20, 21], one could argue that these health behaviours might also be prevalent among Eastern European migrants, leading

to higher CVD mortality. High alcohol consumption is also related to higher injury-related mortality [22].

Conversely, East Asians consistently had lower all-cause mortality than local-born populations. Their relative health advantage might be related to the strong healthy migrant effect, as it is more difficult for East Asians to migrate to Western Europe because of the greater geographical distance. The relatively favourable health behaviours [23, 24] and SES of East Asians should also be explored as a potential explanation for understanding the advantageous mortality pattern as compared to other migrant populations. As suggested by a 2011 report on Chinese (the largest East Asian group) in the Netherlands [25], East Asians generally tend to fare better socioeconomically than other migrant populations, both in terms of educational attainment and employment.

In conclusion, this overview showed a heterogeneous pattern of differences in all-cause and cause-specific mortality between different migrant and local-born populations in Europe. The pattern varied by sex, age group and country of destination. This heterogeneity clearly implies that migrant health is not necessarily worse in Europe. Indeed, there are some migrant populations that are faring particularly well (e.g. East Asia). Further research should help to understand the favourable mortality pattern among these migrant populations, thereby considering the role of selection factors (e.g. healthy migrant effect, salmon bias) and social determinants. Special attention is also needed for migrant populations with relatively high mortality, such as those from Eastern Europe and younger-aged migrants from North Africa, South Asia, and Turkey. This overview substantiates earlier calls [4, 26] as it clearly underlines the need for setting up valid surveillance systems on mortality across Europe, so that cross-country analysis can be conducted. This overview helps us setting priorities in research and health policy at the European level.

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Supplementary Table. Percentages* and absolute numbers of cause-specific deaths in six European countries combined, by region of birth

Cause of death	Region of birth								
	Local-born	North Africa	Sub-Saharan Africa	Caribbean	Other Latin America	South Asia	East Asia	Eastern Europe	Turkey
	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
All-cause mortality	100 (1 946 120)	100 (32 160)	100 (14 216)	100 (16 265)	100 (5219)	100 (15 783)	100 (2340)	100 (8727)	100 (7223)
Infectious diseases	1.5 (28 608)	2.7 (857)	6.1 (869)	2.6 (431)	4.5 (234)	1.1 (181)	4.3 (101)	1.4 (126)	2.2 (156)
TB	0.1 (1426)	0.2 (67)	0.7 (104)	0.2 (25)	0.2 (10)	0.9 (147)	0.3 (6)	0.2 (21)	0.1 (5)
HIV/AIDS	0.6 (11373)	0.8 (247)	4.0 (575)	1.0 (166)	2.9 (149)	0.1 (16)	0.9 (20)	0.3 (22)	0.2 (16)
Cancer	36.1 (701 612)	40.0 (12 868)	24.6 (3502)	21.1 (3440)	30.1 (1570)	12.5 (1974)	43.1 (1009)	25.6 (2236)	23.2 (1679)
Oesophagus and oral cavity	2.7 (52 592)	2.0 (648)	1.7 (241)	1.2 (188)	0.6 (29)	1.5 (233)	3.1 (72)	1.3 (116)	0.6 (45)
Stomach	1.5 (28 464)	1.8 (567)	1.2 (174)	1.8 (296)	1.9 (98)	0.9 (141)	1.5 (34)	1.6 (140)	1.8 (130)
Colon/rectum	3.8 (73 739)	2.9 (948)	2.2 (313)	2.4 (396)	2.0 (106)	1.7 (261)	3.5 (81)	2.1 (179)	1.3 (91)
Liver	0.9 (17 808)	1.7 (541)	2.3 (321)	0.6 (96)	1.0 (53)	0.1 (9)	6.9 (161)	0.6 (54)	0.9 (68)
Breast	3.9 (76 853)	3.3 (1,053)	4.4 (630)	3.2 (517)	3.0 (159)	2.8 (437)	2.5 (58)	2.6 (225)	1.6 (117)
Hodgkin's disease and leukaemia	1.2 (23 731)	1.5 (481)	1.5 (215)	1.1 (186)	2.4 (124)	1.2 (182)	1.6 (37)	1.1 (98)	1.5 (107)
Lung and bronchus	10.4 (202 008)	11.5 (3702)	4.6 (654)	4.7 (768)	5.7 (300)	3.7 (584)	9.5 (223)	7.8 (683)	6.2 (450)
CVD	21.3 (415 311)	17.3 (5566)	19.9 (2831)	24.8 (4038)	15.6 (812)	37.7 (5952)	17.4 (407)	20.4 (1782)	20.7 (1492)
Diabetes	1.4 (27 834)	2.5 (792)	1.8 (257)	5.0 (807)	0.7 (35)	4.4 (701)	1.2 (29)	1.0 (87)	2.9 (206)
Injury-related	9.0 (174 496)	12.5 (4006)	8.2 (1164)	9.7 (1584)	31.7 (1652)	3.0 (472)	12.6 (296)	22.5 (1964)	11.4 (820)
Unintentional injuries	5.2 (101 993)	8.7 (2804)	5.2 (734)	4.6 (748)	23.5 (1226)	1.4 (217)	8.2 (191)	15.6 (1365)	5.9 (428)
Suicide	3.5 (68 058)	2.7 (882)	2.6 (368)	3.3 (540)	4.9 (254)	1.5 (244)	3.5 (83)	5.2 (451)	3.1 (226)
Homicide	0.2 (4 445)	1.0 (320)	0.4 (62)	1.8 (296)	3.3 (172)	0.1 (11)	0.9 (22)	1.7 (148)	2.3 (166)

TB=tuberculosis. HIV=human immunodeficiency virus. AIDS=acquired immune deficiency syndrome. CVD=cardiovascular diseases.

* Percentages are based on the total deaths within a population

PART 2

Perceived ethnic discrimination

CHAPTER 4

The contribution of perceived ethnic discrimination to the prevalence of depression

Published

Umar Z. Ikram, Marieke B. Snijder, Thijs J.L. Fassaert, Aart H. Schene, Anton E. Kunst, Karien Stronks. The contribution of perceived ethnic discrimination to the prevalence of depression. Eur J Public Health 2014;25:243-248

Abstract

Background: European research on the association between perceived ethnic discrimination (PED) and health is importantly lacking. It is also unknown how much PED contributes to disease prevalence. In this study, we quantified the contribution of PED to depression in five ethnic groups in a middle-size European city.

Methods: We used cross-sectional data from the HELIUS study (Healthy Life in an Urban Setting), collected from January 2011-June 2013 in Amsterdam, the Netherlands. We included a random sample of 1753 ethnic Dutch, 1143 South-Asian Surinamese, 1794 African Surinamese, 1098 Ghanaians, and 850 Turks, aged 18-70 years. PED was assessed using the Everyday Discrimination Scale. Patient Health Questionnaire-9 was used for assessing depressive symptoms and Major Depressive Disorder (MDD). We used logistic regression and calculated the contribution of PED to depressive symptoms and MDD using the population attributable fractions.

Results: Depressive symptoms and MDD were most common in Turks and South-Asian Surinamese, and lowest in ethnic Dutch. PED had a positive association with depressive symptoms and MDD in only the ethnic minority groups. The contributions of PED to depressive symptoms and MDD were around 25% in both the Surinamese groups, and Turks, and about 15% in Ghanaians.

Conclusion: We conclude that PED contributes considerably to depression in ethnic minority groups in a European context. As such, ethnic inequalities in depression could be reduced substantially if ethnic minority groups would not perceive any ethnic discrimination. We encourage more European research on the health impact of perceived ethnic discrimination.

Introduction

Perceived ethnic discrimination (PED) is defined as experiencing unfair treatment because of ethnic background [1]. It captures the subtle indignities that occur on day-to-day basis, and is considered an important chronic stressor for particularly ethnic minority groups [2, 3]. Studies show that PED is associated with adverse health outcomes [2-4]. However, this evidence is largely from the United States (US), focuses mainly on African Americans [3]. Findings from the US cannot be readily applied to the European context since European ethnic minority groups differ from those in the US in terms of ethnic origin and migration history [5, 6].

European studies have also found a link between PED and health. Some studies also focused on racial harassment, which differs from PED in that the former addresses racially motivated attacks (either verbal or physical) [7]. A British study showed that perceived discrimination and racial harassment were associated with poor self-rated health in ethnic minority groups [7]. In the European Social Survey, it was found that PED was not associated with poor self-rated health across 26 European countries – however, the association was only examined in the total sample of both ethnic majority and ethnic minority groups [8]. There are relatively fewer studies on mental health. For example, both a Spanish study (using a non-random sample of immigrants) and Dutch study (on a small sample of adolescents) found that PED was associated with adverse mental health [9, 10]. Two British studies found positive association between racial harassment and common mental disorders in ethnic minority groups [11, 12].

Measuring perceptions of ethnic discrimination comprehensively is particularly important for two reasons. First, while overt acts of discrimination (e.g. hate speeches) have largely disappeared from the public discourse, subtle acts of discrimination (e.g. treated with less politeness) are still experienced by ethnic minority groups [13]. Perceptions help capture these experiences. Second, perceptions reflect how one cognitively appraises and evaluates discriminatory situations. This process by itself may instigate a stress response, affect one's self-esteem, and lead to using adverse coping mechanisms (e.g. unhealthy behaviours), eventually resulting in poor health [14, 3]. Stress literature suggests that "stressors that are ambiguous, negative, unpredictable, uncontrollable are particularly pathogenic" [3, pp. 32], and may have long-term health effects [14].

Although numerous US studies have shown the association between PED and health, none of them quantified how much PED contributes to the prevalence of a disease. Such estimates may help researchers as well as policymakers in understanding the health impact of PED, especially in the context of ethnic health inequalities.

In this study, we first assessed the association between PED and depression in five ethnic groups in a European capital, Amsterdam, the Netherlands. We focused on depression because evidence suggests that ethnic minority groups are disproportionally affected by depression in Western countries [9;10]. It has been projected that depression will be the leading cause of disease burden in high-income countries by 2030 [15]. Using the population attributable fraction, we also quantified the contribution of PED to depression

in each ethnic group.

Methods

Study population

We used baseline cross-sectional data from the HELIUS study (Healthy Life in an Urban Setting), which is a multi-ethnic cohort study in Amsterdam, the Netherlands. Participants aged 18-70 years were randomly sampled, stratified by ethnic origin, through the municipality register of Amsterdam. This register includes data on the country of birth of residents and their parents, which are used for determining ethnicity (see definition below) [16]. The definite response rates cannot yet be calculated as a large proportion of the total sample has not been contacted at all. However, we estimated that the response rates in the first phase are approximately 20-40% with some variations across ethnic groups. Data were collected by a questionnaire, either self-administered or through interview by ethnic-matched interviewer. Written informed consent was obtained from all participants prior to inclusion in the study. This study was approved by the Institutional Review Board of the Academic Medical Center, University of Amsterdam. The full study protocol is described elsewhere [16].

We used data collected from January 2011-June 2013. From the total sample of 7307, we excluded Moroccans (n=264), Indonesian Surinamese (n=113), and those with an unknown ethnic background (n=124), because of relatively small sample sizes. Subsequently, participants were excluded with missing data on the covariates (n=260). This resulted in 6546 participants: 1744 ethnic Dutch, 1126 South-Asian Surinamese, 1770 African Surinamese, 1072 Ghanaians, and 834 Turks. (Socio-demographic information on these groups can be found as Supplementary Material.)

Variables

Ethnicity

According to the definition of the Central Bureau of Statistics, ethnicity of a participant was defined according to his country of birth and that of his parents [17]. Specifically, a participant was considered as non-ethnic Dutch if he fulfilled either of the following criteria: 1) he was born outside the Netherlands and had at least one of his parents who was born outside the Netherlands (i.e. first generation); or 2) he was born in the Netherlands but at least one of his parents was born outside the Netherlands (i.e. second generation).

Perceived ethnic discrimination

PED was conceptualized as the subtle forms of interpersonal discrimination based on ethnicity that one perceives in daily life [18]. PED was measured using the Everyday Discrimination Scale (EDS) which is widely used in the US [19, 20]. The EDS captures the frequency of discriminatory experiences in daily life, using nine items (e.g. “being treated with less respect than others”), with a 5-point Likert scale (never to very often) consistent

with the study by Forman [20]. We adapted the EDS by specifically asking the participants how often they had experienced discrimination because of their background, which in the Dutch language is interpreted, especially in the context of the study, as ethnic background. If one of the items of EDS was missing, the mean score of the other items was used to replace the missing item. If more than one item was missing, the variable was considered missing. Mean discrimination score of nine items was calculated. Additionally, the prevalence of experiencing any ethnic discrimination was determined as whether a participant scored 4 (often) or 5 (very often) on at least one item. The Cronbach's alpha was 0.93 for ethnic Dutch, 0.91 for South-Asian Surinamese, 0.90 for African Surinamese, 0.91 for Ghanaians, and 0.90 for Turks.

Depression

Depression was assessed using the Patient Health Questionnaire-9 (PHQ-9) [21]. PHQ-9 determines the prevalence of depressive symptoms and Major Depressive Disorder (MDD) over the preceding two weeks. Baas and colleagues demonstrated PHQ-9's validity among Surinamese in the Netherlands [22]. The PHQ-9 consists of nine items, with a response scale varying from zero (never) to three (nearly every day). If one of the items was missing, the mean score of the other eight items was used to replace the missing item. If more than one item was missing, the variable was considered missing. We considered both depressive symptoms (including milder depressive symptoms) and MDD (clinical diagnosis). A cut-off point ≥ 10 was used to determine depressive symptoms. MDD was established through an algorithm in line with the DSM-IV[19], stating that more than five items were present "more than half the days" (score=2), including at least one of the following items: depressed mood, and loss of interest. The item, "thinking about hurting yourself in some way", also counted if it was scored with several days (score=1). The Cronbach's alpha was 0.83 for ethnic Dutch, 0.92 for South-Asian Surinamese, 0.86 for African Surinamese, 0.87 for Ghanaians, and 0.90 for Turks.

Education level

Educational level was defined as the highest level of education completed with a diploma or certificate of proficiency in the Netherlands or in the country of origin. Participants were divided into four categories: no education or elementary education; lower vocational and general secondary education; intermediate vocational and higher secondary education; and higher vocational education and university.

Employment

Employed was defined as the current status of employment. We used the following categories: employed, unemployed, and not in the labour force.

Statistical analysis

We used logistic regression models to assess the association between PED and depressive symptoms / MDD by ethnic group. The crude model was unadjusted. In the second model,

we adjusted for sex, age, martial status, and generation. In the final model, we also included education and employment.

To quantify the contribution of PED to depression, the population attributable fraction (PAF) was calculated [23, 24]. The PAF should be interpreted as the proportional reduction in the prevalence of depression that would occur if, ideally, no one would perceive any ethnic discrimination. The adjusted formula of the PAF was used (see for detailed discussion [23, 24]):

$$(P((RR - 1)/RR)) \times 100$$

where P is the prevalence of any discrimination among people with depressive symptoms or MDD. RR is the relative risk of depressive symptoms / MDD, adjusted for age, sex, marital status, generation, education, and employment. We first determined the P for each ethnic group. Subsequently, we used Poisson regression to measure ethnic-specific RRs. We assessed the adjusted association between experiencing any ethnic discrimination and depressive symptoms / MDD. We did not calculate the PAFs for ethnic Dutch as their RRs were not statistically significant. We used SPSS version 21.0 and Microsoft Excel 2011 for analysis.

Results

Ethnic minority groups tended to be younger and have lower education attainment than ethnic Dutch (Table 1). They reported PED about fifteen times more, but within ethnic minority groups there were no differences in PED reports. They mostly reported ethnic discrimination on the following items: “That people act as if they are better”, “as if the participant is not as smart” and “treated with less respect” (see Supplementary Material). The prevalence rates of both depressive symptoms and MDD were highest in Turks and South-Asian Surinamese, and the lowest in ethnic Dutch. The differences among all ethnic groups for both depressive symptoms and MDD were statistically significant ($p<0.001$) (see more on the prevalence of depression in the Supplementary Material)

Table 2 shows the associations between PED and depressive symptoms and MDD. After adjustment, both the mean score and the prevalence of discrimination were positively associated with depressive symptoms and MDD. These associations were found in all ethnic minority groups, except for MDD in Ghanaians. No association were observed in ethnic Dutch.

The contributions of PED to depressive symptoms and MDD are presented in Table 3. For depressive symptoms, the adjusted PAF in South-Asian Surinamese was 18.3% (95% confidence interval [CI] 11.4-23.7), suggesting that the prevalence of depressive symptoms in South-Asian Surinamese would be reduced by 18.3% if none of them had perceived any ethnic discrimination. In African Surinamese, Ghanaians and Turks, the adjusted PAFs were 18.5% (10.4-24.9), 16.4% (4.9-24.1), and 24.0% (17.8-29.0), respectively. For MDD, the adjusted PAFs for South-Asian Surinamese, African Surinamese, and Turks were 20.1% (9.5-27.6), 27.5% (15.5-36.0), and 25.5% (15.7-32.5). However, for Ghanaians the adjusted PAF

Table 1. Characteristics of participants and the prevalence of perceived ethnic discrimination (PED)

	Ethnicity				
	Ethnic Dutch	**South-Asian Surinamese**	**African Surinamese**	**Ghanaian**	**Turks**
	(n=1744)	**(n=1126)**	**(n=1770)**	**(n=1072)**	**(n=834)**
Male, %	46.7	47.3	37.9	41.0	46.8
Age in years, mean (SD)	46.48 (13.93)	45.77 (13.14)	46.81 (12.78)	45.01 (12.18)	39.76 (12.17)
First generation, %	-	79.4	83.8	92.0	71.0
Marital status, %					
Married/living with a partner	56.7	48.5	29.8	28.0	68.0
Divorced/separated/widowed	10.8	21.3	16.6	34.3	11.9
Never married	32.5	30.2	53.6	37.7	20.1
Education, %[a]					
1 (lowest)	3.0	15.7	6.2	26.1	34.7
2	15.4	37.1	34.2	38.7	23.6
3	23.2	26.9	36.7	24.4	28.3
4 (highest)	58.4	20.2	22.9	10.7	13.4
Employment, %					
Employed	73.0	61.7	65.1	57.4	53.7
Unemployed	5.4	13.3	13.7	24.6	13.8
Not in the labour force	21.6	25.0	21.1	18.0	32.5
PED					
Mean (SD), range 1-5	1.13 (0.34)	1.97 (0.75)	2.00 (0.75)	1.87 (0.78)	1.86 (0.73)
Prevalence of discrimination, %	1.8	29.7	31.4	28.8	30.6
Depression, %					
Depressive symptoms	5.8	18.9	11.0	9.0	24.0
MDD	2.3	10.2	4.2	3.8	12.9

PED=Perceived ethnic discrimination. MDD=Major Depressive Disorder.

[a] 1=no education or elementary education; 2=lower vocational and general secondary education; 3=intermediate vocational and higher secondary education; 4=higher vocational education or university.

Table 2. Association between perceived ethnic discrimination and depressive symptoms and Major Depressive Disorder, adjusted for potential confounders

Outcome	Perceived ethnic discrimination	OR (95% CI)				
		Ethnic Dutch	South-Asian Surinamese	African Surinamese	Ghanaian	Turks
Depressive symptoms	Mean discrimination score					
	Crude model	1.50 (0.95, 2.36)	1.76 (1.45, 2.15)	1.64 (1.36, 1.97)	1.99 (1.56, 2.55)	1.98 (1.59, 2.46)
	Model 2[a]	1.38 (0.87, 2.20)	1.84 (1.51, 2.26)	1.67 (1.38, 2.02)	2.02 (1.58, 2.59)	2.04 (1.62, 2.56)
	Model 3[b]	1.18 (0.71, 1.95)	1.84 (1.49, 2.27)	1.66 (1.36, 2.01)	2.22 (1.71, 2.89)	2.11 (1.65, 2.69)
	Prevalence of discrimination					
	Crude model	2.38 (0.82, 6.92)	2.22 (1.63, 3.01)	2.04 (1.51, 2.76)	1.70 (1.11, 2.63)	2.76 (1.98, 3.84)
	Model 2	2.26 (0.76, 6.70)	2.25 (1.64, 3.08)	2.08 (1.53, 2.83)	1.69 (1.09, 2.61)	2.98 (2.11, 4.20)
	Model 3	1.48 (0.48, 4.60)	2.11 (1.52, 2.93)	1.86 (1.35, 2.55)	1.84 (1.18, 2.89)	2.98 (2.07, 4.29)
MDD	Mean discrimination score					
	Crude model	0.89 (0.33, 2.38)	1.94 (1.52, 2.48)	1.78 (1.35, 2.35)	2.20 (1.55, 3.11)	1.87 (1.43, 2.42)
	Model 2	0.78 (0.29, 2.12)	1.98 (1.54, 2.55)	1.80 (1.37, 2.38)	2.25 (1.58, 3.20)	1.93 (1.47, 2.54)
	Model 3	0.63 (0.21, 1.88)	1.92 (1.49, 2.49)	1.79 (1.34, 2.38)	2.44 (1.69, 3.53)	1.92 (1.45, 2.57)
	Prevalence of discrimination					
	Crude model	-	2.22 (1.50, 3.29)	2.54 (1.59, 4.06)	1.45 (0.76, 2.77)	2.50 (1.66, 3.77)
	Model 2	-	2.20 (1.47, 3.27)	2.57 (1.60, 4.12)	1.45 (0.75, 2.79)	2.68 (1.75, 4.09)
	Model 3	-	2.02 (1.34, 3.05)	2.24 (1.38, 3.64)	1.62 (0.83, 3.17)	2.56 (1.65, 3.98)

OR=Odds Ratio. CI=confidence interval. MDD=Major Depressive Disorder.

[a] Model 2: adjusted for sex, age, marital status, and generation (generation was not used in ethnic Dutch). [b] Model 3: additionally adjusted for education and employment.

Table 3. The contribution (%) of perceived ethnic discrimination to depressive symptoms and Major Depressive Disorder (MDD) among ethnic groups

	South-Asian Surinamese	African Surinamese	Ghanaian	Turks
Depressive Symptoms				
Prevalence of any discrimination (n)[a]	44.1 (94)	46.2 (90)	39.6 (38)	48.0 (96)
Adjusted RR (95% CI)[b]	1.71 (1.35, 2.16)	1.67 (1.29, 2.17)	1.71 (1.14, 2.55)	2.00 (1.59, 2.52)
Adjusted PAF (95% CI)[c]	18.3 (11.4, 23.7)	18.5 (10.4, 24.9)	16.4 (4.9, 24.1)	24.0 (17.8, 29.0)
MDD				
Prevalence of any discrimination (n)[d]	46.1 (53)	52.7 (39)	36.6 (15)	49.1 (53)
Adjusted RR (95% CI)	1.77 (1.26, 2.49)	2.09 (1.34, 3.27)	1.54 (0.82, 2.92)	2.08 (1.47, 2.96)
Adjusted PAF (95% CI)	20.1 (9.5, 27.6)	27.5 (15.5, 36.0)	12.8 (-8.0, 24.1)	25.5 (15.7, 32.5)

RR=relative risk. PAF=population attributable fraction. CI=confidence interval. MDD=Major depressive disorder.
[a] Prevalence of ethnic discrimination among cases with depressive symptoms. [b] RR is adjusted for sex, age, generation, marital status, education, and employment (calculated by using Poisson regression). [c] PAF with 95% CI based on the 95% CI of the RRs. [d] Prevalence of ethnic discrimination among cases with MDD.

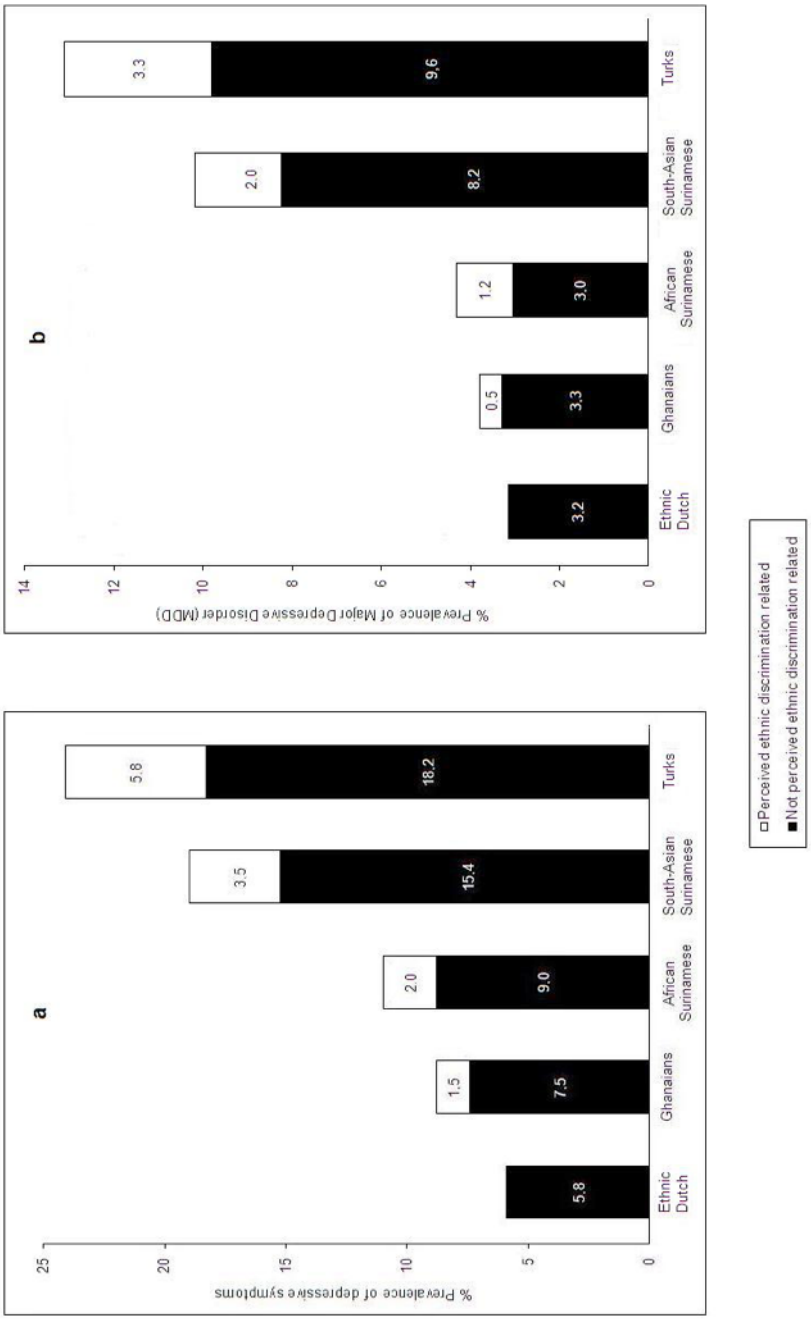

Figure 1. Prevalence of depressive symptoms (Figure a) and Major Depressive Disorder (Figure b) across ethnic groups, stratified by portion related to perceived ethnic discrimination and portion not related to perceived ethnic discrimination.

was 12.8% (-8.0-24.1).

Figure 1 depicts the prevalence of depressive symptoms and MDD across the ethnic minority groups, stratified by discrimination-related and non-discrimination-related. When PED is taken into account, the prevalence of both depressive symptoms and MDD could be reduced considerably in the ethnic minority groups. Specifically, the prevalence of depressive symptoms could be reduced from 24.0 to 18.2% (24.0 minus 5.8) in Turks, 18.9 to 15.4% in South-Asian Surinamese, 11.0 to 9.0% in African Surinamese, and 9.0 to 7.5% in Ghanaians. Similarly, the prevalence of MDD could be reduced from 13.7 to 11.4% in Turks, 10.2 to 8.2% in South-Asian Surinamese, 4.2 to 3.0% in African Surinamese, and 3.8 to 3.3% in Ghanaians.

Discussion

This study showed depressive symptoms and MDD were more common in ethnic minority groups than ethnic Dutch. It further demonstrated that perceived ethnic discrimination (PED) was positively associated with both depressive symptoms and MDD in ethnic minority groups, but not in ethnic Dutch. We calculated that about 16-24% of depressive symptoms and 13-28% of MDD could be attributed to PED in ethnic minority groups. This may suggest that ethnic inequalities in depression could be reduced considerably if ethnic minority groups would not perceive any ethnic discrimination.

Strength of this study is the large random sample of different ethnic groups with distinct socioeconomic and migration histories. This study contributes to the European literature on discrimination and health, as it is the first to use the EDS (which is widely used in the US). This may enrich our understanding on the link between discrimination and health in a European context. Moreover, this study adds to the growing discrimination literature by using PAF to quantify the contribution of PED to depression in different ethnic minority groups.

This study has some limitations. First, the cross-sectional design makes it difficult to draw causal inferences. One could therefore question the usage of PAF which implies causality. However, longitudinal studies from the US have shown that racial discrimination precedes depression, and not vice versa. For example, Schulz and colleagues showed that among African American women an increase in PED over five years led to a subsequent increase in symptoms of depression, after controlling for baseline measures of discrimination and depression [25]. Brown and colleagues found that PED predicted psychological distress in Black Americans 1-2 years later, whereas psychological distress or depression did not subsequently predict PED [26]. Other longitudinal studies found similar findings [27, 28]. Based on this longitudinal evidence, we felt justified in using the PAF to measure the contribution of PED to depression.

Second, for quantifying the contribution of PED to depression in each ethnic group, we used the RR to measure the association between PED and depressive symptoms and MDD. In contrast to the other ethnic minority groups, the RR for Ghanaians did not reach statistical significance. This is probably due to loss of information resulting from dichotomizing the PED

variable. Indeed, analysis with PED as continuous variable showed statistically significant associations between PED and depressive symptoms and MDD among Ghanaians.

Third, as both PED and depression were measured using self-reports, response bias may have occurred [2]. To overcome this, there is a debate whether personality traits should be controlled for [29], e.g. neuroticism – which reflects negative emotionality and poor self-concept [30, 31]. It is suggested that high neuroticism people may report both more PED and more depression, thereby leading to a spurious association between PED and depression. However, neuroticism and depression are to some extent overlapping constructs, as neuroticism partly reflects depression [30]. It is therefore difficult to strictly separate these constructs in empirical analyses. However, when we redid the analyses among those in the lowest neuroticism stratum, the association between PED and depression remained statistically significant (results not shown).

Finally, our sample is regional as this study only included residents of Amsterdam. Nonetheless, the majority of ethnic minority groups are living in the four largest cities (i.e. The Hague, Rotterdam, Utrecht, and Amsterdam) of the Netherlands, which are demographically quite similar [32].

Our findings indicate that depressive symptoms and MDD are more common in the ethnic minority groups than ethnic Dutch. Similarly, a US study found that MDD was higher in African American and Hispanics than white Americans [33]. However, other studies found that Blacks have similar or lower prevalence of depression than Whites [34, 35]. For example, Williams and colleagues showed that the 12-month prevalence of MDD was similar but the lifetime prevalence of MDD was lower in African Americans and Caribbean Blacks than whites [35]. Findings from European studies show a heterogeneous pattern. Shaw and colleagues showed that the prevalence of depressive disorder was similar among African Caribbeans and white British in the UK [36]. Another UK study found that common mental disorders (i.e., depression and anxiety) were more common among South-Asians but similar in Caribbeans [37]. Consistent with our findings, two studies from Belgium [38] and Netherlands [39] found that Turks had higher rates of depressive symptoms than whites.

Nearly one third of the ethnic minority groups reported to have perceived any ethnic discrimination in their daily life in the Netherlands. This is in line with the Eurobarometer Survey and a UK study which both found that 27% of ethnic minority groups reported ethnic discrimination [40, 11].

Similar to earlier evidence, this study indicates that PED was positively associated with depression in ethnic minority groups. Several studies showed positive associations between PED and depression in African Americans, Caribbean Americans, and UK-based Pakistanis and Indians (e.g. [3, 11, 12]). Our findings are consistent with studies from Australia and New Zealand, which demonstrated that perceived discrimination is association with poor mental health among Indigenous Australians and Māori (e.g. [41, 42]). We are aware of only one study that investigated discrimination and health in Turks and Moroccans. Using a small sample of adolescents, this Dutch study also found that PED was positively associated with depression [10].

vvvWe showed that PED substantially contributed to the prevalence of both depressive symptoms and MDD in the ethnic minority groups. The relatively high PAFs among the ethnic minority groups underscores the importance of PED in relation to ethnic inequalities in mental health, although we did not explicitly test whether PED contributes to ethnic inequalities in depression. The PAFs should be interpreted with caution given the abovementioned limitations. We also argue that other important sociocultural factors (e.g. acculturation and ethnic identity) should be addressed in order to understand the mental health of ethnic minority groups [43]. Interestingly, the GBD 2010 data indicate that these ethnic minority groups (except Ghanaians) have lower MDD prevalence in their countries of origin [44], which may suggest that adverse circumstances in the host societies (e.g. ethnic discrimination, acculturative stress) might be at play here.

In conclusion, this study showed that PED contributes considerably to depression in four ethnic minority groups. More European research on this topic is required, especially with longitudinal data, as it helps understand ethnic health inequalities. As such, the European public health community does not only have a moral argument to address PED but also a health imperative.

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Supplementary Box 1. Socio-historical information on the ethnic minority groups included in this study

South Asian Surinamese

South-Asian Surinamese arrived in the Netherlands in the 1960-1970s, after the independence of Suriname from the Netherlands [45, 46]. The most important reason of migration was the unstable political and economic situation in Suriname. The ancestors of South-Asian Surinamese were originally from the Northern parts of India (e.g. Bihar), and worked as contract-workers in Suriname. Although Indian labourers were intended to stay temporarily, many decided to settle permanently in Suriname [45]. South-Asian ethnic populations are living across Europe, especially in the United Kingdom (UK) and the Scandinavian countries.

African Surinamese

African-Surinamese migrated from Suriname to the Netherlands, along with the South-Asian Surinamese[45, 46]. They had similar reasons of migration as South-Asian Surinamese. They are descendants of West Africans who were brought to Suriname during the slave trade in the 18th and 19th century. African-Caribbean populations with similar socio-historical background can also be found in other European countries (e.g. UK and France) and the United States. In 2015, Surinamese peoplea comprise 2% of the general population and 17% of total non-Western migrant populationb in the Netherlands [47]. In Amsterdam, these figures are 8% and 23%, respectively [48]. Of the Surinamese living in the Netherlands, it is estimated that 45% has South-Asian origin and 39% African origin [49]. There is considerable religious diversity among Surinamese: 35% Christian, 25% Hindu, and 10% Muslim (and 30% non-religious) [49].

Ghanaians

Ghanaians migrated to the Netherlands in two phases [50, 16]. In the first phase in the 1970s and 1980s many migrated because of socioeconomic reasons. During the second phase in the early 1990s was due to the unstable political situation in Ghana, drought, and the expulsion of many Ghanaians from Nigeria. There are also large Ghanaian communities in the UK and Germany. In the Netherlands, Ghanaian people comprise 0.1% of the general population and 1% of the total non-Western migrant population [47]. The figures were 1.5% and 4%, respectively, in Amsterdam [48]. Most Ghanaians are Christian, but some are Muslim.

Turks and Moroccans

Migrants from Turkey and Morocco were recruited by the Dutch government in the 1960-1970s as temporary guest workers, to fill the labor shortages in unskilled occupations [51, 16]. However, the majority of the migrants decided to settle and brought their spouses and children to the Netherlands. Currently, Turks and Moroccans are the largest ethnic minority groups in many European countries (e.g. Spain, France, Germany). Turkish and Moroccan people separately account for around 2% of the general population and 19% of the total non-Western migrant population [47]. In Amsterdam, the respective figures for Turkish people were 5% and 15%, respectively, and for Moroccan people 9% and 26%, respectively [48]. Turks and Moroccans are mostly Muslim (95%) [52].

[a] Official statistics do not distinguish between Surinamese subgroups.

[b] In the Netherlands, migrants populations are distinguished between Western (i.e. culturally proximate to the Dutch culture; migrants from, say, North-America, other European countries) and non-Western migrant populations.

Supplementary Table. Mean values (SD) for perceived ethnic discrimination, stratified by separate items and ethnicity

Items of Everyday Discrimination Scale (EDS)	Mean values (SD)				
	Ethnic Dutch	South-Asian Surinamese	African Surinamese	Ghanaian	Turkish
1. Treated with less politeness	1.15 (0.45)	2.21 (0.96)	2.25 (0.97)	2.26 (1.13)	2.31 (1.05)
2. Treated with less respect	1.17 (0.48)	2.15 (0.96)	2.18 (0.97)	2.20 (1.15)	2.25 (1.06)
3. Receive poorer service	1.12 (0.42)	2.01 (0.96)	2.01 (0.97)	1.91 (1.05)	1.99 (1.05)
4. People act as if you are not as smart	1.11 (0.41)	2.23 (1.11)	2.23 (1.12)	1.98 (1.08)	1.91 (1.06)
5. People act as if they are afraid of you	1.09 (0.37)	1.75 (0.96)	1.90 (1.05)	1.66 (0.97)	1.68 (0.93)
6. People act as if you are dishonest	1.08 (0.34)	1.78 (0.95)	1.84 (0.99)	1.69 (0.96)	1.61 (0.93)
7. People act as if they are better	1.20 (0.56)	2.49 (1.21)	2.51 (1.22)	2.11 (1.18)	2.20 (1.21)
8. Threatened or harassed	1.10 (0.37)	1.38 (0.68)	1.27 (0.64)	1.46 (0.79)	1.29 (0.64)
9. Called names or insulted	1.18 (0.48)	1.57 (1.82)	1.59 (0.84)	1.49 (0.81)	1.46 (0.78)

CHAPTER 5

Perceived ethnic discrimination in relation to smoking and alcohol consumption in ethnic minority groups in the Netherlands

Submitted

Marlies Visser, Umar Z. Ikram, Eske M. Derks, Marieke B. Snijder, Anton E. Kunst. Perceived ethnic discrimination in relation to smoking and alcohol consumption in ethnic minority groups in the Netherlands: the HELIUS study

Abstract

Background: Perceived ethnic discrimination (PED) is associated with smoking and alcohol consumption in racial/ethnic groups in the US. As these groups importantly differ from European-based ethnic minority groups, it is unknown whether these findings can also be applied to Europe. We examined the associations of PED with smoking and alcohol consumption in five ethnic minority groups in a European country.

Methods: Data were derived from the HELIUS study in Amsterdam, the Netherlands. We included participants aged 18-70 years of South-Asian Surinamese, African Surinamese, Ghanaian, Turkish and Moroccan origin. We collected self-reported data on PED, daily smoking, heavy smoking, nicotine dependence, current drinking, excessive drinking, alcohol dependence, and neuroticism. Logistic regression was used.

Results: Overall, PED was not consistently associated with smoking and alcohol consumption. In African Surinamese, the associations were positive for daily smoking, nicotine and alcohol dependence (odds ratios of 1.16; 95% confidence interval: 1.06-1.27, 1.34; 1.15-1.57 and 1.40; 1.20-1.64, respectively). In Ghanaians, positive association was observed for current drinking (1.21; 1.08-1.36). No significant associations were observed in the other groups. Neuroticism did not moderate the associations in any of the groups.

Conclusion: The associations of PED with smoking and alcohol consumption considerably varied by ethnicity and outcome measure. This suggests that ethnic minority groups might use different behavioral strategies to cope with PED.

Introduction

Perceived ethnic discrimination (PED) refers to the experience of unfair treatment because of ethnic background (Gee et al., 2009). PED is considered an important chronic psychosocial stressor for ethnic minority groups, and is associated with lower mental and physical health (Williams et al., 2008; Ikram et al., 2015). Studies show that PED is related to unhealthy behaviours, including smoking (Borrell et al., 2010; Borrell et al., 2007; Bennett et al., 2005; Landrine et al., 2006; Chae et al., 2008) and alcohol consumption (Borrell et al., 2010; Borrell et al., 2007; Terrell et al., 2006; Gee et al., 2007). For example, Landrine et al. (2006) found that Latinos, Blacks and Asians who reported discrimination showed higher smoking rates. Another study showed higher odds of heavy drinking in African Americans and Hispanics who reported perceived racial/ethnic discrimination (Borrell et al., 2010). It is suggested that smoking and alcohol consumption might serve as a coping strategy to deal with discrimination (Williams et al., 2008).

However, most studies on smoking and alcohol consumption in relation to ethnic discrimination were conducted in the United States (US), focusing mainly on African Americans. European studies on this topic are lacking. European societies are becoming increasingly ethnically diverse, and reports indicate that ethnic minority groups experience discrimination in different settings (e.g., jobs, housing) (Zick et al., 2008), suggesting that discrimination has public health relevance in Europe as well. Additionally, findings from the US might not be readily applicable to the European context, given the differences between European-based ethnic minority groups and those living in the US, in terms of migration history and country of origin, among other factors.

Since behavioural coping is not only determined by psychosocial stressors but also by personality traits, the association of PED with smoking and alcohol consumption might be moderated by personality traits such as neuroticism. Neuroticism reflects the tendency to experience negative emotions and is characterized by factors such as emotional instability, aggression, worry and anxiety (Lahey, 2009). Literature indicates that people with high neuroticism are more inclined to engage in risky behaviours, including smoking and alcohol abuse (Vollrath and Torgersen, 2002). We hypothesize that neuroticism exacerbates the association of PED with smoking and alcohol consumption. So far, the role of neuroticism has not been assessed in the association between PED and smoking and alcohol consumption.

Our aim was to examine the association of PED with smoking and alcohol consumption among five ethnic minority groups based in Amsterdam, the Netherlands. We investigated the association of PED with daily smoking, heavy smoking and nicotine dependence, as well as with current drinking, excessive drinking and alcohol dependence. Also, we assessed whether neuroticism moderated these associations.

Methods

Study population

We used baseline data from the Healthy Life in an Urban Setting (HELIUS) study, an on-

going multi-ethnic cohort study conducted in Amsterdam, The Netherlands. The study protocol has been described elsewhere (Stronks et al., 2013). Briefly, the HELIUS study sampled participants aged 18-70 years through the municipality registry of Amsterdam, which includes information on the country of birth of the participants and their parents to determine ethnicity. Participants were considered of non-Dutch origin if they themselves were born outside the Netherlands and at least one of their parents (first-generation) or they themselves were born in the Netherlands and both parents were born outside the Netherlands (second-generation) (Keij, 2000). Participants of Surinamese origin were further subdivided (through self-report) into African and South Asian origin. Data were collected through questionnaire (Stronks et al., 2013) (either self-administrated or through interview by ethnically-matched interviewer). The HELIUS study has been approved by the Institutional Review Board of the Academic Medical Center, University of Amsterdam (Stronks et al., 2013).

Baseline data collection took place from January 2011 to December 2015. From the total sample (N=23,942), we excluded participants of Indonesian Surinamese (N=250) or unknown Surinamese origin (N=286), because of the small sample sizes. We also excluded participants with an unknown or other ethnic origin (N=50). Further, participants with missing data on discrimination were excluded (N=230). Those with missing data on other covariates and the outcome measures were excluded in the corresponding analysis only. This resulted in a total sample of 23,126 participants: 4626 Dutch, 3343 South-Asian Surinamese, 4414 African Surinamese, 2441 Ghanaian, 4012 Turkish, and 4290 Moroccan.

Variables

Perceived Ethnic Discrimination

PED was conceptualized as the experiences of interpersonal discrimination based on ethnic background in daily life. It was measured by the Everyday Discrimination Scale (EDS) by Forman et al. (1997). EDS is partly based on the qualitative work done among African Surinamese women in the Netherlands (Essed, 1991). We modified the EDS to specifically measure how often they experienced ethnic discrimination in daily life. EDS uses nine items with response scale varying from 1 (never) to 5 (very often). Mean scores of the nine items were calculated. PED was considered missing if more than one item was missing. If only one item was missing we used the mean score of the other items to substitute the missing item.

Smoking

For smoking we chose three measures to distinguish between different smoking behaviours. Daily smoking was assessed as smoking daily one or more cigarettes (y/n). Heavy smoking was defined as smoking 10 or more cigarettes on a daily basis (y/n) (Okuyemi et al., 2002). Nicotine dependence was determined by the Fagerström scale (Heatherton et al., 1991) consisting of six questions (e.g. do you find it hard not to smoke in places where it is not allowed). The sum score varied from 0-10, with a cut-off of ≥4 considered nicotine dependence (y/n). If one of the items was missing, the Fagerström sum score was calculated with a score of 0 for the missing item. If more than one item was missing the Fagerström

sum score was coded as missing. For non- or ex-smokers the sum score is 0.

Alcohol consumption

For alcohol consumption we also used three measures. Current drinking was determined by asking whether one has used alcohol in the preceding 12 months (y/n). Excessive drinking was determined by asking how often one drinks alcoholic beverages in combination with how many glasses one drinks on a typical day. Drinking of alcoholic beverages 'more than 4 times a week' combined with 'at least 3-4 glasses per day' was considered excessive daily drinking (y/n). The cut-offs for excessive drinking were determined on the Netherlands Mental Health Survey and Incidence Study-2 (De Graaf et al., 2010). Alcohol dependence was determined by the Alcohol Use Disorder Identification Test (AUDIT) (Babor et al., 2001), consisting of 10 questions (e.g. 'how often during the last year have you failed to do what was normally expected from you because of drinking'). The sum score varied from 0-40, with a cut-off of ≥8 for determining alcohol dependence (Babor et al., 2001). If only one item was missing the mean score of the other 9 items was used to substitute the missing item. If more than one item was missing the AUDIT was not calculated and considered missing.

Neuroticism

Neuroticism was measured using the NEO Five Factor Inventory (NEO-FFI), consisting of 12 items (e.g. 'sometimes I feel completely worthless') (McCrae and Terracciano, 2005). The response scale varied from 1 (totally disagree) to 5 (totally agree), with the sum score ranging from 12 to 60. If one item was missing the mean score of the other items was used to replace the missing item. If more than 1 item was missing, the sum score was not calculated and considered missing. To test for effect modification by neuroticism, we used both the neuroticism sum score and an ethnic-specific median-split (low/high neuroticism scores).

Other covariates

Other covariates included age, sex, educational level, employment status, marital status and other psychosocial stressors. Educational level was categorized into: no education and elementary education; lower vocational and general secondary education; intermediate vocational and higher secondary education; and higher vocational education and university. Employment status was categorized into three categories: not in the labour force (e.g. incapacitated for work, retirement), unemployed and employed. Other psychosocial stressors were determined with two items: any negative life events (e.g. 'you were seriously ill or injured') in the last 12 months (y/n) (Rosengren et al., 2004) and feeling distressed at home (never, some periods, several periods, constantly) based on one item on psychological stress from the INTERHEART study (Rosengren et al., 2004).

Statistical analysis

We calculated the crude prevalence rates of different smoking and alcohol measures. Since the prevalence rates of heavy smoking and nicotine dependence as well as excessive

drinking and alcohol dependence were low in some groups, we presented their prevalence rates among the population of current smokers or drinkers, respectively. To assess ethnic differences, we measured the age and sex-adjusted odds ratios for smoking and alcohol consumption using logistic regression.
We assessed the association of PED with smoking and alcohol consumption using multivariable logistic regression. Participants of Dutch origin were excluded from the regression analyses, as their PED mean score were close to base value of 1 (i.e. very little discrimination) with small variation. The regression analyses were presented by ethnicity, as the p-value for interaction (PED*Ethnicity) was statistically significant for three out of six outcome measures (i.e. p-value <0.05).

In the regression analyses we used three models. In Model 1 we adjusted for age and sex. In Model 2 we additionally adjusted for marital status, employment status, education and other psychosocial stressors. In Model 3 we further adjusted for neuroticism. Furthermore, to investigate effect modification by neuroticism, we created the interaction term PED*neuroticism. A p-value for interaction below 0.05 was considered statistically significant. For Ghanaian participants, the interaction analyses for smoking could not be performed, as the number of current smokers in this group was too low. All analyses were performed using SPSS version 23.

Results

In Table 1 the socio-demographic characteristics of the participants are presented. African Surinamese participants were the oldest while Moroccan participants were the youngest. Participants of Dutch origin had the highest education attainment followed by South-Asian Surinamese, African Surinamese, and Ghanaians. The median score of neuroticism was highest in South-Asian Surinamese and Moroccan participants, and lowest in Ghanaian participants. Mean discrimination scores were around 2.00 for the ethnic minority groups.

Table 2 shows the prevalence rates of smoking and alcohol consumption in different ethnic groups. Highest prevalence rates of current smoking were seen among participants of Turkish (35.6%), African Surinamese (33.0%) and South-Asian Surinamese (30.6%) origin while those of Ghanaian origin showed the lowest rates (4.3%). Moroccan participants have a low prevalence rate of smoking (13.9%) but highest rates of heavy smoking (65.9%) and nicotine dependence (39.2%) among smokers. Prevalence rates of current and excessive drinking were highest among Dutch participants (91.1% and 17.9%, respectively), while the current drinking was lowest in Turkish (22.3%) and Moroccan participants (7.5%). Alcohol dependence among drinkers was highest among Moroccan participants (32.1%). Similar patterns were observed when using the age- and sex-adjusted odds ratios.

Table 3 presents the association of PED with smoking in ethnic minority groups. In Model 2, among African Surinamese participants, 1-unit increase in PED mean score was significantly associated with 1.16 (95% confidence interval: 1.06-1.27) and 1.34 (1.15-1.57) higher odds of daily smoking and having nicotine dependence, respectively. Neuroticism slightly attenuated the association, but the associations remained statistically significant. Among Ghanaian

Table 1. General characteristics of the study sample by ethnic group

Variable	Dutch	South-Asian Surinamese	African Surinamese	Ghanians	Turkish	Morocans
	N=4626	N=3343	N=4414	N=2441	N=4012	N=4290
Sex, male (%)	46.0	46.5	40.5	38.7	44.9	37.9
Age in years, mean (SD)	46.12 (14.05)	45.03 (13.53)	47.55 (12.77)	44.21 (11.53)	39.84 (12.45)	39.70 (13.05)
Marital status(%)						
never married	32.4	34.3	54.8	35.0	22.6	27.7
married/living with a partner	57.9	44.1	28.8	36.4	64.0	60.2
divorced/widowed	9.7	21.6	16.4	28.5	13.5	12.1
Education (%) [a]						
1 (lowest)	3.3	13.9	5.5	27.8	31.2	30.2
2	14.2	33.4	36.2	40.1	25.0	18.2
3	22.0	30.1	36.0	25.9	29.2	34.3
4 (highest)	60.4	22.6	22.3	6.3	14.6	17.3
Employment (%)						
not in labour force	20.7	23.7	21.2	16.6	32.7	35.7
unemployed	5.5	15.4	16.4	24.1	14.8	15.8
employed	73.8	60.9	62.4	59.3	52.6	48.5
Other Psychosocial Stressors (%)						
Stress at home						
never – some periods	89.0	81.9	86.6	88.7	81.4	82.5
several periods - constantly	11.0	18.2	13.3	11.3	18.6	17.6
Any life event (in the last 12 months)	59.2	69.8	76.5	58.9	63.3	62.6
Neuroticism						
Median, range 12-60	25.0	27.0	25.0	24.0	26.0	28.0
IQR	12	12	12	10	17	14
Perceived Ethnic Discrimination						
mean score, range 1-5 (SD)	1.13 (0.34)	1.97 (0.75)	2.05 (0.77)	1.86 (0.78)	1.84 (0.73)	1.98 (0.79)

[a] 1 = no education and elementary education; 2 = lower vocational and general secondary education; 3 = intermediate vocational and higher secondary education, 4= higher vocational education and university.

Table 2. Prevalence rates of smoking and alcohol consumption by ethnic group

	Ethnicity					
Outcome Variable	**Dutch**	**South-Asian Surinamese**	**African Surinamese**	**Ghanaian**	**Turkish**	**Moroccan**
Smoking						
Daily smoking						
prevalence (%) (n/N)	25.1 (1157/4618)	30.6 (1020/3332)	33.0 (1148/4394)	4.3 (105/2430)	35.6 (1420/4989)	13.9 (593/4277)
OR[a]	1.00	1.31 (1.18-1.45)	1.59 (1.44-1.74)	0.14 (0.11-0.17)	1.59 (1.44-1.75)	0.47 (0.42-0.53)
Heavy smoking/smokers						
prevalence(%) (n/N)	49.4 (525/1062)	49.0 (465/949)	44.5 (535/1203)	35.7 (30/84)	65.5 (869/1326)	65.9 (360/546)
OR[a]	1.00	0.90 (0.75-1.08)	0.71 (0.59-0.84)	0.43 (0.27-0.69)	2.27 (1.91-2.69)	2.13 (1.70-2.67)
Nicotine dependence/smokers						
prevalence(%) (n/N)	26.6 (304/1143)	39.9 (393/985)	25.4 (355/1395)	27.8 (25/90)	40.8 (565/1384)	39.2 (226/577)
OR[a]	1.00	1.79 (1.49-2.15)	0.89 (0.74-1.06)	0.95 (0.59-1.54)	2.09 (1.76-2.49)	1.85 (1.49-2.31)
Alcohol						
Current drinking						
Prevalence (%) (n/N)	91.1 (4207/4620)	55.4 (1848/3334)	68.7 (3012/4385)	47.0 (1138/2421)	22.3 (890/3987)	7.5 (319/4275)
OR[a]	1.00	0.11 (0.10-0.12)	0.22 (0.20-0.25)	0.08 (0.07-0.09)	0.02 (0.02-0.02)	0.01 (0.01-0.01)
Excessive drinking/drinkers						
Prevalence (%) (n/N)	17.9 (753/4200)	6.3 (116/1839)	5.9 (178/3006)	3.7 (42/1131)	4.5 (40/886)	5.1 (16/314)
OR[a]	1.00	0.29 (0.24-0.36)	0.27 (0.23-0.32)	0.18 (0.13-0.25)	0.22 (0.16-0.31)	0.27 (0.16-0.46)
Alcohol dependence/drinkers						
Prevalence (%) (n/N)	27.9 (1172/4199)	15.3 (281/1837)	10.2 (303/2984)	12.8 (144/1125)	18.1 (160/883)	32.1 (101/315)
OR[a]	1.00	0.39 (0.33-0.45)	0.28 (0.26-0.32)	0.37 (0.31-0.45)	0.39 (0.32-0.47)	0.81 (0.63-1.05)

[a] adjusted for age and sex, with ethnic Dutch as the reference group

Table 3. The association of perceived ethnic discrimination with smoking behaviours by ethnic minority group

	Ethnicity				
Outcome Variable	**South-Asian Surinamese**	**African Surinamese**	**Ghanaian**	**Turkish**	**Moroccan**
Daily smoking					
Model 1	1.00 (0.90-1.11)	1.23 (1.13-1.34)	1.03 (0.80-1.33)	1.05 (0.96-1.16)	1.01 (0.90-1.14)
Model 2	0.94 (0.85-1.05)	1.16 (1.06-1.27)	0.98 (0.75-1.29)	0.97 (0.88-1.06)	0.93 (0.82-1.05)
Model 3	0.94 (0.84-1.04)	1.14 (1.04-1.25)	0.88 (0.67-1.16)	0.94 (0.85-1.04)	0.92 (0.81-1.04)
Heavy smoking/smokers					
Model 1	1.17 (0.99-1.38)	1.09 (0.94-1.25)	2.09 (1.09-4.00)	0.90 (0.77-1.06)	0.99 (0.78-1.27)
Model 2	1.17 (0.99-1.39)	1.09 (0.93-1.26)	2.12 (0.99-4.55)	0.89 (0.76-1.05)	0.93 (0.72-1.21)
Model 3	1.14 (0.95-1.36)	1.06 (0.91-1.24)	2.10 (0.96-4.59)	0.87 (0.74-1.03)	0.92 (0.71-1.20)
Nicotine dependence/smokers					
Model 1	1.24 (1.05-1.46)	1.42 (1.22-1.64)	1.40 (0.73-2.70)	1.12 (0.97-1.30)	1.21 (0.97-1.51)
Model 2	1.19 (1.00-1.42)	1.34 (1.15-1.57)	1.28 (0.57-2.86)	1.06 (0.91-1.16)	1.12 (0.89-1.41)
Model 3	1.10 (0.92-1.32)	1.29 (1.10-1.51)	1.14 (0.48-2.67)	0.99 (0.85-1.16)	1.08 (0.86-1.37)

Model 1 adjusted for age and sex
Model 2 adjusted for Model 1 and marital status, education, employment and other psychosocial stressors
Model 3 adjusted for Model 2 and neuroticism

Table 4. The association of perceived ethnic discrimination (PED) with alcohol consumption by ethnic minority group

	Ethnicity				
Outcome Variable	**South-Asian Surinamese**	**African Surinamese**	**Ghanaian**	**Turkish**	**Moroccan**
Current drinking					
Model 1	0.97 (0.88-1.06)	1.08 (0.99-1.18)	1.26 (1.13-1.40)	1.06 (0.95-1.18)	0.82 (0.70-0.95)
Model 2	0.94 (0.85-1.04)	1.05 (0.96-1.15)	1.21 (1.08-1.36)	0.92 (0.82-1.04)	0.68 (0.57-0.81)
Model 3	0.94 (0.85-1.04)	1.06 (0.97-1.17)	1.22 (1.08-1.36)	0.92 (0.81-1.04)	0.65 (0.55-0.78)
Excessive drinking/drinkers					
Model 1	1.07 (0.84-1.38)	1.30 (1.07-1.57)	1.22 (0.83-1.77)	1.17 (0.75-1.85)	0.94 (0.45-1.96)
Model 2	0.96 (0.74-1.25)	1.18 (0.97-1.44)	1.14 (0.77-1.70)	1.08 (0.67-1.74)	0.64 (0.27-1.51)
Model 3	0.98 (0.75-1.29)	1.11 (0.90-1.36)	1.10 (0.73-1.66)	1.04 (0.63-1.71)	0.60 (0.25-1.45)
Alcohol dependence/drinkers					
Model 1	1.15 (0.97-1.37)	1.57 (1.35-1.83)	1.32 (1.05-1.65)	1.26 (0.99-1.60)	1.42 (1.02-1.98)
Model 2	1.00 (0.83-1.20)	1.40 (1.20-1.64)	1.26 (0.99-1.60)	1.15 (0.90-1.49)	1.21 (0.84-1.75)
Model 3	0.93 (0.76-1.12)	1.25 (1.06-1.48)	1.23 (0.96-1.57)	1.08 (0.83-1.41)	1.08 (0.74-1.58)

Model 1 adjusted for age and sex

Model 2 adjusted for Model 1 and marital status, education, employment and other psychosocial stressors

Model 3 adjusted for Model 2 and neuroticism

participants, positive association with heavy smoking was observed (Model 2: 2.12; 0.99-4.55). For South-Asian Surinamese participants the association with nicotine dependence tended to be positive in but failed to reach statistical significance. No statistically significant associations with smoking behaviours were observed among participants of Turkish or Moroccan origin.

The association of PED with alcohol consumption showed a somewhat similar pattern (Table 4). In African Surinamese participants, the odds ratios in Model 2 for alcohol dependence were 1.40 (1.20-1.64). After adjustment for neuroticism, the association attenuated slightly but remained statistically significant. The associations with current drinking and excessive drinking tended to be positive but failed to reach statistical significance after full adjustment. In Ghanaian participants, 1-unit increase in PED mean score was associated with 1.21 (1.08-1.36) and 1.26 (0.99-1.60) higher odds for current drinking and alcohol dependence, respectively. Neuroticism did not attenuate the association. In Moroccan participants, we found that PED was negatively associated with current drinking (Model 2: 0.68; 0.57-0.81). No associations were observed in South-Asian Surinamese and Turkish participants.
Generally, neuroticism did not appear to moderate the association of PED with smoking or alcohol consumption in the ethnic minority groups (see Supplementary Tables 1 and 2). Most interactions with either the median-split or the sum score of neuroticism were non-significant. However, there were some exceptions. For smoking, we observed that among South-Asian Surinamese participants who scored high on neuroticism had a stronger association with daily smoking with odds ratio 1.02 (0.88-1.18) and heavy smoking with odds ratio 1.33 (1.05-1.69) as compared to those who scored low on neuroticism (OR: 0.86; 0.73-1.02 and 0.94; 0.72-1.25, respectively). For excessive drinking, we found that among Surinamese subgroups that neuroticism exacerbated the association, whereas in Ghanaian participants the association was buffered.

Discussion

We found that the associations of PED with smoking and alcohol consumption varied by ethnicity and outcome measure. Overall, we found positive associations in African-origin groups (i.e. African Surinamese- and Ghanaian-origin), but no statistically significant associations were observed in participants of South-Asian Surinamese, Turkish or Moroccan origin. Specifically, for smoking we observed positive associations of PED with current smoking and nicotine dependence in African Surinamese participants and with heavy smoking in Ghanaian participants. For alcohol consumption, the associations were positive for African Surinamese participants for alcohol dependence, and for Ghanaian participants for current drinking. Besides some exceptions neuroticism did not moderate the associations with smoking or alcohol consumption across the ethnic minority groups.

Limitations

This study has some limitations. First, the cross-sectional study design makes it impossible to assess the temporality of the observed associations. Previous longitudinal studies have actually indicated that discrimination precedes poor health outcomes (and not vice versa) (Schulz et al., 2006; Gee and Walsemann, 2009), but whether this also applies to smoking and alcohol

consumption is uncertain. Second, discrimination experiences might not have been measured optimally across the ethnic groups. We measured PED using the Everyday Discrimination Scale (EDS) (Forman et al., 1997) and this scale was developed based on a qualitative study among African American and African Surinamese women (Essed, 1991). Misclassification of PED, if non-differential to smoking or drinking, may have underestimated the observed associations. Third, because smoking and alcohol consumption are generally seen as socially undesirable behaviours in some cultures, there is a chance of underreporting. This might be particularly relevant for Muslims as alcohol is strictly prohibited in Islam (Dotinga, 2005). Underreporting for smoking might have occurred for women since this is considered socially unacceptable in some African (Kaplan et al., 1990) and Muslim cultures (Van Oort et al., 2006).

In light of the literature

Previous literature on the association of discrimination with smoking has largely reported positive results. US studies found positive associations between racial/ethnic discrimination and smoking in African Americans (Borrell et al., 2010; Borrell et al., 2007; Bennett et al., 2005), Latinos, Asians and Whites (Landrine et al., 2006; Chae et al., 2008). In a study among African American young adults, Bennet et al. (2005) found that racial/ethnic harassed participants were twice as likely to use tobacco daily than participants who did not report ethnic harassment. These findings are partly in line with our study, as we found associations with smoking predominately in African-origin populations.

Similar to our study, previous literature on the relationship of discrimination with alcohol consumption found heterogeneous results. Borrell et al. (2007) found a positive association between self-reported racial discrimination and past year alcohol consumption in African Americans. Gee et al. (2007) also found a positive association between unfair treatment and alcohol dependence in Filipino Americans. On the contrary, Yen et al. (1999) found that reaction to unfair treatment did not seem to be associated with heavy drinking, alcohol dependence or drinks per month among non-white respondents of urban transit operators.

Interpretation of results

Our study found some positive associations among African-origin groups but no associations in participants of South-Asian Surinamese, Turkish or Moroccan origin. Although the underlying reasons for these observed variations remain to be investigated, we suggest three different possible reasons. First, the observed variations in associations might be due to differences in how different ethnic groups perceive ethnic discrimination. Given the positive associations of PED with smoking and alcohol consumption for both African Surinamese and Ghanaian participants, the impact of discrimination on health behaviors might be related to skin tone, which is an important determinant of discrimination (Perreira and Telles, 2014). Additionally, the differences in how discrimination is experienced might be related to differences in historical background and migration history. People of Turkish of Moroccan origin arrived as temporary guest workers in the Netherlands. In contrast, people of African Surinamese origin have a history of Dutch colonialism, slavery, and racism, which possibly may have shaped their current consciousness and awareness regarding discrimination. This in turn could have made discrimination more salient in their lives (Essed, 1991).

Second, the ethnic variations in the associations might be related to the differences in the coping resources as used by the ethnic minority groups. It could be possible that people of South-Asian Surinamese, Turkish and Moroccan origin have more effective coping resources at their disposal to deal with PED. These groups tend to have stronger support networks through family systems and ethnic institutions (Dhami and Skeikh, 2000) Studies found that high levels of social support and strong sense of belonging tend to protect against the adverse health effects of discrimination (Kimura, 2008).

Third, differential behavioural responses to PED in the ethnic groups might possibly help understand the ethnic variation. As mentioned, religion and culture play an important role in shaping the smoking and alcohol consumption patterns in some ethnic groups (Dotinga, 2005; Kaplan et al., 1990; Van Oort et al., 2006) The majority of South-Asian Surinamese, Moroccan and Turkish participants are Hindu or Muslim, and their religion and cultural values discourage or prohibit smoking and alcohol consumption, especially in women (Dotinga, 2005; Kaplan et al., 1990; Van Oort et al., 2006). Therefore, people of these ethnic minority groups might be less likely use smoking or alcohol consumption as a means to cope with PED. They may instead use other (unhealthy) behaviors such as reduced physical activity or more unhealthy diet. Indeed, evidence from the US indicates that perceived chronic discrimination is associated with increased abdominal obesity in a multi-ethnic sample (Hunte and Williams, 2009).

In contrast to our hypothesis, our findings overall indicate that the associations of PED with smoking and alcohol consumption are not moderated by neuroticism. We expected neuroticism to exacerbate the associations, as unhealthy behavioural responses may result from an interaction of a negative personality traits and environmental stressors (Lazarus and Folkman, 1984). It is possible that neuroticism might not be relevant in relation to PED as environmental stressor. It might be that negative traits other than neuroticism are more relevant for PED, such as hostility, which reflects the negative perceptions of others and the surroundings, as compared with neuroticism which is more inward-oriented.

Conclusion

Our results indicate that the associations of PED with smoking and alcohol consumption vary across ethnic minority groups. This may suggest that ethnic minority groups differ in how they perceive, cope with, and behaviourally respond to experiences of ethnic discrimination. This should be further studied in in-depth qualitative research. Research should also look into other behavioural responses such as physical activity and dietary intake, as well as other negative personality traits (e.g. hostility). This study contributes to the growing European literature on discrimination and health and also helps to better understand the underlying factors of smoking and drinking patterns in some ethnic minority groups residing in Europe.

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Supplementary Table 1. The association of perceived ethnic discrimination (PED) with smoking behaviours by neuroticism (median-split and sum score) by ethnic minority group[a,b]

Outcome Variable	South-Asian Surinamese	African Surinamese	Turkish	Moroccan
Daily smoking				
Neuroticism - high	1.02 (0.88-1.18)	1.17 (1.03-1.32)	0.91 (0.80-1.04)	0.83 (0.70-0.99)
Neuroticism - low	0.86 (0.73-1.02)	1.09 (0.95-1.24)	0.99 (0.85-1.14)	0.96 (0.79-1.17)
p-value for interaction	0.05	0.62	0.25	0.94
p-value for interaction sum score	0.20	0.45	0.74	0.38
Heavy smoking/smokers				
Neuroticism - high	1.33 (1.05-1.69)	1.07 (0.88-1.31)	0.92 (0.74-1.14)	0.80 (0.56-1.14)
Neuroticism - low	0.94 (0.72-1.25)	1.05 (0.83-1.33)	0.85 (0.65-1.10)	1.05 (0.69-1.59)
p-value for interaction	0.09	0.93	0.88	0.44
p-value for interaction sum score	0.01	0.34	0.97	0.49
Dependence/smokers				
Neuroticism - high	1.29 (1.02-1.64)	1.24 (1.01-1.51)	1.16 (0.94-1.42)	1.05 (0.78-1.42)
Neuroticism - low	0.99 (0.75-1.30)	1.39 (1.07-1.81)	0.84 (0.65-1.08)	1.13 (0.77-1.66)
p-value for interaction	0.16	0.72	0.09	0.93
p-value for interaction sum score	0.10	0.48	0.15	0.56

[a] The associations were adjusted for age, sex, marital status, education, employment and other psychosocial stressors.

[b] Due to low numbers of smokers, no reliable estimates could be calculated for Ghanaian participants.

Supplementary Table 2. The association of perceived ethnic discrimination (PED) with alcohol consumption by neuroticism (median-split and sum score) by ethnic minority group[a]

Outcome Variable	South-Asian Surinamese	African Surinamese	Ghanaian	Turkish	Moroccan
Current drinking					
Neuroticism - high	0.95 (0.83-1.09)	1.05 (0.93-1.20)	1.10 (0.94-1.28)	0.88 (0.75-1.03)	0.63 (0.49-0.80)
Neuroticism - low	0.93 (0.80-1.08)	1.04 (0.91-1.19)	1.33 (1.12-1.58)	0.96 (0.80-1.14)	0.68 (0.52-0.88)
p-value for interaction	0.89	0.73	0.17	0.55	0.78
p-value for interaction sum score	0.78	0.82	0.01	0.38	0.75
Excessive drinking/drinkers					
Neuroticism - high	1.24 (0.86-1.78)	1.31 (1.01-1.70)	0.93 (0.56-1.56)	1.03 (0.55-1.92)	-
Neuroticism - low	0.72 (0.47-1.1)	0.86 (0.61-1.23)	1.83 (0.90-3.71)	0.86 (0.35-2.13)	0.36 (0.03-4.98)
p-value for interaction	0.06	0.08	0.32	0.78	0.83
p-value for interaction sum score	0.02	0.02	0.14	0.42	0.81
Dependence/drinkers					
Neuroticism - high	0.90 (0.70-1.16)	1.30 (1.06-1.59)	1.18 (0.86-1.61)	1.03 (0.73-1.44)	1.16 (0.71-1.90)
Neuroticism - low	1.03 (0.78-1.36)	1.26 (0.94-1.67)	1.37 (0.92-2.05)	1.33 (0.87-2.04)	0.87 (0.47-1.69)
p-value for interaction	0.50	0.79	0.83	0.27	0.70
p-value for interaction sum score	0.81	0.69	0.18	0.06	0.33

[a] The associations were adjusted for age, sex, marital status, education, employment and other psychosocial stressors.

CHAPTER 6

The association of perceived ethnic discrimination with general and abdominal obesity in ethnic minority groups

Submitted

Heiko Schmengler, Umar Z. Ikram, Marieke B. Snijder, Anton E. Kunst, Charles Agyemang. The association of perceived ethnic discrimination with general and abdominal obesity in ethnic minority groups – the HELIUS study

Abstract

Background: There is some but inconsistent evidence that discrimination is associated with obesity. The association may differ according to type of obesity and ethnic group. This study examines the association of perceived ethnic discrimination (PED) with general and abdominal obesity in five ethnic minority groups.

Methods: We used baseline data from the HELIUS study, collected from 2011-2015. The study sample included 2,297 Ghanaians, 4,110 African Surinamese, 3,021 South-Asian Surinamese, 3,562 Turks, and 3,868 Moroccans aged 18–70 years residing in Amsterdam, the Netherlands. Body mass index (BMI) was used as measure for general obesity, and waist circumference (WC) for abdominal obesity. PED was measured using the Everyday Discrimination Scale. We used linear regression models. In additional analysis, we used standardized variables to compare the strength of the associations.

Results: PED was significantly, positively associated with BMI in South-Asian Surinamese (beta coefficient 0.338; 95% confidence interval 0.106-0.570), African Surinamese (0.394; 0.171-0.618), and Turks (0.269; 0.027-0.510). The pattern for WC was similar, with positive associations in South-Asian Surinamese (0.759; 0.166-1.353), African Surinamese (0.833; 0.278-1.388), and Turks (0.870; 0.299-1.440). The strength of the associations with BMI and WC was comparable in the groups. No significant associations were observed among Moroccans and Ghanaians.

Conclusion: Ethnic variations are observed in the association of PED with both general and abdominal obesity. Further research on psychosocial buffers and underlying biological mechanisms might help in understanding these variations.

Introduction

Obesity is considered one of the most important risk factors for morbidity and mortality worldwide.[1] Evidence indicates important ethnic differences in obesity.[2, 3] In the United States (US), for example, African Americans are more obese than White Americans and Asian Americans.[3] In the Netherlands, as compared to the European Dutch group, abdominal obesity is less prevalent among African Surinamese men, but more prevalent among African Surinamese women and South-Asian Surinamese.[2]

These ethnic differences in obesity might be explained by differences in demographics, socioeconomic status, health behaviours, but also by psychosocial stressors.[4] An important psychosocial stressor is perceived discrimination.[5] There is some evidence indicating a negative impact of perceived discrimination on obesity,[6, 7] potentially operating through depressive symptoms,[8, 9] health behaviours,[10] and direct physiological stress pathways (e.g. hypothalamic-pituitary-adrenal axis).[11-13]

Several studies investigated the association between perceived discrimination and obesity in ethnic minority groups in the United States, yielding mixed results.[6, 7, 14, 15] In a cross-sectional study, Jewish, Polish, Irish, and Italian Whites who perceived chronic discrimination had a higher likelihood of an increased waist circumference (WC) than Jewish, Polish, Irish, and Italian Whites who did not perceive chronic discrimination. This relationship, however, was not found among other White Americans, Hispanic Americans, and African Americans.[16] In a longitudinal study, participants who indicated constantly high levels of discrimination over the 9-year study period showed the largest gains in WC.[6] Lewis et al. found that experiences of discrimination were positively associated with visceral fat in both White American and African American women,[7] although a recent study did not find this association in African American adults.[15]

The current literature has several gaps, however. First, most research on perceived discrimination and obesity has been conducted on ethnic minority groups in the United States, predominately African Americans and Hispanic Americans. These groups differ from those residing in Europe, due to different migration histories and ethnic origins, amongst other factors.[17] Hence the US findings cannot simply be generalised to the European-based ethnic minority groups. Second, most discrimination studies on obesity have focused on discrimination in general, with relatively few studies investigating the association with a specific type of discrimination. A type of discrimination that is particularly relevant to ethnic minority groups is perceived discrimination based on ethnic background. Little is known whether perceived ethnic discrimination (PED) is associated with obesity in different ethnic groups. Although different from ethnic discrimination, some studies have assessed the association of racism with obesity. For example, Cozier et al. found that everyday racism is longitudinally associated with obesity among African American women.[18] Finally, only few studies have assessed whether discrimination is differentially associated with general or abdominal obesity. It might be possible that the association differs by type of obesity, given potential differences in the underlying biological mechanisms (e.g. stress-related pathways, abdominal fat accumulation).[7, 19, 20]

In this present study, we aimed to investigate the association of PED with general and abdominal obesity in different ethnic minority groups residing in a European city. These ethnic minority groups differ in migration history and country of origin among other factors (see Box, pp. 83), providing an opportunity to assess whether there are ethnic variations in the associations of PED with general or abdominal obesity.

Methods

Study population

Baseline data were used from the Healthy Life in Urban Settings (HELIUS) study, a multi-ethnic cohort study in Amsterdam, the Netherlands. The study has been described in detail elsewhere.[17] Participants aged 18-70 were randomly sampled from the municipality register, stratified by ethnicity (see below for definition). Data were collected through questionnaires (either self-administered or by ethnically-matched interviewer) and a physical examination. The physical examination was conducted by trained research staff at the designated research locations of HELIUS. All participants gave written informed consent. The HELIUS study was approved by the Institutional Review Board of the Academic Medical Center, University of Amsterdam.

Data were collected from January 2011 until December 2015. The total number of participants, who filled in the questionnaire and attended the physical examination, was 22,165. We excluded Indonesian Surinamese (N=233), Surinamese of different or unknown origin (N=267), as well as participants of unknown ethnic background (N=48) because of their comparably small sample sizes. In addition, we excluded the Dutch-origin group (N=4,564) as their mean PED score was close to 1 (i.e. no discrimination perceived), making it difficult to investigate the association with the necessary statistical precision. Furthermore, participants with missing PED scores (further N=195) were excluded. Subsequently, a total sample of 16,858 participants was included in our analysis: 3,021 South-Asian Surinamese, 4,110 African Surinamese, 2,297 Ghanaians, 3,562 Turks, and 3,868 Moroccans.

Ethnicity

Individuals were considered of non-Dutch ethnic origin if they were born outside the Netherlands and at least one parent was born outside the Netherlands (first generation), or if they were born in the Netherlands, and at least one parent was born outside the Netherlands (second generation).[17] The Surinamese subgroups were determined by self-report (i.e. African or South-Asian ethnicity).

Perceived ethnic discrimination

Perceived ethnic discrimination (PED) is conceptualized as the subtle forms of interpersonal discrimination on grounds of ethnic background as experienced in daily life.[8] PED was assessed with a nine items questionnaire based on the Everyday Discrimination Scale (EDS).[21] EDS was developed in the US,[22] yet its conceptual work was based on a qualitative study conducted among African Surinamese women in the Netherlands and African

American women in the US.[23] EDS was found to be suitable for use in different ethnic groups.[21] Participants respond to nine statements using a five-point Likert scale (1=never to 5=very often), e.g., "You're treated with less politeness than other people", "People act like they think you're not smart". We adjusted the scale by asking participants specifically about discrimination because of their ethnic background. We calculated the mean score of the nine EDS items. In case one of the nine questions was missing, the average of the other eight items was calculated. In case more than one item was missing, the variable was deemed missing.

General obesity

The Body Mass Index (BMI) reflects general obesity and is calculated by dividing someone's weight (kg) by the square of their height (m).[24] Both height and body weight of the participants were measured in duplicate in barefoot subjects wearing light clothes only.[17]

Abdominal obesity

Waist circumference (WC) (cm) is a measure of abdominal fat mass, and is used as a measure for abdominal obesity. WC was determined using a tape measure at the level midway between the lower rib margin and the iliac crest.

Covariates

We considered the following covariates: demographics (age, sex, marital status), socioeconomic status (education, employment), other psychosocial stressors (domestic stress, any negative life events), health behaviours (smoking, alcohol consumption, physical activity), and depressive symptoms. Categories for marital status were: married/living with partner, divorced/separated/widowed, and never married. There were four categories for education: no education or primary school only, lower vocational and lower secondary education, intermediate vocational and intermediate/higher secondary education, and higher vocational education and university. Current employment status was categorized into: currently employed, unemployed, or not in the labour force. Domestic stress was defined as perceived psychosocial stress (feeling irritable, anxiety, or trouble sleeping) arising from one's living circumstances at home (never/some, periods/several, periods/constantly). Any negative life events were operationalized as any type of self-reported threatening experience (e.g. the death of a close relative or friend, major financial crisis) during the previous twelve months (yes/no).

Physical activity was self-reported and included different activities (e.g. household and occupational activities, sports), measured with the SQUASH questionnaire.[25] We subdivided the total activity scores into quartiles. Alcohol use was determined with the following categories: no consumption (abstinence from alcohol during the previous twelve months), low consumption (1-2 glasses), moderate consumption (3-4 glasses), and high consumption (5+ glasses), on a typical day when alcohol is consumed. For smoking, participants were classified as current smokers, ex-smokers, or never smokers.

Patient Health Questionaire-9 (PHQ-9) was used to assess the presence of depressive symptoms over the past two weeks,[26] with sum scores varying between 0-27. A cut-off value of ≥10 was used to determine depressive symptoms.

Statistical analyses

We first calculated the mean BMI and WC by ethnicity. We used linear regression to assess the association of PED with BMI and WC. The associations differed by ethnicity (WC: p-value for interaction [PED*ethnicity] p=0.025; BMI: p=0.118), but not by sex (p-value for interaction [PED*sex] for both BMI and WC p>0.05), so the associations were presented by ethnic group. If data were missing for a particular covariate, the participant was excluded in the analyses that included that covariate (e.g. participants with missing data on smoking were excluded only from the models that included the smoking variable).

We used four consecutive models for assessing the association of PED with BMI and WC. For model 1, we adjusted for age and sex. In Model 2 we additionally adjusted for potential confounders: marital status, education, employment status, domestic stress, and any negative life events. We further adjusted for health behaviours in Model 3 and for depressive symptoms in Model 4 as potential intermediate factors. In order to determine whether PED was differentially related to BMI and WC, the linear regression analyses were repeated using Z-score transformations of BMI and WC, ensuring comparability of the regression coefficients of the associations for BMI and WC.

Results

Table 1 shows the characteristics of the study population by ethnicity. Turkish and Moroccan participants tended to be younger than the other groups, and were more likely to be married/ living with partner and to have no or only elementary education. The mean PED score was highest amongst the African Surinamese, and lowest in the Ghanaian and Turkish groups. The mean BMI of all groups was above 25 (i.e. overweight), with the highest means in Ghanaian and Turkish participants (around 28.5). The Turkish group also had the highest mean WC. Compared to the other groups, South-Asian Surinamese participants tended to have a lower BMI and WC.

Table 2 presents the associations of PED with BMI and WC. PED was significantly associated with BMI in South-Asian Surinamese, African Surinamese, and Turkish participants after adjusting for potential confounders (Model 2). After further adjustment for health behaviours and depressive symptoms, the associations attenuated slightly but remained statistically significant (Models 3 and 4). No significant associations were observed in Ghanaian and Moroccan participants. A somewhat similar pattern emerged for WC, with statistically significant associations in South-Asian Surinamese, African Surinamese, and Turkish participants (Model 2). Similar to BMI, the associations between PED and WC changed little after adjusting for health behaviours and depressive symptoms (Models 3 and 4). Again, we found no significant associations with WC in Moroccan and Ghanaian participants.

Table 3 presents the associations of PED with BMI and WC using the z-scores. The standardised

regression coefficients of both measures tended to be similar in all ethnic groups, with the confidence intervals largely overlapping. This indicates that the strength of the association of PED with BMI and WC is similar across the ethnic groups.

Table 1. Characteristics of the participants in the total sample and by ethnic minority group

Variable	South-Asian Surinamese	African Surinamese	Ghanaians	Turks	Moroccans
	n= 3,021	n= 4,110	n= 2,297	n= 3,562	n= 3,868
Age in years, mean (SD)	45.45 (13.41)	47.92 (12.53)	44.68 (11.21)	40.33 (12.17)	40.42 (12.93)
First generation, %	76.3	83.5	95.3	70.1	68.5
Marital status, %					
Married/living with a partner	44.8	29.3	36.8	65.1	61.6
Divorced/widowed	22.0	16.6	29.3	13.7	12.3
Never married	33.1	54.1	33.8	21.3	26.1
Education, %[a]					
1 (lowest)	14.2	5.4	28.5	31.6	31.1
2	33.4	35.9	40.0	24.8	17.9
3	29.4	35.8	25.3	28.6	33.5
4 (highest)	23.1	22.9	6.2	15.0	17.6
Employment status, %					
Employed	61.9	63.4	60.0	52.9	49.0
Unemployed	14.7	15.7	24.2	14.9	15.7
Not in the labour force	23.5	20.9	15.8	32.2	35.3
Other psychosocial stressors					
Stress at home, %					
Never	45.6	50.9	57.2	45.2	48.6
Some periods of stress	36.1	35.5	31.1	35.6	33.0
Several periods of stress	11.9	9.8	7.9	12.7	12.0
Permanent stress	6.4	3.7	3.7	6.5	6.3
Any recent negative event, %	69.5	76.2	59.9	63.8	63.5
Health behaviours					
Smoking, %					
Current	28.5	31.6	4.5	34.6	13.5
Past	13.6	19.5	8.2	18.1	12.6
No	57.9	48.9	87.3	47.3	73.8
Physical activity[b], %					
Q1 (lowest)	20.0	16.2	28.6	34.1	27.7

Q2	24.5	22.9	23.6	25.8	27.2
Q3	30.3	28.7	18.8	20.9	24.9
Q4 (highest)	25.2	32.2	29.1	19.2	20.2
Daily alcohol consumption, %					
None	43.8	31.4	52.4	77.3	92.8
1-2 glasses	31.3	43.7	40.0	9.7	1.5
3-4 glasses	15.3	17.9	6.3	7.3	2.6
5 or more glasses	9.7	7.1	1.2	5.7	3.1
Depressive symptoms, %	18.5	10.7	9.2	23.4	21.0
PED score, mean (SD), range 1-5	1.97 (0.76)	2.04 (0.76)	1.88 (0.79)	1.86 (0.73)	1.99 (0.78)
Body Mass Index	26.29 (4.82)	27.82 (5.54)	28.45 (5.01)	28.55 (5.71)	27.56 (5.22)
Waist Circumference	91.74 (13.04)	93.01 (14.04)	93.16 (12.44)	94.44 (14.07)	93.11 (13.53)

SD=standard deviation. PED=Perceived ethnic discrimination.
[a] 1 = no education or elementary education;
2 = lower vocational and general secondary education;
3 = intermediate vocational and higher secondary education;
4 = higher vocational education or university.
[b] Physical activity was defined as the SQUASH total activity score per week and was categorized into quartiles.

Table 2. The association of perceived ethnic discrimination (mean score varying from 1-5) with BMI and WC by ethnicity

		Beta coefficients (95% CI)				
		South-Asian Surinamese	**African Surinamese**	**Ghanaians**	**Turks**	**Moroccans**
BMI	Model 1	0.363 (0.137 - 0.589)*	0.403 (0.185 - 0.622)*	0.018 (-0.232 - 0.268)	0.196 (-0.047 - 0.438)	0.067 (-0.130 - 0.265)
	Model 2	0.369 (0.138 - 0.600)*	0.354 (0.130 - 0.577)*	-0.016 (-0.272 - 0.241)	0.301 (0.060 - 0.542)*	0.080 (-0.119 - 0.279)
	Model 3	0.367 (0.137 - 0.597)*	0.418 (0.196 - 0.641)*	-0.009 (-0.267 - 0.249)	0.285 (0.046 - 0.524)*	0.060 (-0.138 - 0.259)
	Model 4	0.338 (0.106 - 0.570)*	0.394 (0.171 - 0.618)*	-0.026 (-0.287 - 0.234)	0.269 (0.027 - 0.510)*	0.057 (-0.142 - 0.256)
WC	Model 1	0.813 (0.233 - 1.392)*	0.890 (0.347 - 1.434)*	-0.203 (-0.799 - 0.394)	0.680 (0.108 - 1.251)*	0.287 (-0.203 - 0.777)
	Model 2	0.800 (0.209 - 1.390)*	0.760 (0.205 - 1.315)*	-0.241 (-0.852 - 0.371)	0.924 (0.356 - 1.493)*	0.361 (-0.131 - 0.853)
	Model 3	0.826 (0.238 - 1.414)*	0.902 (0.348 - 1.455)*	-0.227 (-0.841 - 0.388)	0.868 (0.304 - 1.432)*	0.313 (-0.179 - 0.805)
	Model 4	0.759 (0.166 - 1.353)*	0.833 (0.278 - 1.388)*	-0.254 (-0.875 - 0.367)	0.870 (0.299 - 1.440)*	0.307 (-0.186 - 0.800)

CI=confidence interval. BMI=Body Mass Index. WC=Waist circumference.
Model 1: adjusted for age and sex.
Model 2: adjusted for Model 1 + education, employment status, marital status, other psychosocial stressors.
Model 3: adjusted for Model 2 + physical activity, alcohol consumption, and smoking.
Model 4: adjusted for Model 3 + depressive symptoms.

* denotes statistical significance at p-value <0.05.

Table 3. The associations of perceived ethnic discrimination (mean score varying from 1-5) with z-scores of BMI and z-scores of WC by ethnicity

		Beta coefficients (95% CI)				
		South-Asian Surinamese	**African Surinamese**	**Ghanaians**	**Turks**	**Moroccans**
BMI	Model 1	0.075 (0.028 - 0.122)*	0.073 (0.033 - 0.112)*	0.004 (-0.046 - 0.054)	0.034 (-0.008 - 0.077)	0.013 (-0.025 - 0.051)
	Model 2	0.077 (0.029 - 0.125)*	0.064 (0.023 - 0.104)*	-0.003 (-0.054 - 0.048)	0.053 (0.011 - 0.095)*	0.015 (-0.023 - 0.054
	Model 3	0.076 (0.028 - 0.124)*	0.075 (0.035 - 0.116)*	-0.002 (-0.053 - 0.050)	0.050 (0.008 - 0.092)*	0.012 (-0.027 - 0.050)
	Model 4	0.070 (0.022 - 0.118)*	0.071 (0.031 - 0.111)*	-0.005 (-0.057 - 0.047)	0.047 (0.005 - 0.089)*	0.011 (-0.027 - 0.049)
WC	Model 1	0.062 (0.018 - 0.107)*	0.063 (0.025 - 0.102)*	-0.016 (-0.064 - 0.032)	0.048 (0.008 - 0.089)*	0.021 (-0.015 - 0.057)
	Model 2	0.061 (0.016 - 0.107)*	0.054 (0.015 - 0.094)*	-0.019 (-0.069 - 0.030)	0.066 (0.025 - 0.106)*	0.027 (-0.010 - 0.063)
	Model 3	0.063 (0.018 - 0.108)*	0.064 (0.025 - 0.104)*	-0.018 (-0.068 - 0.031)	0.062 (0.022 - 0.102)*	0.023 (-0.013 - 0.059)
	Model 4	0.058 (0.013 - 0.104)*	0.059 (0.020 - 0.099)*	-0.020 (-0.070 - 0.029)	0.062 (0.021 - 0.102)*	0.023 (-0.014 - 0.059)

CI=confidence interval. BMI=Body Mass Index. WC=Waist circumference.
Model 1: adjusted for age and sex.
Model 2: adjusted for Model 1 + education, employment status, marital status, other psychosocial stressors.
Model 3: adjusted for Model 2 + physical activity, alcohol consumption, and smoking.
Model 4: adjusted for Model 3 + depressive symptoms.

* denotes statistical significance at p-value <0.05.

Discussion

This study aimed at investigating whether PED is associated with general and abdominal obesity in different ethnic minority groups in a European setting. We found that the associations varied by ethnicity. Overall, we observed consistently positive associations in African Surinamese, South-Asian Surinamese, and Turkish for both general obesity (BMI) and abdominal obesity (WC). However, we did not find any associations in Ghanaian and Moroccan participants. We found that the associations of PED with abdominal and general obesity were of similar strength in the ethnic groups.

A particular strength of this study is that it has a large sample size. Another strength of the study is the composition of the multi-ethnic sample, including groups with similar migration history and demographics, but different ethnic identity (Turkish and Moroccan); groups with similar ethnic identity, but different ancestry (African Surinamese and South Asian Surinamese); and groups with similar ancestry but different ethnic identity and migration history (Ghanaian and African Surinamese).[27] This study also has some limitations. First, the data were cross-sectional, which makes it difficult to assess temporality. However, the few longitudinal studies (from the USA) indicate that racism or perceived discrimination precedes increase in waist circumference [6] and obesity.[18] Second, since the everyday discrimination scale (EDS), as used in this study, is conceptually based on the discrimination experiences of African Surinamese and African Americans, the EDS might possibly not adequately capture the discrimination experiences of other ethnic groups. However, the EDS was shown to be suitable in several ethnic groups in an American sample.[21] Third, residual confounding might have occurred, as some constructs were not measured comprehensively. For example, the SES variable could have included income, which was not assessed in the HELIUS study.

Our results suggest that PED is positively associated with general and abdominal obesity in some ethnic groups, even after partial adjustment for health behaviours and depression. This points towards direct or other indirect mechanisms that we have not assessed, such as hypercortisolism or differences in food intake. It could be that amongst Turkish, South-Asian, and African Surinamese participants PED is associated with increased allostatic load and HPA axis dysregulation.[11-13] Even small increases in serum cortisol levels contribute to abnormalities in glucose metabolism, similar to metabolic syndrome patients.[28] Chronic stress may also lead to changes in food intake. Eating high sugar foods may be a coping mechanism to reduce stress, as it is shown that cortisol responses to a stress test may be attenuated upon drinking sucrose-sweetened beverages.[29] In addition, our findings imply that PED is similarly related to general and abdominal obesity, and that the strength of the associations is similar for both BMI and WC. This suggests that perceived discrimination might affect adiposity (e.g. through hypercortisolism) across the whole body, rather than specific areas (e.g. abdominal region). Increased fat- and sugar intake due to chronic stress could also be equally related to increased BMI and WC.[10, 29]

We found ethnic variations in the associations of PED with general and abdominal obesity. This corroborates previous evidence that the association of perceived discrimination with obesity differed by race/ethnicity.[16] Reasons for these ethnic variations are not clear. In

principle, these variations can possibly be understood by differences in how discrimination is perceived, in psychosocial buffers, and in biological responses to PED. It is possible that to some ethnic groups PED may be more stressful or threatening than others, for example due to differences in culture and migration history. For example, qualitative evidence from Lithuania suggests that members of the Polish minority perceive discrimination as a hazard to "social or material welfare",[30] whilst in Jews discrimination tends to evoke associations with danger to "health and life" due to the experience of the holocaust.[30] Similarly, discrimination in the Dutch context might invoke memories of past injustices associated with slavery and indenture labour during the Dutch Colonial Empire amongst the two Surinamese subgroups.[31]

The ethnic variations in the link between PED and obesity could also be explained by differences in the presence or influence of psychosocial buffers. A recent study, for example, showed that strong ethnic identity, large ethnic social network, and religiosity weaken the association of PED with depression.[32] Brody et al. found that high levels of social support attenuated the association between perceived racial discrimination and allostatic load in African American youths.[11] In the Netherlands, Ghanaians have high intra-group cohesion, social support, and religious involvement within their ethnic group, which may protect them against metabolic disturbances/obesity due to PED.[33] Despite having similar demographic characteristics, Turkish and Moroccan origin groups exhibit differences in their ethnic identity and social support structures.[34] Hence, it might be possible that participants of Ghanaian and Moroccan origin have more psychosocial buffers than Surinamese and Turkish participants in coping with discrimination.

Lastly, it is possible that the ethnic variations in the association between PED and obesity might be explained by differences in biological responses to PED across ethnic groups. Recent findings from the HELIUS study (in press) suggest that, for example, whilst PED is related to elevated WC in South-Asian Surinamese participants, Moroccans tend to respond to PED with reduced HDL-C, rather than increased adiposity.[27] In an American sample, perceived discrimination was associated with weaker diurnal cortisol rhythms in White Americans, but stronger diurnal rhythms amongst African Americans.[35] Such differences in physiological responses might potentially be attributable to epigenetic regulations (e.g. foetal programming),[36] and life course stress, as a response to environmental stressors both in the countries of origin and the host country.[37]

In conclusion, our study found that PED was associated with both general and abdominal obesity in some ethnic minority groups, with the strength of association with general and abdominal obesity being similar. More research is needed to understand these ethnic variations. It should be investigated how ethnic groups perceive ethnic discrimination differently, what different psychosocial buffers ethnic groups employ in coping with discrimination, and which underlying biological mechanisms are involved in different ethnic groups. Further understanding of the association of PED with obesity might potentially help in addressing the ethnic differences in obesity.

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CHAPTER 7

Perceived ethnic discrimination and the metabolic syndrome in ethnic minority groups

Published

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Abstract

Background: Ethnic differences in the metabolic syndrome could be explained by perceived ethnic discrimination (PED). It is unclear whether PED is associated with the metabolic syndrome. We assessed this association and quantified the contribution of PED to the metabolic syndrome.

Methods: Baseline data were used from the HELIUS study collected in the Netherlands from 2011-2014. The population-based sample included South-Asian Surinamese, African Surinamese, Ghanaian, Turkish, and Moroccan participants (aged 18-70 years). PED was measured using the Everyday Discrimination Scale. The metabolic syndrome was determined according to the harmonized definition of the International Diabetes Federation, American Heart Association, and others. Logistic regression was used for analysis. Population attributable fraction (PAF) was used to calculate the contribution of PED.

Results: PED was positively associated with the metabolic syndrome in South-Asian Surinamese, African Surinamese and Moroccan participants (odds ratio; 95% confidence interval: 1.13; 0.99-1.30, 1.15; 1.00-1.32, and 1.19; 1.03-1.38, respectively) after adjusting for potential confounders and mediators. No significant association was observed among Ghanaian and Turkish participants. For the individual components, the associations were statistically significant for blood pressure, fasting glucose, and waist circumference among Surinamese participants. PED was associated with dyslipidemia in Moroccan participants. The PAFs were 5% for South-Asian Surinamese and Moroccan participants, and 7% for African Surinamese participants.

Conclusions: We found a positive association of PED with the metabolic syndrome in some ethnic groups, with PED contributing around 5-7% to the metabolic syndrome among Surinamese and Moroccans. This suggests that PED might contribute to ethnic differences in the metabolic syndrome.

Introduction

The metabolic syndrome, a clustering of cardio-metabolic risk factors including waist circumference, triglycerides, glucose, blood pressure, and high-density lipoprotein cholesterol (HDL-C), is considered an important risk factor for both type 2 diabetes and cardiovascular diseases (CVD) (1-3). Studies suggest important differences in the prevalence of the metabolic syndrome across ethnic groups. For example, a study from the United Kingdom found that South-Asians and African-Caribbeans had a higher age-adjusted prevalence of the metabolic syndrome than white Europeans (4). Similar findings were found among people of South-Asian Surinamese and African Surinamese origin in the Netherlands (5, 6).

These ethnic differences could partly be explained by unhealthy diet and behaviors (7, 8), yet evidence from the general populations suggests that psychosocial factors are also associated with the metabolic syndrome (9, 10). An important psychosocial factor for ethnic minority groups is experiencing ethnic discrimination (11). A European survey found that around 30% of ethnic minorities reported ethnic discrimination (12). A Dutch report found that around 40-50% of the ethnic minorities had experienced ethnic discrimination, mainly in public areas and on the labor market (13). A qualitative study among African Surinamese-origin women in the Netherlands indicated that everyday racism occurs in the media and public spaces (including schools), and mainly enacts through group-based stereotypes (e.g., being lazy, lack of discipline) (14). Indeed, ethnic discrimination includes a range of experiences and occurs at different levels (e.g., institutional). In this paper, we focus on everyday discrimination only. Specifically, we define perceived ethnic discrimination (PED) as experiencing unfair treatment in everyday life at interpersonal level, on the ground of ethnic background (15, 16).

Several studies have shown that perceived discrimination is associated with poor health outcomes (17-20). However, the literature is limited as most studies are from the United States (US), with a focus on African Americans (18, 19). This makes any generalizations to European settings difficult, particularly considering the important differences between European-based ethnic minority groups and those living in the US, in terms of migration history and living conditions in the host country, amongst others. Additionally, most discrimination studies focused on mental health outcomes, but over the last years studies are increasingly considering cardiovascular risk factors (19-22). One review demonstrated that different levels of racism are not consistently associated with elevated blood pressure (23). A recent meta-analysis found that racial discrimination was weakly associated with blood pressure (24). Other studies found a positive association of perceived discrimination with coronary artery calcification (25), intima-media thickness (26), waist circumference (27), and visceral fat (28). An association between everyday racism and incident obesity was also observed in a recent study (29). It should be noted that only some of the discrimination studies on cardiovascular risk factors have specifically assessed racial/ethnic discrimination. Moreover, the literature has not yet assessed the association between PED and the metabolic syndrome. It is further unknown what the potential contribution of PED is to the prevalence of the metabolic syndrome. This knowledge may help understand the importance of PED relative to other factors (e.g., behavioral factors) in relation to the metabolic syndrome.

To fill this gap, our study aimed at assessing the association of PED with the metabolic syndrome and its individual components among different ethnic minority groups in Amsterdam, the Netherlands. Our study sample is unique relative to other multi-racial/ethnic cohorts, in that it represents groups with the same ancestral background but different ethnicity (i.e., African Surinamese and Ghanaian origin), groups with similar ethnic background but different ancestry (South-Asian Surinamese and African Surinamese origin), and groups with the same migration history but different ethnicity (Turkish and Moroccan origin) (see Box on pp. 83 for additional information). We also quantified the contribution of PED to the prevalence of the metabolic syndrome for each group separately. This study might expand our understanding of the role of PED in relation to ethnic differences in the metabolic syndrome.

Methods

Study population

Data were used from the Healthy Life in an Urban Setting (HELIUS) study. Full details of the study have been reported elsewhere (30). Briefly, HELIUS is a multi-ethnic cohort study in Amsterdam, the Netherlands. Participants aged 18-70 years were randomly sampled, stratified by ethnic origin, through the municipality register of Amsterdam. This register includes data on the country of birth of residents and their parents, which are used to determine ethnicity. Consistent with the definition of the Statistics Netherlands, a participant was considered to be of non-Dutch origin if (s)he fulfilled either of the following criteria: 1) born outside the Netherlands, and at least one of the parents born outside the Netherlands; or 2) born in the Netherlands but at least one of the parents born outside the Netherlands (31). The Surinamese subgroups (African or South-Asian origin) were determined using self-reported ethnic origin. Because data collection is still ongoing, definite response rate cannot be calculated. Preliminary response rates, however, are approximately 20-40%, with some variations between ethnic groups. Data collection included a questionnaire (either self-administered or through interview by ethnic-matched interviewer) and a physical examination including the collection of biological samples. Written informed consent was obtained from all participants prior to inclusion in the study. The HELIUS study was approved by the Institutional Review Board of the Academic Medical Center, University of Amsterdam.

We used baseline data collected from January 2011 until June 2014. From the total sample (n=14,628), we excluded people of Dutch origin (n=2,192), because the association between PED and the metabolic syndrome could not determined with the required statistical precision for this group, given its very low PED score with little variation therein (mean score 1.13, standard deviation 0.35). In addition, we excluded Indonesian Surinamese participants (n=148) and those with an unknown/other Surinamese origin or unknown/other ethnic origin (n=180), because of their relatively small sample sizes. Those who did not undergo physical examinations were excluded (n=1,247), because the presence of the metabolic syndrome could not be determined. We further excluded participants with missing data on PED (n=126), metabolic syndrome and its individual components (n=71) and all other covariates (n=486). For the current analysis, the total sample consisted of 10,178

participants: 2,179 South-Asian Surinamese, 2,053 African Surinamese, 1,681 Ghanaian, 2,154 Turkish, and 2,111 Moroccan participants.

Perceived ethnic discrimination

PED was conceptualized as the everyday experiences of interpersonal discrimination because of ethnic background (15). It was measured using the Everyday Discrimination Scale (EDS) (32), which captures the frequency of unfair treatment in daily life. EDS can be used across different ethnic groups (33). EDS is developed in the US but is conceptually based on the qualitative work by Essed which was partly conducted in the Netherlands (14). EDS includes nine items (e.g., 'being treated less respect than others', and 'you are threatened or harassed'), with a response scale varying from one (never) to five (very often), consistent with the study by Forman and colleagues (34). We adapted the EDS such that participants were specifically asked about unfair treatment because of ethnic background. We calculated the PED mean score: 1.00 (lowest) – 5.00 (highest). If one of the items was missing, the mean score of the other eight items was used to replace this missing item. If more than one item was missing, the sum score was not calculated and the measurement was considered missing. The Cronbach's alphas were 0.91 for South-Asian Surinamese, 0.90 for African Surinamese, 0.91 for Ghanaian, 0.90 for Turkish, and 0.91 for Moroccan participants.

Metabolic syndrome

The metabolic syndrome was determined according to the harmonized definition proposed by the International Diabetes Federation, American Heart Association, and others (35). By this definition, the metabolic syndrome is present if at least three of the following five criteria are met (yes/no): 1. elevated fasting glucose (≥5.6 mmol/L, or glucose-lowering medication); 2. elevated blood pressure (systolic ≥130 and/or diastolic ≥85 mmHg, or blood pressure lowering medication); 3. reduced high-density lipoprotein cholesterol ([HDL-C] <1.0 mmol/L for men, 1.3 mmol/l for women, or lipid-lowering medication); 4. elevated triglycerides (≥1.7 mmol/L, or lipid-lowering medication); 5. elevated waist circumference (ethnic- and country-specific cut-off values were used; for all women ≥80 cm, South-Asian men ≥90 cm, and other men ≥94 cm).

Overnight fasting blood samples were drawn and plasma samples were used to determine the concentration of glucose by spectrophotometry, using hexokinase as primary enzyme (Roche Diagnostics, Japan). Triglycerides and HDL-C were determined by colorimetric spectrophotometry (Roche Diagnostics, Japan). Blood pressure was measured in a seated position using a semi-automatic sphygmomanometer (Microlife WatchBP Home; Microlife AG, Switzerland). Using appropriate cuff sizes, two readings were taken on the upper arm at heart level after being seated for at least five minutes. The mean of the two readings was used for analysis.

Covariates

Demographic variables included age, sex, and marital status. Socioeconomic variables were level of education and employment status. Highest obtained education was categorized

into four categories: no education or elementary education; lower vocational and general secondary education; intermediate vocational and higher secondary education; and higher vocational education and university. Employment status was categorized into three categories: employed; unemployed; and not in the labor force. Other psychosocial factors were stress at home and recent negative life events. Stress at home was determined by asking the participant whether she or he felt stressed because of the situation at home in the past 12 months on a 4-point Likert scale (never to constantly). Participants were asked whether they experienced any negative event in the past 12 months (e.g., serious injury, deceased family member; yes/no).

Self-reported health behaviors included current smoking (yes, past, no) and daily alcohol consumption (none, 1-2, 3-4, or 5 or more glasses per day). Physical activity was also determined, using the SQUASH questionnaire (36), which assessed the amount of time spent on physical activities per week (minutes/week) – we categorized this variable into quartiles.

Depressive symptoms were measured using the Patient Health Questionnaire (PHQ-9). PHQ-9 determines the prevalence of depressive symptoms over the preceding two weeks, with a sum score varying from 0 (lowest) to 27 (highest). A cut-off value ≥10 was used to determine depressive symptoms (37).

Statistical analysis

The analyses were stratified by ethnicity. The age-standardized prevalence rates of the metabolic syndrome and its individual components were calculated using the direct standardization method, with the total HELIUS population (also including participants of Dutch origin) as the standard population. We also calculated the continuous measures of the individual components of the metabolic syndrome.

We used logistic regression with the metabolic syndrome or its individual components as the dependent variable and PED mean score as the main independent variable. Two consecutive models were created. Model 1 adjusted for age, sex, ethnicity (in the total sample only), marital status, education, employment status, and other psychosocial factors. Model 2 additionally adjusted for potentially mediating factors (i.e., factors through which PED may impact metabolic syndrome and its components), and included health behaviors and depressive symptoms.

The contribution of perceived ethnic discrimination to the prevalence of the metabolic syndrome was quantified by calculating the population attributable fraction (PAF). The PAF is interpreted as the proportional reduction in the prevalence of the metabolic syndrome that would occur if no one would experience ethnic discrimination. We only selected the ethnic minority groups for which we observed a statistically significant association between PED and the metabolic syndrome. We used the following formula for the PAF (38):

$$(P((RR - 1)/RR)) \times 100$$

Table 1. Characteristics of the five ethnic minority groups

Variable	South-Asian Surinamese	African Surinamese	Ghanaian	Turkish	Moroccan
	n=2,179	n=2,053	n=1,681	n=2,154	n=2,111
Female, %	55.3	63.7	58.6	54.5	61.6
Age in years, mean (SD)	45.80 (13.17)	47.33 (12.56)	45.14 (11.05)	40.31 (12.00)	40.19 (12.91)
Marital status, %					
Married/living with a partner	46.2	30.1	35.5	66.8	60.7
Divorced/separated/widowed	22.9	17.0	31.6	12.6	12.4
Never married	30.8	52.9	32.9	20.6	27.0
Education, %[a]					
1 (lowest)	15.3	6.6	30.0	33.9	33.1
2	33.7	33.9	38.8	24.6	18.1
3	28.8	35.9	24.7	27.6	32.4
4 (highest)	22.2	23.6	6.5	14.0	16.5
Employment status, %					
Employed	62.0	65.1	59.3	53.1	48.0
Unemployed	14.1	14.3	24.7	14.8	16.4
Not in the labor force	23.8	20.7	16.0	32.2	35.5
Other psychosocial factors					
Stress at home, %					
Never	45.7	51.4	57.6	44.0	49.3
Some periods of stress	36.0	35.3	30.8	36.4	32.5
Several periods of stress	12.4	10.0	8.2	13.0	11.6
Permanent stress	6.0	3.3	3.3	6.5	6.6
Any recent negative event, %	69.8	75.6	60.7	63.8	63.8
Health behaviors					
Smoking, %					
Current	28.0	30.5	4.6	33.9	13.2
Past	13.7	19.6	8.7	18.6	12.6
No	58.3	49.9	86.7	47.5	74.2
Physical activity[b], %					
Quartile 1 (lowest)	22.9	18.3	31.4	38.0	31.2
Q2	26.0	25.0	22.2	24.3	27.5
Q3	27.1	26.4	17.2	18.2	21.2
Quartile 4 (highest)	24.0	30.3	29.2	19.5	20.2
Daily alcohol consumption, %					
None	43.7	32.6	51.2	77.8	92.3
1-2 glasses	31.6	43.5	40.9	9.6	1.5
3-4 glasses	14.9	16.8	6.6	7.0	2.7
5 or more glasses	9.8	7.0	1.4	5.6	3.5
Depression, %	18.9	11.0	9.6	22.4	21.3
PED score, mean (SD), range 1-5	1.97 (0.75)	2.00 (0.75)	1.88 (0.80)	1.85 (0.73)	1.97 (0.78)

SD=standard deviation. PED=Perceived ethnic discrimination.

[a] 1 = no education or elementary education; 2 = lower vocational and general secondary education; 3 = intermediate vocational and higher secondary education; 4 = higher vocational education or university.

[b] Physical activity was defined as the amount of time spent on physical activity per week (minutes/week) and was categorized into quartiles.

where P is the prevalence of PED among participants with the metabolic syndrome. The presence of PED was defined as having a mean score of ≥ 2.00. RR is the relative risk ratio of the association between the prevalence of PED and the metabolic syndrome, adjusted for age, sex, marital status, education, employment status, and other psychosocial factors. Poisson regression was used to estimate the RRs.

In further analyses of the individual components, we replaced dichotomous measures by continues measures, and we analyzed their association with PED using linear regression. In these analyses, the continuous measures did not account for medication use (participants on medication were not excluded, as this would reduce the sample size substantially). We used SPSS version 21.0 and Microsoft Excel 2007 for analysis. A p-value below 0.05 was considered statistically significant.

Results

Participants of Ghanaian origin had lower education and higher unemployment rates than the other ethnic minority groups (Table 1). Participants of Turkish, Moroccan, and South-Asian Surinamese origin experienced more stress at home and had higher levels of depressive symptoms. Smoking and alcohol consumption were relatively low among Ghanaian and Moroccan participants. Mean PED scores were similar across the ethnic minority groups, with a mean score around 2.00.

Compared to the excluded participants (i.e. those who did not undergo physical examination), the included participants were older, and more often married and employed. Also the mean PED scores were slightly higher (1.94 vs. 1.86 in excluded participants, p-value <0.001).

Age-standardized prevalence rates of the metabolic syndrome and its individual components showed considerable ethnic variation (Table 2). The prevalence of the metabolic syndrome was around 43% in South-Asian Surinamese and Turkish, 34% in Moroccan, and 30% in African Surinamese and Ghanaian participants. Dyslipidemia (i.e. elevated triglycerides and reduced HDL-C) was most common in those of South-Asian Surinamese and Turkish origin, followed by those of Moroccan, African Surinamese and Ghanaian origin. This pattern was also observed with the mean scores for triglycerides and HDL-C. The prevalence of elevated fasting glucose was highest in participants of South-Asian Surinamese, Turkish and Moroccan origin, although the mean scores tended to be similar across the groups. Elevated blood pressure had the highest prevalence in Ghanaian and African Surinamese participants (65% and 56%, respectively) and lowest among Moroccan participants (38%). A similar pattern emerged with the mean scores for the systolic and diastolic pressure.

Table 3 presents the associations of PED with the metabolic syndrome and its individual components. In the total group (data not shown), PED was weakly associated with the metabolic syndrome (Model 1 OR 1.07; 95% CI: 1.01-1.14). The association did not change, after further adjustment for potential mediating factors (Model 2 OR 1.06; 95% CI: 1.00-1.13). The association between PED and the metabolic syndrome differed by ethnicity (p-value for interaction 0.035). For participants of Surinamese (both South Asian and African) and Moroccan origin, higher PED was associated with higher odds of having the

Table 2. Mean scores and age-standardized prevalence rates of the metabolic syndrome and its individual components by ethnic group

	South-Asian Surinamese	African Surinamese	Ghanaian	Turkish	Moroccan
Metabolic syndrome					
Prevalence[a], % (95% CI)	42.9 (40.8-45.0)	30.0 (28.0-32.0)	30.1 (27.9-32.3)	42.6 (40.5-44.7)	34.2 (32.2-36.2)
Waist circumference					
Elevated[b], prevalence % (95% CI)	68.3 (66.3-72.3)	61.5 (59.4-63.6)	65.5 (63.2-67.8)	73.9 (72.0-75.8)	70.4 (68.5-72.3)
Mean in cm (SD)	91.77 (12.73)	92.56 (13.78)	93.19 (12.14)	94.56 (13.97)	92.89 (13.36)
Triglycerides					
Elevated[c], prevalence % (95% CI)	29.9 (28.0-31.8)	11.7 (10.3-13.1)	10.1 (8.7-11.5)	30.8 (28.9-32.7)	18.2 (16.6-19.8)
Mean in mmol/l (SD)	1.19 (0.84)	0.85 (0.51)	0.74 (0.46)	1.23 (0.92)	0.94 (0.62)
HDL-C					
Reduced[d], prevalence % (95% CI)	44.2 (42.1-46.3)	24.5 (22.6-26.4)	20.7 (18.8-22.6)	43.5 (41.4-45.6)	36.5 (34.4-38.6)
Mean in mmol/l (SD)	1.32 (0.37)	1.53 (0.43)	1.61 (0.44)	1.30 (0.36)	1.36 (0.35)
Blood pressure					
Elevated[e], prevalence % (95% CI)	48.9 (46.8-51.0)	55.8 (53.7-57.9)	65.1 (62.8-67.4)	46.5 (44.4-48.6)	38.1 (36.0-40.2)
Systolic mean in mmHg (SD)	129.20 (18.32)	132.42 (17.82)	136.55 (18.97)	124.23 (16.10)	122.72(15.35)
Diastolic mean in mmHg (SD)	80.08 (10.24)	81.71 (10.68)	84.97 (11.51)	77.62 (10.24)	74.77 (9.43)
Fasting glucose					
Elevated[f], prevalence % (95% CI)	40.0 (37.9-42.1)	25.3 (23.4-27.2)	27.1 (25.0-29.2)	34.8 (32.8-36.8)	37.0 (34.9-39.1)
Mean in mmol/l (SD)	5.79 (1.46)	5.50 (1.48)	5.38 (1.18)	5.49 (1.18)	5.55 (1.42)

HDL-C=High-density lipoprotein cholesterol. CI=confidence interval.

[a] Defined according to the harmonized definition proposed by the International Diabetes Federation, National Heart, Lung, and Blood Institute, and others. By this definition, the metabolic syndrome is present if at least three of the following five criteria are met: 1. elevated fasting glucose; 2. elevated blood pressure; 3. reduced high-density lipoprotein cholesterol; 4. elevated triglycerides; 5. elevated waist circumference.

[b] Elevated waist circumference: based on ethnic- and country-specific cut-off values; for all women ≥80 cm, South-Asian men ≥90 cm, and other men ≥94 cm.

[c] Elevated triglycerides: ≥1.7 mmol/L or lipid lowering medication use.

[d] Reduced HDL-C: <1.0 mmol/L for men, 1.3 mmol/l for women, or lipid-lowering medication use.

[e] Elevated blood pressure: systolic ≥130 and/or diastolic ≥85 mmHg, or blood pressure lowering medication use.

[f] Elevated fasting glucose: ≥5.6 mmol/L, or glucose-lowering medication use.

Table 3. The association of perceived ethnic discrimination (PED) with the metabolic syndrome and its individual components by ethnic group, adjusted for potential confounders and mediators

	Odds Ratio (95% confidence interval)				
	South-Asian Surinamese	African Surinamese	Ghanaian	Turkish	Moroccan
Metabolic syndrome[a]					
Model 1	1.15 (1.01-1.32)*	1.17 (1.02-1.34)*	0.91 (0.78-1.05)	0.94 (0.82-1.08)	1.21 (1.05-1.40)*
Model 2	1.13 (0.99-1.30)	1.15 (1.00-1.32)*	0.89 (0.77-1.04)	0.92 (0.80-1.06)	1.19 (1.03-1.38)*
Elevated waist circumference[b]					
Model 1	1.24 (1.07-1.42)*	1.06 (0.92-1.23)	0.89 (0.75-1.06)	1.07 (0.92-1.24)	1.05 (0.91-1.21)
Model 2	1.23 (1.06-1.42)*	1.07 (0.92-1.24)	0.90 (0.76-1.07)	1.03 (0.88-1.20)	1.04 (0.90-1.20)
Elevated triglycerides[c]					
Model 1	1.07 (0.94-1.22)	1.11 (0.94-1.33)	1.10 (0.90-1.35)	0.89 (0.77-1.03)	1.18 (0.99-1.39)
Model 2	1.06 (0.93-1.21)	1.09 (0.92-1.30)	1.08 (0.87-1.34)	0.88 (0.76-1.03)	1.16 (0.98-1.37)
Reduced HDL-C[d]					
Model 1	1.07 (0.96-1.21)	1.07 (0.93-1.22)	1.15 (0.98-1.34)	0.92 (0.81-1.04)	1.25 (1.10-1.41)*
Model 2	1.06 (0.94-1.20)	1.06 (0.92-1.21)	1.22 (0.96-1.32)	0.90 (0.79-1.03)	1.24 (1.10-1.41)*
Elevated blood pressure[e]					
Model 1	1.12 (0.98-1.29)	1.10 (0.95-1.26)	0.88 (0.75-1.03)	1.09 (0.95-1.26)	1.05 (0.91-1.20)
Model 2	1.12 (0.97-1.28)	1.10 (0.96-1.27)	0.89 (0.76-1.05)	1.09 (0.95-1.26)	1.05 (0.92-1.20)
Elevated fasting glucose[f]					
Model 1	1.11 (0.98-1.27)	1.10 (0.96-1.26)	0.86 (0.74-1.00)*	1.00 (0.86-1.16)	1.08 (0.93-1.24)
Model 2	1.10 (0.96-1.25)	1.09 (0.95-1.25)	0.85 (0.73-0.99)*	1.00 (0.86-1.16)	1.06 (0.91-1.22)

WC=waist circumference; HDL-C=High-density lipoprotein cholesterol; BP=blood pressure; FG=fasting glucose.

[a] Defined according to the harmonized definition proposed by the International Diabetes Federation, National Heart, Lung, and Blood Institute, and others. By this definition, the metabolic syndrome is present if at least three of the following five criteria are met: 1. elevated fasting glucose; 2. elevated blood pressure; 3. reduced high-density lipoprotein cholesterol; 4. elevated triglycerides; 5. elevated waist circumference.

[b] Elevated waist circumference: based on ethnic- and country-specific cut-off values; for all women ≥80 cm, South-Asian men ≥90 cm, and other men ≥94 cm.

[c] Elevated triglycerides: ≥1.7 mmol/L or lipid lowering medication use.

[d] Reduced HDL-C: <1.0 mmol/L for men, 1.3 mmol/l for women, or lipid-lowering medication use.

[e] Elevated blood pressure: systolic ≥130 and/or diastolic ≥85 mmHg, or blood pressure lowering medication use.

[f] Elevated fasting glucose: ≥5.6 mmol/L, or glucose-lowering medication use. * denotes statistical significance at p-value < 0.05.

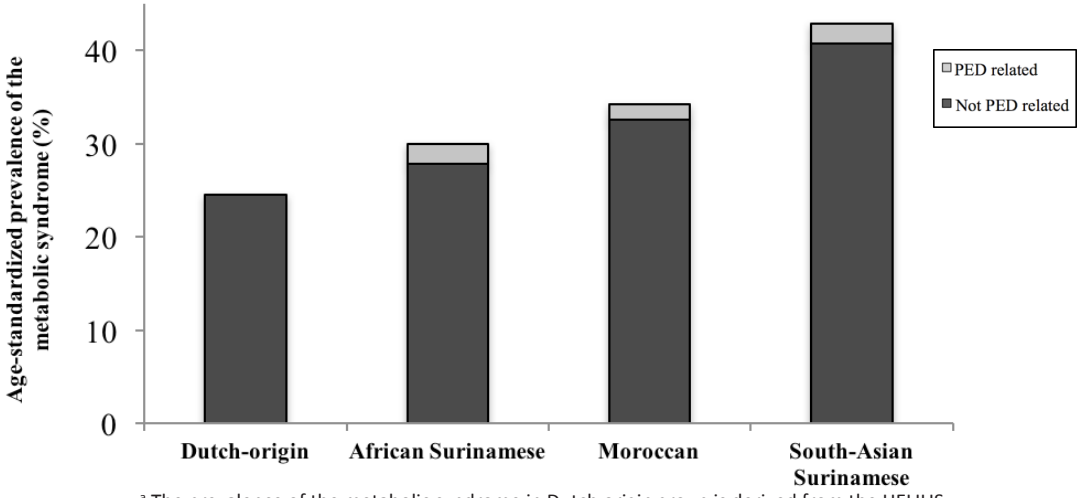
Model 1: adjusted for potential confounders: age, sex, ethnicity (in total sample only), marital status, education, employment, and other psychosocial factors (i.e., any recent negative life event, stress at home). Model 2: Model 1 + adjusted for potential mediators: health behaviors (i.e., smoking, physical activity, daily alcohol consumption), and depressive symptoms.

Table 4. The contribution of perceived ethnic discrimination to the prevalence of the metabolic syndrome in ethnic groups, using the population attributable fraction

	South-Asian Surinamese	African Surinamese	Moroccan
Prevalence of perceived ethnic discriminationa, %	52.9	50.9	47.4
Adjusted RR[b] (95% CI)	1.10 (1.01-1.19)	1.16 (1.02-1.32)	1.11 (0.98-1.25)
Adjusted PAFc, % (95% CI)	4.8 (0.5-8.4)	7.0 (1.0-12.3)	4.7 (1.0-9.5)

RR=relative risk ratio. CI=confidence interval. PAF=population attributable fraction.
[a] Prevalence of PED among cases with the metabolic syndrome.
[b] RR is adjusted for age, sex, marital status, education, employment, and other psychosocial factors (i.e. any recent negative life event, stress at home), calculated using Poisson regression.
[c] PAF calculated with the following formula: (P((RR-1)/RR)) x 100, where P is the prevalence of perceived ethnic discrimination and RR is the measure of association between perceived ethnic discrimination and the metabolic syndrome. The 95% CI is based on the 95% CI of the RRs.

Figure 1. Age-standardized prevalence of the metabolic syndrome in the ethnic groups[a], stratified by perceived ethnic discrimination (PED) related and not PED related



[a] The prevalence of the metabolic syndrome in Dutch origin group is derived from the HELIUS dataset.

metabolic syndrome. Each unit increase in PED was associated with 15% higher odds in South-Asian Surinamese, 17% in African Surinamese, and 21% in Moroccan participants. After adjusting for health behaviors and depressive symptoms in Model 2, the associations attenuated slightly but remained statistically significant. Among participants of Ghanaian and Turkish origin, no significant associations between PED and metabolic syndrome were observed.

Overall, PED was moderately associated with the individual components of the metabolic syndrome, with variations by ethnic group. Specifically, PED was significantly associated with elevated waist circumference in participants of South-Asian Surinamese origin only (Model 1 OR 1.24; 95% CI: 1.07-1.42). For elevated triglycerides, the association was significant

for those of Moroccan origin (Model 1 OR: 1.18; 95% CI: 0.99-1.39). For reduced HDL-C, the associations for Moroccan and Ghanaian participants tended to be positive. PED was positively associated with elevated blood pressure and fasting glucose in both Surinamese subgroups. All associations remained essentially unchanged after further adjustment for health behaviors and depressive symptoms. When using the continuous measures of the individual components of the metabolic syndrome, the findings were generally similar to those with dichotomous measures (see Supplementary Table).

After adjusting for age, sex, marital status, education, employment status, and other psychosocial factors, the contribution of PED to the prevalence of the metabolic syndrome in participants of South-Asian Surinamese origin was 4.8% (95% CI: 0.5-8.4) (Table 4). This suggests that the prevalence of the metabolic syndrome in those of South-Asian Surinamese origin would be reduced by 4.8%, if they did not experience ethnic discrimination. The contributions in participants of African Surinamese and Moroccan origin were 7.0% (95% CI: 1.0-12.3) and 4.7% (95% CI: 1.0-9.5), respectively. Figure 1 depicts these contributions to the prevalence of the metabolic syndrome across these ethnic minority groups.

Discussion

Evidence indicates ethnic differences in the prevalence of the metabolic syndrome. To understand these differences, we assessed the association of perceived ethnic discrimination (PED) with the metabolic syndrome and its individual components in five ethnic minority groups living in the Netherlands. We found that PED was weakly but significantly associated with the metabolic syndrome in South-Asian Surinamese, African Surinamese, and Moroccan participants, but not significantly in Ghanaian and Turkish participants. The associations with the individual components varied by ethnicity. We calculated that PED contributed approximately 5% to the prevalence of the metabolic syndrome in those of South-Asian Surinamese and Moroccan origin, and 7% in those of African Surinamese origin. This suggests that PED might contribute to ethnic differences in the metabolic syndrome.

This study had some limitations. First, we used cross-sectional data, so causal inferences could be made only with caution. However, longitudinal studies suggest that perceived discrimination temporally predicts poor health (27, 39-41). We therefore felt confident in using the PAF. Second, response bias might have occurred, given the differences between included and excluded participants. It is difficult to comment on the direction and magnitude of the potential bias, as no information was available on the presence of the metabolic syndrome among excluded participants. Third, socioeconomic status (SES) may confound the association between PED and metabolic syndrome. We used educational attainment and employment status as proxy measures for SES, but this might have insufficiently captured SES. Finally, there could be residual confounding of health behaviors (e.g., no data on diet).

Consistent with previous studies on perceived discrimination and cardiovascular risk factors, we found that PED was variably linked with the metabolic syndrome and its individual components across ethnic minority groups. An association between perceived discrimination and coronary artery calcification was found in middle-aged African American women (25). In another US multi-ethnic study the association between racial discrimination

and coronary artery calcification was not observed (42). A 2011 review on the link between racism and blood pressure also showed mixed findings (23). It indicated that studies with rested measures of blood pressure and hypertension diagnosis generally did not find any association, while studies that used ambulatory blood pressure measurements consistently observed a positive association (23).

Our study demonstrated ethnic variation in the association between PED and the metabolic syndrome. We observed positive (albeit weak) associations in the Surinamese and Moroccan participants but none among those of Ghanaian and Turkish origin. This variation could be explained by differences in social and cultural contexts (see Box pp. 83). Given their historical links with the Netherlands, Surinamese subgroups might have a differential relationship with the host society, compared to the other ethnic minority groups (43). Relatively, they have been longer in the Netherlands and are more acculturated (e.g., no significant language barriers) (43), which may have led to more discriminatory experiences and higher vigilance toward potential discriminatory encounters (44). Indeed, research indicates that increasing length of residence, as proxy for acculturation, exacerbates the association between discrimination and health (45). On the contrary, the Ghanaian group is a relatively recent ethnic minority, with most of them arriving in the 1990s. Further, they have strong social support and intra-group cohesion, with religious institutions playing an important role (46). Social support and religious involvement prove to buffer against the health impact of discrimination (47, 48). A study, for example, showed that African Americans with high emotional support from parents and peers had a weaker association between perceived discrimination and allostatic load than those with low emotional support (49).

Even though people of Moroccan and Turkish origin share similar migration history (guest workers), religious background, and socioeconomic status, they importantly differ in social support systems and ethnic identity (50). Turkish people have generally strongly-developed, well-organized social networks along ethnic and religious lines, with strong Turkish identification (50). Ethnic identity is also regarded as a buffer against discrimination (47), and both social support and ethnic identity might provide those of Turkish origin the resources to cope with discrimination.

Interestingly, the two West-African origin groups with similar ancestry – African Surinamese and Ghanaian – have differential association of PED with the metabolic syndrome. This could be explained by the above-mentioned differences (e.g., length of residence, acculturation). Another explanation might be related to the historical background, as African Surinamese people (in contrast to Ghanaian people) share a history of slavery (51) which could make discriminatory experiences more salient and thus with greater health impact. In addition, qualitative work on everyday racism suggests that in the Netherlands, contrary to the US, discrimination is more culturally-based rather than color-based (14). This might be relevant for these groups which share skin color but have vastly different cultures (46, 51), suggesting that negative stereotypes of African Surinamese culture (e.g., laziness) (14) might be the driving force rather than color. These differences between the West-African origin groups clearly emphasize the need to pay attention to the diversity within the African groups (52).

We found that health behaviors and depressive symptoms did not explain the association

between PED and the metabolic syndrome. Hence this association could possibly be attributed to stress-related neuroendocrine and sympathetic nervous system pathways (53-55). Emerging evidence indicates that these pathways are linked with perceived discrimination. A study among Mexican American adolescents found that perceived discrimination was associated with increased cortisol output and steeper cortisol awakening (56). A recent study in African American adolescents showed that racial discrimination has a positive association with 'allostatic load' (49), a concept that captures the dysregulation of bodily systems due to chronic stressors (57, 58). The metabolic syndrome partly reflects allostatic load (55, 59). A German study among Turkish immigrants found that perceived discrimination is associated with increased activation of the perigenual anterior cingulate cortex, a key brain region involved in modulating neuroendocrine and sympathetic nervous systems (60).

Furthermore, the associations of PED with the individual components provide two insights. First, the associations with the individual components were overall weak across the ethnic groups. This suggests that PED possibly influences the components individually to a lesser extent than the metabolic syndrome as a whole. This supports the notion that the biological response to a stressor involves interplay of different factors, as such using multi-factorial constructs (e.g., allostatic load, metabolic syndrome) might help to better capture this response. This was most notable in African Surinamese participants, in whom the individual components did not have any significant associations with PED, but the metabolic syndrome did.

Second, we found ethnic variations in the components underlying the association between PED and the metabolic syndrome, implying that different ethnic groups respond differently to a given stressor. This might point towards a potential role for fetal programming (61) and epigenetics (62). The fetal programming indicates that during pregnancy a fetus is biologically prepared for life after birth, hence adult health is partly determined by prenatal exposures (61). Given the differences in ancestral and migration history, and living and working circumstances in country of origin/destination, one could argue that these ethnic groups are differently cardio-metabolically programmed, which may result in a different biological response to stressors (63). In addition, epigenetics could help understand our findings. Different ethnic groups possibly have different genetic predisposition to specific metabolic disturbances, and once they are exposed to a stressor such as PED a diverse pattern of disturbances may develop.

Our study suggests PED was weakly associated with metabolic syndrome in some but not all ethnic minority groups. Our estimates suggest that around 5-7% of the prevalence of the metabolic syndrome is attributable to PED in some groups. And given the high prevalence of the metabolic syndrome in these groups, addressing PED might prove beneficial at population level. However, more (longitudinal) research is needed to understand the underlying mechanisms that link PED with health in general and CVD risk factors in particular. More innovative measures (e.g., ambulatory measurements, hair cortisol) could be used to capture these potential mechanisms. Future studies can also focus on factors that may buffer this association (e.g., social support). Expanding this evidence base might enhance our understanding to what extent and how PED impacts health in different ethnic minority groups.

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Supplementary Table. The association of perceived ethnic discrimination (PED) with the continuous measures of the individual components of the metabolic syndrome by ethnic group, adjusted for potential confounders and mediators

	Regression coefficient (95% confidence interval)				
	South-Asian Surinamese	African Surinamese	Ghanaian	Turkish	Moroccan
Waist circumference					
Model 1	0.976 (0.304-1.648)*	0.753 (0.002-1.505)*	-0.320 (-0.987-0.347)	0.953 (0.249-1.657)*	0.251 (-0.396-0.897)
Model 2	0.942 (0.266-1.618)*	0.734 (-0.014-1.483)	-0.383 (-1.060-0.293)	0.808 (0.103-1.513)*	0.196 (-0.449-0.841)
Triglycerides					
Model 1	0.004 (-0.043-0.051)	0.010 (-0.019-0.039)	-0.005 (-0.033-0.022)	-0.012 (-0.063-0.040)	0.011 (-0.022-0.044)
Model 2	0.001 (-0.046-0.048)	0.005 (-0.023-0.034)	-0.009 (-0.037-0.019)	-0.023 (-0.075-0.029)	0.012 (-0.021-0.045)
HDL-C					
Model 1	-0.015 (-0.035-0.004)	-0.017 (-0.042-0.007)	0.017 (-0.010-0.043)	0.001 (-0.018-0.020)	-0.020 (-0.039- -0.002)*
Model 2	-0.008 (-0.028-0.011)	-0.017 (-0.042-0.007)	0.011 (-0.016-0.038)	0.002 (-0.017-0.021)	-0.019 (-0.038- -0.001)*
Systolic blood pressure					
Model 1	0.208 (-0.711-1.127)	0.415 (-0.550-1.381)	-1.121 (-2.198- -0.043)*	0.951 (0.103-1.799)*	0.567 (-0.187-1.322)
Model 2	0.130 (-0.797-1.056)	0.407 (-0.561-1.375)	-1.191 (-2.289- -0.094)*	1.049 (0.196-1.902)*	0.580 (-0.172-1.333)
Diastolic blood pressure					
Model 1	0.329 (-0.210-0.868)	-0.082 (-0.674-0.511)	-0.826 (-1.489- -0.163)*	0.747 (0.208-1.285)*	0.079 (-0.400-0.559)
Model 2	0.280 (-0.263-0.822)	-0.071 (-0.665-0.523)	-0.862 (-1.536- -0.187)*	0.724 (0.181-1.266)*	0.064 (-0.416-0.545)
Fasting glucose					
Model 1	0.009 (-0.068-0.086)	0.052 (-0.034-0.137)	-0.041 (-0.112-0.030)	-0.029 (-0.095-0.036)	0.055 (-0.020-0.129)
Model 2	0.007 (-0.071-0.084)	0.046 (-0.039-0.132)	-0.041 (-0.113-0.032)	-0.044 (-0.110-0.022)	0.054 (-0.021-0.128)

HDL-C=High-density lipoprotein cholesterol. * denotes statistical significance at p-value < 0.05.
Model 1: adjusted for potential confounders: age, sex, ethnicity (in total sample only), marital status, education, employment, and other psychosocial factors (i.e., any recent negative life event, stress at home).

Model 2: Model 1 + adjusted for potential mediators: health behaviors (i.e., smoking, physical activity, daily alcohol consumption), and depressive symptoms.

PART 3

Social context

CHAPTER 8

Parental smoking and adult offspring's smoking behaviours in ethnic minority groups: an intergenerational analysis

Submitted

Umar Z. Ikram, Marieke B. Snijder, Eske M. Derks, Ron J.G. Peters, Anton E. Kunst, Karien Stronks. Parental smoking and adult offspring's smoking behaviours in ethnic minority groups: an intergenerational analysis in the HELIUS study

Abstract

Background: To understand smoking among ethnic minority groups, studies have largely focused on societal factors, with little attention being paid to family influences. Yet studies from majority groups suggest that parental smoking is an important risk factor. It is unknown whether this applies to ethnic minority groups. We investigated the association between parental smoking and adult offspring's smoking behaviours among ethnic minority groups.

Methods: We used data from the HELIUS study, collected in Amsterdam (the Netherlands) from January 2011-December 2015. The sample consisted of 2,184 pairs from South-Asian Surinamese, African Surinamese, Turkish, Moroccan, and Ghanaian origin. We collected self-reported smoking data: current status, duration of exposure to parental smoking, number of daily cigarettes, heavy smoking (>10 cigarettes/day), and nicotine dependency (using the Fagerström). Analyses were stratified by offspring's age, cohabitating with parent, education (parent/offspring), offspring's cultural orientation, and gender concordance within pairs. Logistic regression was used.

Results: Overall, parental smoking was associated with offspring's smoking behaviours (e.g. current smoking: odds ratio 2.33; 95% confidence interval 1.79-3.03), with little between-group variation. We found dose-response associations: the higher or stronger exposure to parental smoking the higher odds for offspring's smoking. The associations were similar across different strata, but stronger in gender-concordant pairs (3.16; 2.12-4.51 vs. 1.73; 1.15-2.59 in gender-discordant pairs; p-value for interaction 0.017).

Conclusions: Parental smoking is associated with offspring's smoking behaviours in ethnic minority groups across different strata but particularly in gender-concordant pairs. Future studies should simultaneously consider societal factors and parental influences, to comprehensively understand the drivers of smoking behaviours among ethnic minority groups.

Introduction

Smoking is an important risk factor for mortality and morbidity.[1,2] Studies from Western countries have shown considerable differences in current smoking across ethnic minority groups. The 2016 statistical report of the American Heart Association, for example, showed that among adults around 28% of American Indians/Alaska Natives smoked, as compared to 21% in White and African Americans and 15% in Asian and Hispanic Americans.[2] Similar heterogeneous patterns were observed among ethnic minority groups residing in European countries, such as England,[3] the Netherlands,[4] and Sweden.[5]

To understand the smoking behaviours among ethnic minority groups, the current literature has largely focused on societal factors, especially sociocultural integration into the host society. However, the studies have yielded inconsistent results. For example, using nationally representative data from the US, Bosdriesz et al showed that migration generation and age at time of entry to the US, as proxies for cultural integration, were not clearly linked with smoking among migrants from different countries.[6] A 2005 review among Hispanic Americans suggested that higher integration was associated with either more or less smoking.[7] Another recent review among migrants in Western countries (mainly East Asians in the US) showed that a longer residence duration in the host country was generally associated with higher smoking rates among women but lower rates among men.[8]

So far, little attention has been paid to the impact of family factors in shaping smoking behaviours in ethnic minority groups. A family factor that is particularly relevant in relation to smoking is parental smoking. Evidence from mainly White majority groups indicates that parental smoking is strongly associated with smoking behaviours in offspring. For example, a 2011 meta-analysis showed that if at least one parent smoked, children were 1.72 times more likely to uptake smoking, and if both parent smoked, children were 2.73 times more likely.[9] Similar findings were observed in more recent studies in adolescents[10-12] and adults.[13,14] This association presumably operates through the impact of genetic risk factors associated with smoking within families (i.e. heritable factors)[15-17] and social learning processes (e.g. parenting, parental role modelling).[18,19]

For ethnic minority groups, however, the association between parental smoking and offspring's smoking could be different for two reasons. First, the underlying processes may play out differently for ethnic minority groups. In a recent twin study, for example, it was shown that in adulthood genetic factors played a more important role for White Americans, compared to African Americans.[15] Second, the cultural meaning attached to smoking might be differential for ethnic minority groups. In some cultures, smoking is not accepted, particularly for women.[20,21] Hence, along the female line, parental smoking might not be necessarily associated with offspring's smoking.

The present study aimed to assess the association between parental smoking and adult offspring's smoking behaviours in five ethnic minority groups. We examined whether there is a dose-response association between parental smoking and offspring's smoking behaviours. In addition, we assessed whether the association differed by socio-demographic strata. We hypothesised that the association is stronger for those who are less integrated into the

Dutch society, because of a stronger orientation towards own culture and family. We also expected a stronger association for those co-habiting with parents and those younger than 30 years, given the higher exposure to parental smoking and hence continued influence of social learning processes. We further hypothesised that the association is stronger for gender-concordant pairs, since the influence of parenting or role modelling might depend on gender-concordance. This study may help to develop a more comprehensive understanding of smoking behaviours in ethnic minority groups.

Methods

Study population

Data were used from a subsample of the Healthy Life in an Urban Setting (HELIUS) study. Full details of the study have been reported elsewhere.[22] Briefly, HELIUS is a multi-ethnic cohort study in Amsterdam, the Netherlands. Participants aged 18-70 years were randomly sampled from the municipal register, stratified by ethnic origin. This register includes data on the country of birth of residents and their parents, which are used to determine ethnicity. A participant was considered to be of non-Dutch origin if (s)he fulfilled either of the following criteria: 1) born outside the Netherlands, and at least one of the parents born outside the Netherlands; or 2) born in the Netherlands but at least one of the parents born outside the Netherlands.[23] The Surinamese subgroups were determined through self-reported ethnic origin (i.e. African, South-Asian, Javanese, or other Surinamese origin).

Data were collected through a questionnaire, which was either self-administrated or by interview by a trained (ethnically-matched) interviewer. Participants who agreed to participate in HELIUS were asked whether they had parents, siblings, partner and/or offspring, aged 18-70 years and also living in Amsterdam. A maximum of three of those family members were also included in HELIUS. The HELIUS study was approved by the Institutional Review Board of the Academic Medical Center, University of Amsterdam. Written informed consent was obtained from all participants.

Baseline data were collected from January 2011 until December 2015. A total of 23,942 participants filled in the HELIUS questionnaire. Within this sample, we identified 2,645 parent-offspring pairs. From this sample, we excluded those of Javanese Surinamese origin (n=25) and those of an unknown/other Surinamese or unknown/other ethnic origin (n=41), because of the low numbers. We further excluded those of Dutch origin (n=395), as this paper focused on ethnic minority groups only. Parents with missing on current smoking (n=7), and adult offspring with missing data on current smoking (n=3), heavy smoking (n=45), and nicotine dependence (n=18) were excluded in the corresponding analysis. Participants (either parent or offspring) with missing data on covariates were excluded in the corresponding analyses only. Finally, our sample consisted of 2,184 parent-offspring pairs: 498 of South-Asian Surinamese origin; 481 of African Surinamese origin; 497 of Turkish origin; 517 of Moroccan origin; and 191 of Ghanaian origin.

Parental smoking

To determine parental smoking we used three self-reported measures. First, current parental smoking status was determined by asking parents whether they smoked currently (current smoker), used to smoke (former smoker), or never smoked (non-smoker). The latter two categories were taken together as no (current) smoker in the main analyses (hence: current smoker / no current smoker). Second, we asked the smoking parents how many cigarettes they currently used on daily basis. This variable was categorized into two categories through median-split: low number (mean: 6.03, SD: 3.38), high number (19.29, 6.01). Third, current nicotine dependency status was determined using the Fagerström questionnaire (consisting of six items).[24] We calculated the sumscore (range: 0-10), with >4 indicating nicotine dependence.[24]

Offspring's smoking

Smoking behaviours in the adult offspring were assessed using four self-reported measures. First, current smoking was determined in the same way as for the parent (current smoker / no current smoker). Second, we defined heavy smoking as smoking >= 10 cigarettes per day (yes/no), with the comparative group being smokers who consume less than 10 cigarettes and non-current smokers. Third, similar to parents, we used the Fagerström questionnaire for nicotine dependence. The comparative group was non-nicotine dependent, including the non-smokers and smokers without nicotine dependence. Fourth, we assessed the duration of exposure to parental smoking among adult offspring, which was determined by combining offspring's age, the year of smoking initiation of the parent, and the year of smoking cessation (in case the parent had stopped). The duration of exposure to parental smoking was categorized into two categories through median-split: short exposure (mean: 13.01 years, SD: 5.93 years), and long exposure (28.21, 5.47).

Covariates

Socio-demographic data were collected for both parent and adult offspring. We included information on age, sex, and education. We defined education as highest educational attainment in the Netherlands or in the country of origin. This variable was divided into four categories: no education or elementary education; lower vocational and general secondary education; intermediate vocational and higher secondary education; and higher vocational education and university. When stratifying the analysis by education, the first two categories were taken together as 'low education' while the latter two together represented 'high education'. In addition, we assessed whether the adult offspring was co-habiting with parent(s) (yes/no). Offspring's cultural orientation was determined by assessing orientation to own culture and to the Dutch culture. We used the Dutch-Psychological Acculturation Scale (D-PAS) to measure orientation to both cultures separately.[25] D-PAS uses 10 items with response scale ranging from 1 (totally disagree) to 5 (totally agree) (e.g. 'I have a lot in common with Dutch/Surinamese/Turks/Moroccans/Ghanaians').[25] We calculated the mean score for both cultures, and based on the score distributions in the total sample, the following cut-off point was used: <3 (weak orientation) and ≥3 (strong orientation).

Statistical analysis

Parent and offspring data were linked, such that parent-offspring formed pairs in the analysis. Around 85% represented unique pairs (i.e., the parent had only one offspring and the offspring had only one parent in the dataset), so multi-level modelling was not required. We calculated sex-standardized prevalence rates for different smoking behaviours. We used multivariable logistic regression models to assess the associations between parental smoking and smoking behaviours in adult offspring, adjusting for both parental and offspring's age, sex and education. Since the association did not significantly differ by ethnicity (all p-values for interaction >0.05) and to increase statistical power, ethnic minority groups were taken together for further analyses. The associations for the total sample were additionally adjusted for ethnicity.

In addition, we assessed whether the association differed by socio-demographic variables in the total sample. The following socio-demographic variables were considered: offspring's and parental education (low/high); offspring's age (split at 30 years, as we assumed that from this age a greater independence is gained from parents, reducing parental influences), cohabiting with parent (yes/no); gender-specific associations (concordant [e.g., mother-daughter] / discordant [e.g., mother-son]); offspring's cultural orientation (at own culture [weak/strong] and at Dutch culture [weak/strong]). The associations were presented for each stratum of the various socio-demographic variables, along with p-values for interaction.

Finally, we assessed whether the associations occurred in a dose-response manner. We examined the associations in different strata of four variables: 1) parental smoking status (never smoker=ref / former smoker / current smoker); 2) current number of daily cigarettes by parent (non-smoker=ref / low / high); 3) duration of exposure to parental smoking (no exposure=ref / short / long); and 4) current parental dependency status (non-smoker=ref / non-dependent smoker / dependent smoker). SPSS version 21.0 was used for data analysis.

Results

Table 1 presents the characteristics of both parents and adult offspring. Mean parental age was around 55 years and mean offspring's age around 28 years, with some variation between the groups. Both parents and offspring were mostly women. Hence mother-daughter pairs were most prevalent (34-49%), followed by mother-son (22-33%), father-daughter (11-21%), and father-son pairs (10-19%). The majority of adult offspring was cohabiting with their parents (around 55%). Parents of Moroccan and Turkish origin had lowest educations while those of Surinamese origin had relatively high education. There were no ethnic differences in offspring's education. The majority of the offspring was oriented to the own culture (around 93%) and to the Dutch culture (around 80%).

In the total sample, current parental smoking was positively associated with smoking behaviours in adult offspring (Table 2). For current smoking, the odds ratio (OR) for the total sample was 2.3 in Model 3 (95% confidence interval [CI]: 1.8-3.0), suggesting that ethnic minority offspring were 2.3 times more likely to smoke if their parent smoked. There were some differences between the ethnic groups, but these were not statistically significant

(p-value for interaction: 0.36). For offspring's heavy smoking and nicotine dependence, similar patterns were observed, with no variation between the groups.

Figure 1 shows the adjusted associations between different parental smoking behaviours and offspring's smoking behaviours. Overall the associations tended to occur in a dose-response manner, with the p-values for trend <0.001. More specifically, the ORs for the offspring's smoking behaviours were higher for current smoking parents than for former smoking parents (Figure 1A). Similar patterns emerged when stratified by the current number of daily cigarettes used by parent: the higher the number the stronger associations with smoking behaviours among offspring (Figure 1B). We also observed dose-response associations with the duration of exposure to parental smoking: the longer exposure the stronger associations with offspring's smoking behaviours (Figure 1C). Compared to non-smoking parents, offspring's smoking behaviours were more strongly increased for those with dependent parents than for those with non-dependent parents (Figure 1D).

In Table 3, the adjusted associations are presented for the total sample, stratified by various socio-demographic variables. Except for gender-specific associations, the associations were generally about equally strong across all strata, with the ORs ≥2.0. For example, the associations between parental smoking and offspring's smoking behaviours were still strongly positive among offspring ≥30 years of age and among those not cohabiting with parent, with no statistical difference with their counterparts. We observed that the significantly stronger for gender-concordant than for gender-discordant pairs, with the p-values for interaction for all outcome measures being <0.05. For example, for current smoking, the OR for gender-concordant pairs was 3.2 (95%CI: 2.1-4.5) versus 1.7 (1.2-2.6) for gender-discordant pairs (p-value for interaction: 0.017). At gender-specific level, all pairs had strong positive associations for the offspring's smoking behaviours (OR>2), except for the mother-son pairs.

Discussion

Summary

This study aimed to assess the associations between parental smoking and adult offspring's smoking behaviours in five ethnic minority groups. We observed that these associations were consistently strong, occurring in a dose-response manner. In addition, the associations were similar in different socio-demographic strata (e.g. ethnicity, offspring's age, cohabitation with parent). However, the associations tended to be stronger for gender-concordant pairs (e.g. mother-daughter) as compared to gender-discordant pairs (e.g. mother-son).

Strengths and limitations

An important strength of this study is that it used linked intergenerational data to collect detailed information on smoking (amongst other variables) for both parent and adult offspring in a similar manner. This allowed assessing the associations reliably and comprehensively. Another strength is the multi-ethnic sample, making it possible to assess the associations simultaneously in various ethnic minority groups.

Table 1. Characteristics and prevalence rates of smoking behaviours of parents and adult offspring among five ethnic minority groups, Amsterdam, the Netherlands (2011-2015)

	Ethnic minority group									
	South-Asian Surinamese		African Surinamese		Turkish		Moroccan		Ghanaian	
	Parent	Offspring	Parent	Offspring	Parent	Offspring	Parent	Offspring	Parent	Offspring
	N=498	N=498	N=481	N=481	N=497	N=497	N=517	N=517	N=191	N=191
Socio-demographics										
Mean age, years (SD)	55.63 (7.02)	29.34 (7.81)	56.78 (6.46)	30.32 (8.04)	51.59 (6.89)	26.69(6.30)	54.70(7.18)	27.00(6.47)	52.15(6.62)	24.37 (6.37)
Offspring's age below 30 years, % (N)	-	57.4 (286)	-	50.9 (245)	-	70.0 (348)	-	67.5 (349)	-	81.2 (155)
Women, % (N)	66.9 (333)	48.4 (241)	78.8 (379)	60.1 (289)	66.6 (331)	54.7 (272)	69.8 (361)	68.9 (356)	71.2 (136)	62.3 (119)
Cohabiting with parent, % (N)	-	55.5 (233)	-	50.0 (186)	-	55.9 (257)	-	56.1 (253)	-	74.3 (117)
Education[a], % (N)										
1 (lowest)	24.0 (119)	5.0 (25)	6.1 (29)	3.3 (16)	63.1 (309)	4.9 (24)	69.3 (356)	3.7 (19)	3.7 (19)	6.8 (13)
2	42.8 (21)	17.1 (85)	40.8 (195)	16.7 (80)	18.8 (92)	23.2 (114)	13.0 (67)	18.4 (94)	42.2 (79)	30.9 (59)
3	19.0 (94)	45.8 (228)	29.9 (143)	53.3 (256)	14.3 (70)	50.8 (250)	16.0 (82)	50.2 (257)	27.8 (52)	51.8 (99)
4 (highest)	14.1 (70)	32.1 (160)	23.2 (111)	26.7 (128)	3.9 (19)	21.1 (104)	1.8 (9)	27.7 (142)	1.6 (3)	10.5 (20)
Offspring's acculturation, % (N)										
Orientation to own culture	-	92.8 (440)	-	93.9 (414)	-	95.7 (468)	-	92.6 (464)	-	92.6 (175)
Orientation to Dutch culture	-	88.7 (422)	-	87.3 (386)	-	83.5 (409)	-	83.5 (420)	-	75.1 (142)
Smoking behaviours[b], % (N)										
Current smoking	23.6 (98)	30.7 (154)	25.7 (105)	32.7 (153)	27.9 (121)	34.9 (172)	11.5 (36)	18.7 (75)	5.3 (7)	4.6 (7)

Heavy smoking	12.1 (45)	11.6 (57)	10.9 (36)	7.2 (32)	20.3 (82)	21.6 (103)	6.8 (21)	11.4 (40)	2.2 (3)	-
Nicotine dependence	7.4 (29)	8.9 (44)	2.6 (14)	5.3 (25)	12.3 (53)	12.2 (59)	3.1 (10)	6.5 (23)	3.4 (3)	0.7 (1)
Gender-specific pairs										
Concordant pairs										
Mother-Daughter	33.9 (169)		48.6 (234)		37.6 (187)		48.4 (250)		44.5 (85)	
Father-Son	18.7 (93)		9.8 (47)		16.3 (81)		9.7 (50)		11.0 (21)	
Discordant pairs										
Mother-Son	32.9 (164)		30.1 (145)		29.0 (144)		21.5 (111)		26.7 (51)	
Father-Daughter	14.5 (72)		11.4 (55)		17.1 (85)		20.5 (106)		17.8 (34)	

[a] 1 = no education or elementary education; 2 = lower vocational and general secondary education; 3 = intermediate vocational and higher secondary education; 4 = higher vocational education or university.

[b] Sex-standardized prevalence rates.

Table 2. Associations between parental current smoking and different offspring's smoking behaviours among ethnic minority groups

	OR (95% CI)				
Outcome variable	**All ethnic minority groups**[a,b]	**South-Asian Surinamese**	**African Surinamese**	**Turkish**	**Moroccan**
Current smoking					
Model 1	2.42 (1.87-3.14)	3.36 (2.04-5.53)	2.12 (1.33-3.38)	2.11 (1.36-3.26)	2.55 (0.92-7.04)
Model 2	2.39 (1.84-3.10)	3.38 (2.03-5.64)	2.16 (1.35-3.47)	1.93 (1.23-3.03)	2.49 (0.89-6.97)
Model 3	2.33 (1.79-3.03)	3.20 (1.90-5.39)	2.03 (1.26-3.29)	1.94 (1.23-3.05)	2.54 (0.89-7.21)
Heavy smoking					
Model 1	2.90 (2.06-4.08)	4.59 (2.37-8.90)	2.98 (1.38-6.43)	2.05 (1.25-3.35)	4.90 (1.23-19.56)
Model 2	2.79 (1.98-3.34)	4.49 (2.30-8.74)	2.99 (1.37-6.49)	1.85 (1.12-3.07)	5.44 (1.33-22.25)
Model 3	2.71 (1.92-3.83)	3.83 (1.95-7.52)	2.76 (1.26-6.06)	1.89 (1.13-3.15)	5.01 (1.20-20.98)
Nicotine dependence					
Model 1	2.98 (2.02-4.40)	4.31 (2.07-8.98)	2.12 (0.89-5.06)	2.51 (1.38-4.57)	8.25 (1.41-48.46)
Model 2	2.83 (1.90-4.20)	4.23 (2.02-8.85)	2.24 (0.93-5.41)	2.05 (1.10-3.80)	8.72 (1.42-53.53)
Model 3	2.82 (1.91-4.26)	4.02 (1.89-8.52)	2.21 (0.91-5.45)	2.18 (1.16-4.10)	6.90 (1.11-43.06)

OR=odds ratio. CI=confidence interval.
Model 1: adjusted for sex and age of both parent and offspring, and ethnicity (only when all ethnic minority groups are pooled).
Model 2: Model 1 additionally adjusted for offspring education.
Model 3: Model 2 additionally adjusted for parental education.
[a] P-value for interaction by ethnicity (used in Model 3): 0.362 for current smoking, 0.683 for heavy smoking, and 0.810 for nicotine dependence.
[b] The 'All ethnic minority groups' category includes those of Ghanaian origin as well. However, separate analyses were not done for Ghanaians due to the very low smoking rates.

Figure 1. Associations between parental smoking patterns and offspring's smoking behaviours among ethnic minority groups[a,b]

Figure 1A.

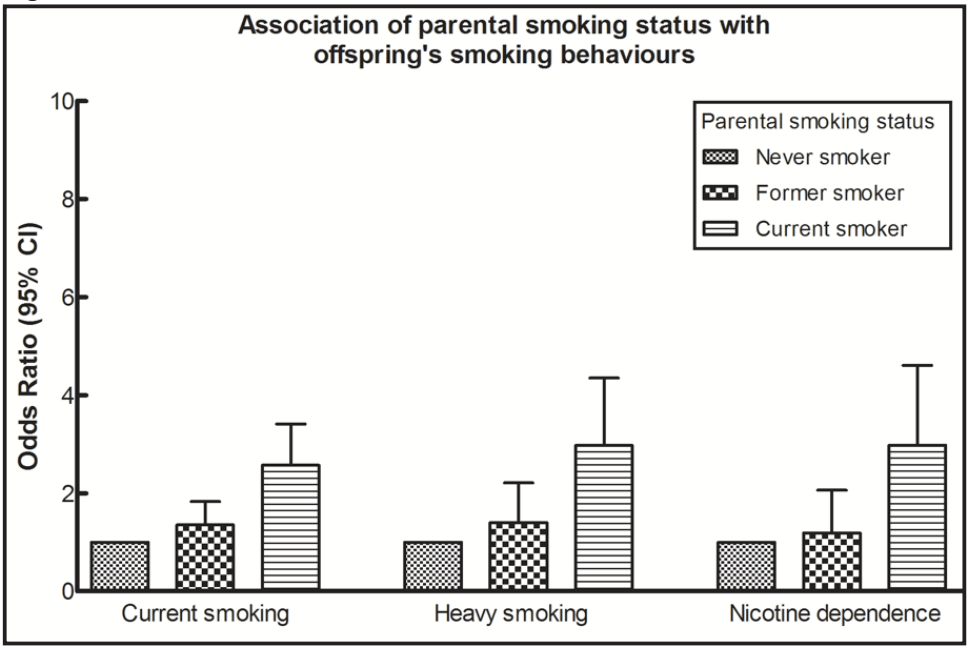
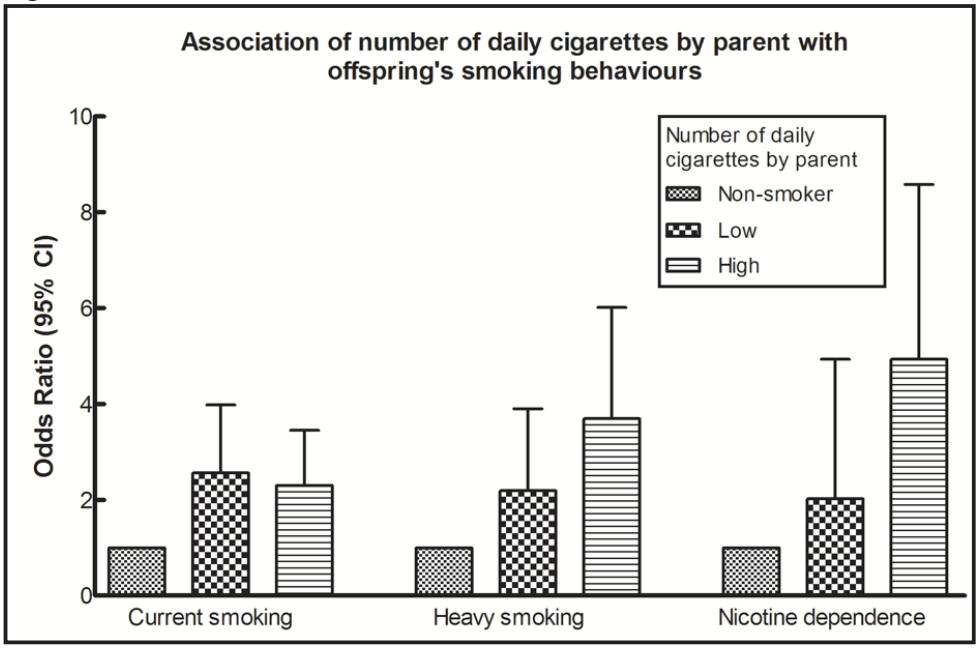


Figure 1B.



[a] The associations were adjusted for ethnicity; sex and age of both parent and offspring; education of both offspring and parent.

[b] P-trend for all outcomes was <0.001.

Figure 1C.

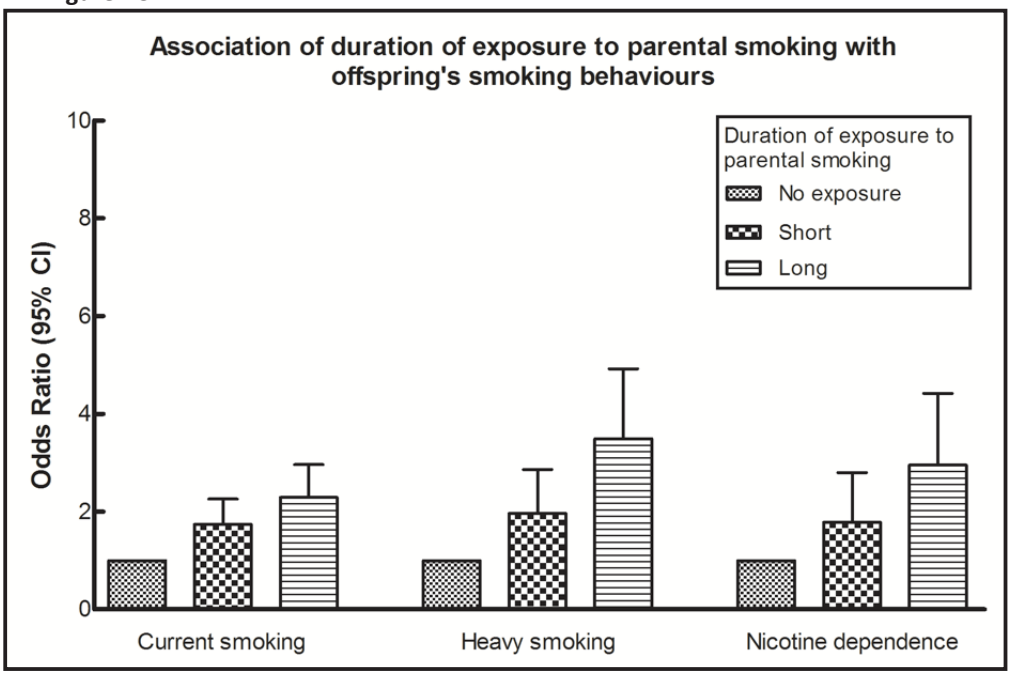


Figure 1D.

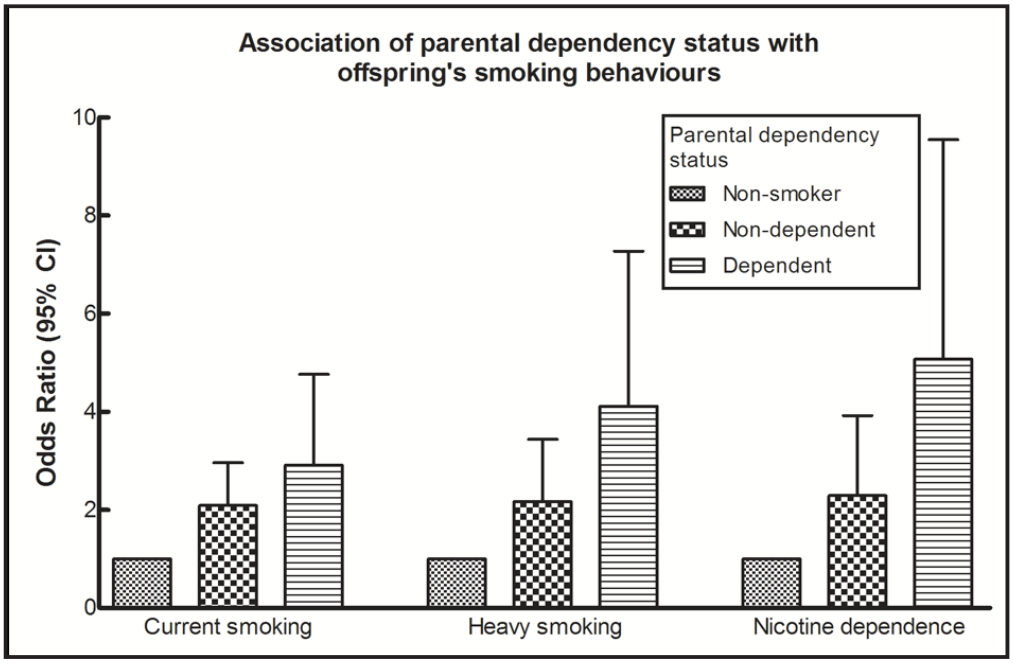


Table 3. Associations between parental current smoking and offspring's smoking behaviours among ethnic minority groups across different strata[a]

	Offspring smoking behaviour								
	Current smoking			Heavy smoking			Nicotine dependence		
Stratified by	n/N[b]	OR (95% CI)	P-value[c]	n/N[b]	OR (95% CI)	P-value[c]	n/N[b]	OR (95% CI)	P-value[c]
Offspring education									
Low	191/522	3.12 (1.84-5.28)		87/507	2.81 (1.54-5.14)		66/517	3.45 (1.77-6.73)	
High	362/1628	2.08 (1.53-2.82)	0.160	142/1602	2.67 (1.75-4.09)	0.963	86/1532	2.63 (1.58-4.38)	0.813
Parental education									
Low	407/1500	2.25 (1.65-3.06)		190/1468	2.41 (1.64-3.54)		122/1489	2.72 (1.73-4.29)	
High	146/650	2.73 (1.63-4.58)	0.850	39/641	3.78 (1.70-8.40)	0.291	30/646	2.93 (1.23-7.00)	0.916
Offspring age									
<30 years	313/1360	2.50 (1.79-3.48)		126/1353	3.04 (1.92-4.79)		81/1348	3.81 (2.21-6.54)	
>= 30 years	240/790	2.03 (1.29-3.19)	0.462	104/776	2.38 (1.36-4.16)	0.904	71/787	1.95 (1.04-3.64)	0.545
Cohabiting with parent									
Yes	216/1038	2.26 (1.53-3.32)		85/1022	2.05 (1.21-3.49)		51/1027	3.91 (2.03-7.52)	
No	235/803	2.47 (1.57-3.87)	0.644	106/786	3.61 (2.03-6.42)	0.080	68/802	2.46 (1.29-4.69)	0.812
Gender-specific associations									
Concordant	302/1195	3.16 (2.12-4.51)		121/1174	3.67 (2.32-5.81)		80/1189	3.85 (2.25-6.57)	
Mother-daughter	197/908	3.15 (1.97-5.03)		67/898	3.56 (1.89-6.70)		45/908	3.54 (1.72-7.29)	
Father-son	105/287	2.98 (1.70-5.23)		54/276	3.53 (1.78-6.99)		35/281	4.38 (1.88-10.17)	
Discordant	251/955	1.73 (1.15-2.59)		108/935	1.91 (1.11-3.29)		72/946	1.94 (1.03-3.64)	
Mother-son	198/609	1.48 (0.87-2.53)		89/590	1.41 (0.70-2.85)		56/600	1.97 (0.85-4.53)	
Father-daughter	53/346	2.32 (1.19-4.55)	0.017[d]	19/345	4.17 (1.36-12.79)	0.022[d]	16/346	2.42 (0.77-7.61)	0.038[d]
Offspring acculturation									

Orientation to own culture[e]									
Yes	499/1933	2.33 (1.76-3.08)		209/1895	2.78 (1.93-4.01)		138/1921	2.95 (1.93-4.51)	
No	34/133	2.78 (0.84-9.25)	0.915	10/131	2.63 (0.28-24.35)	0.442	8/130	-	-
Orientation to Dutch culture[e]									
Yes	459/1755	2.36 (1.76-3.16)		188/1720	3.00 (2.03-4.42)		127/1743	3.16 (2.02-4.94)	
No	76/317	2.33 (1.08-5.01)	0.887	32/312	1.57 (0.59-4.17)	0.358	20/314	1.84 (0.54-6.27)	0.364

OR=odds ratio. CI=confidence interval.

[a] The associations were adjusted for sex and age of both the parent and offspring; offspring education; and parental education.

[b] number of cases among offspring / total Number of offspring within stratum.

[c] P-value for interaction.

[d] This p-value for interaction represents statistical differences between gender-concordant and -discordant associations.

[e] Categorisation based on the cut-off point at 3 (score range 1-5; <3 no, >=3 yes.

This study also has some limitations. First, we used cross-sectional data, so reverse causality cannot be fully excluded. However, the dose-response associations we found lend some support to causal claims. Also, longitudinal studies have suggested that parental smoking precedes offspring's smoking.[10,13] Second, for study inclusion both parents and offspring had to be residing in Amsterdam, which may have potentially introduced selection bias. It is difficult to determine the direction and magnitude of this bias, but there is no reason to assume that the association would disappear or change dramatically if those living outside Amsterdam were also included. Third, as most participants were women, the generalizability of our findings might be affected. However, in gender-specific analyses we also found positive associations in father-son pairs, suggesting that the associations are not restricted to women only. Fourth, the data were self-reported so misclassification may have occurred, due to social desirability (e.g. reported fewer cigarettes used on daily basis) and recall issues (e.g. uncertain how long has it been since one quitted). These biases, if non-differential, are most likely to have led to an underestimation of the associations in our study. Finally, residual confounding might have occurred. The confounding variables potentially related to both parental smoking and offspring's smoking could be cultural norms regarding smoking (e.g. smoking not acceptable for women in some cultures),[26] or smoking behaviours of other family members. We did not assess these variables.

Interpretation of findings

We observed strong associations between parental smoking and offspring's smoking behaviours in ethnic minority groups. This is consistent with studies among majority groups.[9,10,13,18,27] Heritability and social learning processes within families with a smoking parent could help explaining these findings. Several studies among monozygotic and dizygotic twins have indicated that smoking behaviours are partly determined by heritable factors. For example, a Turkish twin study suggested that heritability plays a role in nicotine dependence and smoking initiation.[17] Similar findings were observed in a Dutch study.[16] It should be noted that the impact of heritability might differentiate according to smoking behaviour and ethnic group. In the twin studies the impact of heritability was greater for nicotine dependence (75-80%) than for smoking initiation (10-44%).[16,17] For smoking initiation, heritability accounted for 44% in the Dutch sample[16] and 10% in the Turkish sample,[17] suggesting differential impact of genetic versus environmental influences in the ethnic groups.

Social learning processes within families with a smoking parent may also explain the associations we found. The following two social processes might be relevant in this regard: (i) social learning through role modelling: smoking parents may transmit positive attitudes, norms and beliefs on smoking;[18,28,29] and (ii) parenting practices (e.g. smoking house rules, behavioural control): smoking parents may be less stringent or less effective in attempts to prevent their children from smoking.[29] These social processes, in turn, may shape the smoking attitudes, beliefs, and opportunities regarding smoking, and ultimately smoking behaviours of the offspring.

Contrary to our hypotheses, we found that the associations between parental smoking and offspring's smoking behaviours were quite similar across different socio-demographic strata.

This suggests that the impact of social learning processes within families may persist among these groups across diverse social situations,[27-29] including situations in which the offspring presumably lives an 'independent' life (e.g. not cohabiting with parent). In addition, we speculate that the impact of heritable factors in these groups might be so strong during life course that it surpasses the influence of the socio-demographic variables. A recent study suggested that for White Americans genetic influence remains strong for cigarette use in adulthood.[15]

We found that the associations were stronger for gender-concordant pairs than for gender-discordant pairs in ethnic minority groups. This is consistent with prior studies conducted among predominately majority groups.[11,18,27,30] It could be speculated that social learning processes might be at play here. These processes may possibly dependent on gender-concordance, such that fathers act as role models for their sons and mothers for daughters.[29] In addition, when looking specifically at the gender-specific associations, we did not find any statistically significant associations between maternal smoking and son's smoking behaviours, whereas paternal smoking determined both son's and daughter's smoking. This could be related to the important role fathers (as compared to mothers) play in setting the norms and examples (e.g. regarding smoking) in the family among some ethnic minority groups. Two studies conducted among Turkish and Moroccans parents suggested that they regard the strategic part of parenting (e.g. disciplining, future planning, and explaining about what's good or evil) to be the responsibility of the father, while mothers are mainly responsible for providing emotional support to their children.[31,32]

The strong and consistent associations between parental smoking and offspring's smoking behaviours, as observed in our study, might help to understand the lack of convergence of smoking rates of ethnic minority groups towards the smoking rates of the host group. It has been suggested that with more integration into the host society, smoking rates tend to converge towards the host group's patterns.[8,33] However, the evidence base for this is mixed,with several examples of ethnic minority groups whose smoking rates remained at the (either high or low) levels that were observed in previous years or in countries of origin. We speculate that the smoking rates of second generation migrants reflect those of the first generation in part because of strong intra-family transmission of (non-)smoking behaviours.

Conclusion

Our study showed that parental smoking was consistently associated with adult offspring's smoking behaviours across ethnic minority groups (i.e. South-Asian Surinamese, African Surinamese, Turkish, Moroccan, and Ghanaian origin). Our findings indicate that, besides societal factors family influences should be taken into account, in order to expand our understanding of the drivers of smoking behaviours in ethnic minority groups.

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CHAPTER 9

Perceived ethnic discrimination and depressive symptoms: the buffering effects of ethnic identity, religion and ethnic social network

Published

Umar Z. Ikram, Marieke B. Snijder, Matty A.S. de Wit, Aart H. Schene, Karien Stronks, Anton E. Kunst. Perceived ethnic discrimination and depressive symptoms: the buffering effects of ethnic identity, religion and ethnic social network. Soc Psychiatry Psychiatr Epidemiol 2016;51:679-688

Abstract

Background: Perceived ethnic discrimination (PED) is positively associated with depressive symptoms in ethnic minority groups in Western countries. Psychosocial factors may buffer against the health impact of PED, but evidence is lacking from Europe. We assessed whether ethnic identity, religion, and ethnic social network act as buffers in different ethnic minority groups in Amsterdam, the Netherlands.

Methods: Baseline data were used from the HEalthy Living In a Urban Setting (HELIUS) study collected from January 2011- June 2014. The random sample included 2501 South-Asian Surinamese, 2292 African Surinamese, 1877 Ghanaians, 2626 Turks, and 2484 Moroccans aged 18-70 years. Depressive symptoms were assessed using the Patient Health Questionnaire-9. PED was measured with the Everyday Discrimination Scale. Ethnic identity was assessed using the Psychological Acculturation Scale. Practicing religion was determined. Ethnic social network was assessed with number of same-ethnic friends and amount of leisure time spent with same-ethnic people.

Results: PED was positively associated with depressive symptoms in all groups. The association was weaker among (a) those with strong ethnic identity in African Surinamese and Ghanaians, (b) those practicing religion among African Surinamese and Moroccans, (c) those with many same-ethnic friends in South-Asian Surinamese, Ghanaians, and Turks, and (d) those who spend leisure time with same-ethnic people among African Surinamese and Turks.

Conclusion: Ethnic identity, religion, and ethnic social network weakened the association between PED and depressive symptoms, but the effects differed by ethnic minority group. These findings suggest that ethnic minority groups employ different resources to cope with PED.

Background

Discrimination is a social phenomenon that manifests itself in different forms in our contemporary society[1-3]. One form is perceived ethnic discrimination (PED), which represents the day-to-day experiences of overt and subtle acts of unfair treatment because of ethnic background[3,4]. A survey indicated that ethnic discrimination tends to be widespread across Europe, with around 30% of the ethnic minorities reported being discriminated against on grounds of ethnic background[5]. A Dutch report suggested a higher figure, around 40-50%, and indicated that ethnic minorities mostly experience discrimination in the public space and in the labour market[6]. A 1991 qualitative study suggested that most African Surinamese women in Amsterdam experienced discrimination in the media, public space, and at work and school[7]. They were confronted with group-based stereotypes (e.g. lack of discipline, language deficit, low education, single mother). This was largely confirmed in a more recent qualitative study among 2nd-generation Surinamese and Moroccan adults (unpublished, conference presentation[8]).

PED is considered a chronic stressor, with growing evidence indicating that PED is positively associated with adverse physical and mental health outcomes among ethnic minority groups[4,9-11]. Evidence seems to be most consistent with depressive symptoms, suggesting that higher PED is associated with more depressive symptoms across ethnic minority groups[10,11]. Although it is pivotal to tackle discrimination itself, assessing which psychosocial factors weaken the association between discrimination and depressive symptoms enhances our understanding on how ethnic minority groups cope with PED[12,13]. This might help understand why some people are more resilient to PED than others.

Previous research on psychosocial factors as potential buffers against PED has yielded mixed results. For example, a meta-analysis found that social support and group identification did not modify the association between discrimination and mental health outcomes[11]. A 2009 review reported mixed findings for racial identity as a buffer for the association between discrimination and health – in some studies racial identity actually tended to exacerbate the association[12]. This review also found that social support generally did not act as a buffer[12]. However, most studies had a relatively small sample consisting of young adults (mainly students), drawn with convenience sampling. Further, the majority of the studies were conducted in the United States (US) – mainly with African-Americans. European research on this topic is urgently needed. The relatively recent influx of migrants from across the world has dramatically changed §the European demographics. Further, given the important socio-historical differences (e.g. migration history, countries of origin), findings from the US may not readily be applied to European-based ethnic minority group, who might experience and cope with discrimination differently than those living in the US[7].

In the present study, we focus on three potential psychosocial factors that are particularly relevant to the lives of these ethnic minority groups: ethnic identity, religion, and ethnic social network. Ethnic identity is defined as "the subjective sense of ethnic group membership that involves self-labelling, sense of belonging, preference for the group, positive evaluation of the ethnic group, ethnic knowledge, and involvement in ethnic group activities"[14, pp. 225,15]. We hypothesise that strong ethnic identity weakens the association between PED and

depressive symptoms. This might occur through taking pride in being a member of an ethnic group, which might buffer against the effects of PED[16,17]. Strong ethnic identity may also create awareness of the socio-cultural history of the ethnic group, enabling individuals to adequately distinguish whether discrimination is directed at them personally, or at their ethnic group as whole[13]. Evidence suggests that attributing discrimination to the ethnic group instead of personal characteristics yields psychological benefits, as it prevents self-blame, personal devaluation and low self-esteem[2,12].

Religion might weaken the association between PED and depressive symptoms. This may occur through its spiritual and social support component[18,19]. Spirituality may enable an individual to acquire and employ different religious-specific coping styles (e.g. praying, seeking support from religious peers, accepting one's fate), which may help to deal with stressors[20]. Research has shown that spirituality might have a beneficial impact on mental health, as it enables an individual to control feelings of anger and resentment[21]. In addition, religious institutions may provide professional social support and guidance in social and judicial affairs such as discrimination19. A study among African Americans showed that church-based social support buffered the association between racism and anxiety symptoms[22]. So far, very few studies have examined the buffering effects of religion on the association between PED and health. A 2008 Dutch report indicated ethnic minority groups were more religious and visited more often religious gatherings than ethnic Dutch; the highest rates were observed among Turks and Moroccans[23].

Ethnic social network reflects the presence of same-ethnic people within one's social network. It is important to note that despite the close relationship between social support and social network, these constructs are different in that the former entails the quality of the social support one receives whereas the latter represent the extent and size of one's network (i.e. quantity)[24]. We hypothesize that a large ethnic social network would weaken the association between PED and depressive symptoms. Ethnic social network promotes connectedness among same-ethnic people. This may not only help establish supportive and sustainable relationships but also provides an opportunity to share personal experiences with those who might have experienced discrimination themselves[12]. A recent study found that family support moderated the association between discrimination and depression among Asian Americans[25]. An ethnic social network may also enable individuals to be involved in ethnic social activities, distracting from negative feelings, and providing positive interactions and experiences with same-ethnic people instead[26].

To test our hypotheses, we used a large population-based sample of adults from the five largest ethnic minority groups living in a medium-sized European city. For each ethnic minority group, we assessed whether ethnic identity, religion, and ethnic social network weakened the association between PED and depressive symptoms. The ethnic minority groups included in our study differ from each other in various ways (see Box on pp. 83 for more information), so we expect the buffering effects to differ by ethnic minority group. By investigating the potential buffering effects of these psychosocial factors in different ethnic minority groups in a European context, we could gain a broader understanding of the coping resources employed by ethnic minority groups against PED.

Methods

Study population

We used baseline data from the Healthy Life in an Urban Setting (HELIUS) study, a multi-ethnic cohort study in Amsterdam, the Netherlands. The full study protocol is described elsewhere[27]. Briefly, participants aged 18-70 years were randomly sampled stratified by ethnic origin through the municipality register of Amsterdam. This register includes data on the country of birth of residents and their parents, which were used to determine ethnicity (see below). We were able to contact about 65% of those invited (Surinamese 73%, Ghanaians 69%, Turks 60%, Moroccans 66%), either by response card or after home visit by an ethnically-matched interviewer. Of those contacted, about 42% agreed to participate (Surinamese 43%, Ghanaians 50%, Turks 34%, Moroccans 32%). After positive response, participants received a digital or paper version of the questionnaire (depending on the preference). Participants who were unable to complete the questionnaire themselves were offered assistance from a trained ethnically-matched interviewer. Data collection was still on going at the time of data analysis for this study. Written informed consent was obtained from all participants prior to the study inclusion.

Baseline data were collected from January 2011 until June 2014. From the total sample (n=14628), we excluded ethnic Dutch (n=2192). From the remaining ethnic minority groups, we excluded Surinamese with Indonesian origin (n=148) and with unknown origin (n=151), and those with unknown ethnic background (n=29), as these groups were relatively small. Subsequently, participants were excluded with missing data on PED, depression and/or education (n=328). This finally resulted in 11780 participants: 2501 South-Asian Surinamese, 2292 African Surinamese, 1877 Ghanaians, 2626 Turks, and 2484 Moroccans.

Variables

Ethnicity

Participant's ethnicity was defined according to the country of birth of the participants as well as that his parents28. Specifically, a participant was considered of non-Dutch ethnicity if either of the following criteria was fulfilled: 1) born outside the Netherlands and at least one parent born outside the Netherlands (i.e. first generation); or 2) born in the Netherlands but both parents born outside the Netherlands (i.e. second generation). In addition, self-reported ethnicity was used to determine Surinamese subgroups (either African or South-Asian origin).

Perceived ethnic discrimination

PED was conceptualized as the day-to-day experiences of unfair treatment (both overt and subtle) because of ethnic background[1]. To measure PED we used the Everyday Discrimination Scale (EDS), a widely used scale in US studies[29,30]. The EDS is developed based on a qualitative study among African American women but also in African Surinamese women in the Netherlands[7], suggesting that the EDS can be used among ethnic minority groups in

European settings as well. The EDS captures the frequency of experiences of discrimination in everyday life, using nine items (e.g. “being treated with less respect than others”). We adapted the EDS such that the participants were specifically asked about discriminatory experiences because of their ethnic background. The response scale for each item varied from 1 (never) to 5 (very often), consistent with the study by Forman et al[29]. The mean discrimination score of the nine items was calculated (1=lowest, 5=highest) and used in the analyses. The Cronbach’s alpha was 0.91 for South-Asian Surinamese, 0.90 for African Surinamese, 0.91 for Ghanaians, 0.90 for Turks, and 0.92 for Moroccans.

Depressive symptoms

Depressive symptoms were assessed using the Patient Health Questionnaire-9 (PHQ-9)[31]. The PHQ-9 assesses the presence of depressive symptoms over the preceding two weeks. Baas et al. demonstrated the validity of PHQ-9 among Surinamese in the Netherlands[32]. The PHQ-9 consists of nine items, with a response scale varying from 0 (never) to 3 (nearly every day). Hence the total sum score for depression symptoms varied between 0 (lowest) to 27 (highest). The Cronbach’s alpha was 0.92 for South-Asian Surinamese, 0.86 for African Surinamese, 0.87 for Ghanaians, 0.90 for Turks and 0.88 for Moroccans.

Educational level

Educational level was defined as the highest level of education completed with a diploma or certificate of proficiency, either in the Netherlands or in the country of origin. Based on the highest level of education completed, participants were divided into four categories: no education or elementary education; lower vocational and general secondary education; intermediate vocational and higher secondary education; and higher vocational education and university.

Ethnic identity

Ethnic identity was conceptualized as the sense of belonging to one’s own ethnic group that shares cultural values and beliefs33,34. It reflects a sense of membership and the positive feelings toward one’s ethnic heritage and/or identity12,34. It was measured using the 10-items of Psychological Acculturation Scale (PAS; e.g. “I have a lot in common with Surinamese/Ghanaian/Turkish/Moroccan people”, “I feel proud to be part of Surinamese/Ghanaian/Turkish/Moroccan culture”)35. We did not use the single self-identification item (e.g. “I feel Surinamese”), since it may fail to fully capture the multifaceted nature of ethnic identity, as conceptualized above34. A multidimensional scale as the PAS might work better as a measure for ethnic identity. For example, individuals might not necessarily identify themselves as Surinamese or Ghanaian but psychologically they could be strongly connected to and find comfort within their own group. Furthermore, ethnic minority members may provide social desirable answers to the self-identification item. We may reduce this potential bias by using a multi-item scale to assess ethnic identity. The response scale of PAS ranged from 1 (totally disagree) to 5 (totally agree), leading to a sum score varying between 10 (weakest ethnic identity) and 50 (strongest ethnic identity). For assessing effect modification, we decided to dichotomize ethnic identity after considering the sum score

distribution within each ethnic minority group: <40 (weak ethnic identity) and >=40 (strong ethnic identity). The Cronbach's alpha was 0.93 for South-Asian Surinamese, 0.92 for African Surinamese, 0.94 for Ghanaians, 0.93 for Turks, and 0.92 for Moroccans.

Religion

Religion was conceptualized as currently practicing religion. It was measured using a single item, "Do you practice a specific religion right now?", with yes/no response.

Ethnic social network

Ethnic social network was conceptualized as the presence of same-ethnic people within one's social network[12]. We assessed ethnic social network using two proxy items on a 5-point Likert scale: 1) "I have Surinamese/Ghanaian/Turkish/Moroccans friends" (1=none, 5=very many), and 2) "I spend my free time with Surinamese/Ghanaian/Turkish/Moroccan people" (1=never, 5=always). We initially developed a composite variable, but since the Cronbach's alpha was low in the ethnic minority groups (varying between 0.52-0.71), we decided to analyse these two variables separately. One variable concerned the number of same-ethnic friends and the other was related to leisure time spent with same-ethnic people. To test effect modification, we dichotomized both variables. Based on the score distributions, both items were dichotomized at the score of 4, with score of 4 or higher indicating high number of same-ethnic friends and often (or always) spending leisure time with same-ethnic people.

Statistical analysis

To handle missing data for PED, depression and ethnic identity, we employed the following strategy: if one of the items was missing, the mean score of the other eight items was used to replace the missing item. If more than one item was missing, the variable was considered missing. Data for ethnic identity, religion, and two ethnic social network measures were missing in less than 1% of all participants, with little between-group variation (see also Table 1). These participants were excluded from the analyses that included these variables.

Linear regressions were used to examine the association between PED and depressive symptoms. The normal probability plot (P-P plot) of residuals of depressive symptoms showed that this variable was about normally distributed. The regressions were estimated for the total sample and for each ethnic minority group separately. We performed the analyses with the total sample to increase the statistical power and to possibly identify any interaction effects which may be too small to be demonstrated in the group-specific analysis. The models were adjusted for ethnicity (only in the total sample), sex, age, migration generation, and education. In a previous study using similar data we found that these potential confounders attenuated the association between PED and depressive symptoms[36]. To assess whether this association differed by ethnicity, we used the interaction term (PED*Ethnicity). To assess whether ethnic identity, religion, and ethnic social network measures modified the association, we created interaction terms of the psychosocial factor and PED (e.g. religion*PED). SPSS version 21.0 was used for analysis.

Results

Characteristics of the study population are presented in Table 1. The majority of the ethnic minority groups was first-generation. Average age for both Surinamese subgroups was 45 years, and for Turks and Moroccans around 40 years. Ghanaians and Turks more often had a lower education while the Surinamese subgroups had medium education. Mean PED scores were largely similar across the ethnic minority groups, with a mean score around 2. Depressive symptoms were more common in South-Asian Surinamese, Turks, and Moroccans and less so in African Surinamese and Ghanaians.

Most Turks and Ghanaians had a strong ethnic identity (around 75%), and for South-Asian Surinamese this was around 50%. The majority of the participants practiced religion, particularly Turks and Moroccans (around 95%). Above 60% of Turks and Ghanaians had many same-ethnic friends and often spent leisure time with same-ethnic people.

Table 2 shows the association between PED and depressive symptoms and the buffering effects of the psychosocial factors. In all ethnic minority groups, PED was positively associated with depressive symptoms, after adjusting for sex, age, migration generation, and education. The association differed by ethnicity (p-value for interaction 0.001). For example, the association was stronger in South-Asian Surinamese (regression coefficient 1.88; 95% confidence interval [CI] 1.59-2.17) than in African Surinamese (1.21; 0.98-1.45).

Ethnic identity

Ethnic identity buffered the association between PED and depressive symptoms in the total sample (Table 2). Those with a strong identity had a regression coefficient of 1.51 (95% CI 1.35-1.66) versus 1.86 (1.65-2.07) with weak ethnic identity (p-value for interaction 0.008). This buffering effect was particularly observed in African Surinamese (strong ethnic identity 0.90; 0.61-1.19 versus weak ethnic identity 1.64; 1.26-2.02), and to lesser extent in Ghanaians (1.48; 1.21-1.75 versus 2.00; 1.51-2.48). No buffering effects were observed in the other ethnic minority groups.

Religion

Religion did not weaken the association between PED and depressive symptoms in the total sample, but the pattern differed by ethnic minority group. The association was weaker among those who practice religion in Moroccans (regression coefficient 1.47; 95% CI 1.18-1.76 versus not being religious 4.43; 1.91-6.95) and to lesser extent in African Surinamese (1.11; 0.84-1.37, compared to not being religious 1.61; 1.10-2.12).

Same-ethnic friends

Having many same-ethnic friends weakened the association between PED and depressive symptoms in the total sample (regression coefficient 1.47; 95% CI 1.29-1.65 versus low number of same-ethnic friends 1.84; 1.68-2.01). This effect was most pronounced in South-Asian Surinamese (1.11; 0.57-1.65 versus 2.15; 1.80-2.50). A similar pattern was also

Table 1. Characteristics of the study population

Variable	Total sample	South-Asian Surinamese	African Surinamese	Ghanaians	Turks	Moroccans
	n=11780	n=2501	n=2292	n=1877	n=2626	n=2484
Male, %	41.6 (4897)	45.7 (1143)	37.3 (856)	40.9 (767)	45.7 (1200)	37.5 (931)
Age in years, mean (SD)	43.01 (13.07)	45.27 (13.40)	46.94 (12.83)	44.61 (11.41)	39.80 (12.36)	39.30 (13.10)
First generation migrant, % (n)	77.4 (9116)	77.3 (1933)	83.0 (1903)	94.2 (1768)	70.3 (1846)	67.1 (1666)
Education, % (n)[a]						
1 (lowest)	23.5 (2773)	15.4 (384)	6.8 (156)	29.5 (554)	33.5 (880)	32.2 (799)
2	29.5 (3471)	33.8 (846)	34.4 (789)	38.7 (726)	24.9 (655)	18.3 (455)
3	30.5 (3590)	29.2 (731)	35.9 (822)	25.4 (476)	28.0 (735)	33.3 (826)
4 (highest)	16.5 (1946)	21.6 (540)	22.9 (525)	6.4 (121)	13.6 (356)	16.3 (404)
Perceived ethnic discrimination score, mean (SD), range 1 (lowest) – 5 (highest)	1.92 (0.76)	1.97 (0.75)	2.01 (0.76)	1.87 (0.79)	1.82 (0.73)	1.96 (0.79)
Depressive symptoms score, mean (SD), range 0 (lowest) – 27 (highest)	5.03 (5.50)	5.36 (5.79)	3.90 (4.52)	3.33 (4.33)	6.24 (6.01)	5.75 (5.75)
Ethnic identity[b], % (n)						
Strong ethnic identity (score >=40)	65.9 (7716)	51.8 (1290)	63.0 (1435)	76.8 (1432)	74.7 (1944)	65.5 (1615)
Missing	0.7 (78)	0.4 (10)	0.6 (13)	0.7 (13)	0.8 (22)	0.8 (20)
Religion, % (n)						
Currently practicing	88.2 (10302)	81.1 (2019)	78.1 (1785)	88.2 (1608)	94.0 (2448)	98.6 (2442)
Missing	0.8 (97)	0.4 (10)	0.3 (6)	2.8 (53)	0.8 (21)	0.3 (7)
Number of same-ethnic friends[c], % (n)						
Many (score >=4)	47.3 (5527)	29.3 (728)	44.0 (1000)	64.2 (1196)	62.7 (1623)	39.7 (980)
Missing	0.9 (107)	0.7 (18)	0.8 (18)	0.8 (15)	1.4 (38)	0.7 (18)
Leisure time with same-ethnic people[d], % (n)						
Often/always (score >=4)	57.8 (6756)	51.0 (1268)	63.0 (1435)	59.9 (1113)	61.2 (1582)	54.9 (1358)
Missing	0.8 (97)	0.5 (13)	0.6 (14)	1.0 (19)	1.5 (40)	0.4 (11)

SD=standard deviation. [a] 1 = no education or elementary education; 2 = lower vocational and general secondary education; 3 = intermediate vocational and higher secondary education; 4 = higher vocational education or university. [b] Ethnic identity: sum score ranges from 10 to 50, with a cut-off at 40 (<40 weak ethnic identity, >=40 strong ethnic identity). [c] Same-ethnic friends: score range 1-5, with a cut-off at 4 (<4 low number, >=4 high number). [d] Leisure time spent score range 1-5, with a cut-off at 4 (<4 sometimes, >=4 often/always).

Table 2. The association between perceived ethnic discrimination (PED) and depressive symptoms according to potential effect modifiers. Analyses in the total sample and per ethnic group

	Adjusted regression coefficient (95% CI) for the association PED-depressive symptoms					
Stratified by	**Total sample**	**South-Asian Surinamese**	**African Surinamese**	**Ghanaians**	**Turks**	**Moroccans**
Association[a] without interaction	1.68 (1.55, 1.80)	1.88 (1.59, 2.17)	1.21 (0.98, 1.45)	1.63 (1.40, 1.87)	2.11 (1.80, 2.41)	1.51 (1.23, 1.80)
Ethnic identity						
Weak	1.86 (1.65, 2.07)	2.00 (1.58, 2.43)	1.64 (1.26, 2.02)	2.00 (1.51, 2.48)	2.16 (1.60, 2.71)	1.53 (1.05, 2.00)
Strong	1.51 (1.36, 1.66)	1.76 (1.36, 2.16)	0.90 (0.61, 1.19)	1.48 (1.21, 1.75)	2.00 (1.63, 2.36)	1.37 (1.02, 1.72)
p-value for interaction	0.008*	0.414	0.002*	0.070	0.638	0.599
Religion						
No	1.63 (1.26, 2.00)	1.85 (1.18, 2.52)	1.61 (1.10, 2.12)	1.07 (0.34, 1.79)	1.36 (0.10, 2.63)	4.43 (1.92, 6.95)
Yes	1.68 (1.55, 1.81)	1.89 (1.57, 2.21)	1.11 (0.84, 1.37)	1.69 (1.44, 1.95)	2.14 (1.83, 2.46)	1.47 (1.18, 1.76)
p-value for interaction	0.808	0.926	0.085	0.112	0.241	0.022*
Number of same-ethnic friends						
Low	1.84 (1.68, 2.01)	2.15 (1.80, 2.50)	1.20 (0.88, 1.51)	1.98 (1.59, 2.37)	2.50 (2.01, 2.99)	1.57 (1.20, 1.94)
High	1.47 (1.29, 1.65)	1.11 (0.57, 1.65)	1.21 (0.86, 1.56)	1.38 (1.08, 1.67)	1.87 (1.48, 2.26)	1.44 (1.00, 1.88)
p-value for interaction	0.004*	0.001*	0.958	0.016*	0.046*	0.653
Leisure time with same-ethnic people						
Sometimes	1.91 (1.72, 2.09)	1.96 (1.56, 2.37)	1.76 (1.38, 2.14)	1.56 (1.19, 1.92)	2.46 (1.98, 2.93)	1.75 (1.33, 2.16)
Often/always	1.49 (1.33, 1.66)	1.78 (1.36, 2.20)	0.90 (0.61, 1.19)	1.66 (1.35, 1.98)	1.92 (1.52, 2.32)	1.31 (0.92, 1.69)
p-value for interaction	0.001*	0.535	<0.001*	0.669	0.087	0.128

CI=confidence interval.

[a] This association was adjusted for ethnicity (in the total sample only), sex, age, migration generation, and education. All associations in the interaction analyses were adjusted for these variables as well.

* Denotes statistical significant interaction term at the $p < 0.05$ level with two-tailed test.

observed among Turks and Ghanaians.

Leisure time with same-ethnic people

In the total sample, the association between PED and depressive symptoms was weaker among those who often spend leisure time with same-ethnic people (1.49; 1.33-1.66 versus spend sometimes 1.91; 1.72-2.09). The effect was found particularly among African Surinamese (0.90; 0.61-1.19 versus 1.76; 1.38-2.14) and less so in Turks (1.92; 1.52-2.32 versus 2.46; 1.98-2.93). No buffering effects were observed in the other ethnic minority groups.

Discussion

This study found that perceived ethnic discrimination (PED) was positively associated with depressive symptoms in ethnic minority groups. Ethnic identity, religion, and ethnic social network weakened this association, although the buffering effects differed by ethnic minority group. We observed that the association between PED and depressive symptoms was weaker among (a) those with a strong ethnic identity in African Surinamese and Ghanaians, (b) those who practice religion among African Surinamese and Moroccans, and (c) those with a large ethnic social network in all ethnic minority groups (except Moroccans).

This study had some potential limitations. First, the design of this study was cross-sectional, thus limiting the possibilities for causal inferences. However, we were mainly interested in exploring possible effect modification by the psychosocial factors, and not necessarily in the association between PED and depressive symptoms as such. Second, the sample consisted of populations living in the one European city, therefore the findings may not be generalised to other European cities. Third, the response rates were quite low, so non-response bias might have occurred. Since our study mainly focused on the interaction analyses and not prevalence estimates, the selective response may not necessarily be an important limitation. The selective response might have biased the prevalence estimates, but is seems unlikely that it may have biased the strength and direction of the interaction effects. Finally, the measurement of the psychosocial factors might not be adequate enough to fully capture the buffering effects in relation to PED. For example, for ethnic social network we only assessed the quantitative aspect but not the qualitative. Religion was measured with a single question but could have been supplemented with, say, religious social support and type of religion. A study among Arab Americans showed that the association between ethnic discrimination and psychological distress tended to be stronger among Christians than Muslims[37].

We found evidence suggesting that the buffering effect of ethnic identity was strongest in African Surinamese and to lesser extent Ghanaians. Maybe for these two African-origin groups, particularly for African Surinamese, the health-buffering effect of ethnic identity operates through sense of belonging, which might be related to their socio-cultural history of slavery and racism[38]. And because of this historical awareness, ethnic identity could be an important source of resilience for these particular groups to overcome the effects of PED. For the other ethnic minority groups, different dimensions of ethnic identity may act as buffers in relation to PED (e.g. family history, belonging to the ethnic community).

We further found that religion weakened the association between PED and depressive symptoms in African Surinamese and particularly in Moroccans, but not in other groups. This is only in part consistent with previous studies from the US, which showed that religion had protective effect in African Americans[22] but no effect in Arab Americans[37]. Our divergent pattern across ethnic minority groups could possibly be explained by how religion is experienced, and how it relates to discrimination. Maybe among African Surinamese and Moroccans religion is a positive phenomenon (e.g. source of strength or inspiration, social support), making them resilient in the face of daily stressors[20]. A Dutch report indicated that Moroccans are more actively engaged in religious activities, partly as a response to the currently hostile climate toward their Muslim-Moroccan background[39]. Interestingly, only 2% of Moroccans did not practice religion and they could differ from those who are religious in different ways. For example, they could experience more overall discrimination, both by other-group members (because of their ethnic background) and by same-group members (social exclusion due to religious abandonment).

The measures of ethnic social network tend to have buffering effects in most ethnic minority groups. Among most ethnic minority groups, same-ethnic friends had protective effect, suggesting that same-ethnic friends might serve for them as an outlet to share their discriminatory experiences in order to reduce the psychological burden. In African Surinamese, however, spending leisure time with same-ethnic people was protective. It could be that for African Surinamese experiencing discrimination, given its historical connotation, is being seen as personal failure or shameful[7], so people might be cautious in discussing such experiences with their friends but rather engage in ethnic social activities (including those organized by the church).

It could be argued that the buffering effects of ethnic social network, as found in this study, owes to the social network in general, regardless of the ethnic nature. However, in additional analyses (data not shown), we did not find any evidence that having ethnic Dutch friends and spending leisure time with ethnic Dutch people weakened the association between PED and depressive symptoms across the ethnic minority groups.

In conclusion, ethnic identity, religion, and ethnic social network weakened the association between PED and depressive symptoms, but the buffering effects differed by ethnic minority group. The particular psychological and sociological meanings different ethnic minority groups attach to these certain psychosocial factors might help understand these disparate buffering effects. Further research should investigate the effects of ethnic identity, religion, and ethnic social network in relation to PED in more depth, both quantitatively and qualitatively. Quantitative studies could explore the different dimensions of, say, religion such as the frequency of attending religious services, social support from religious institutions. Qualitative research could unravel how ethnic minority groups use and which meaning they attach to various psychosocial factors in relation to PED. This may help to grasp the underlying sources of resilience that are employed by ethnic minority groups to overcome experiences of ethnic discrimination.

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CHAPTER 10

Ethnic composition of the residential environment and the health of Turks and Moroccans in Amsterdam

Submitted

Eleonore Veldhuizen, Umar Z. Ikram, Sjoerd de Vos, Anton E. Kunst. The relationship between ethnic composition of the residential environment and self-reported health among Turks and Moroccans in Amsterdam

Abstract

Few studies investigated whether the health of ethnic minority groups is related to the co-residence of other minority groups. We examined whether the general and mental health among Moroccans in Amsterdam was related to the density of Turks in their residential environment, and vice versa. In Amsterdam at large, Moroccans' health was positively associated with the co-residence of Turks, but not the other way around. Associations were clearer for co-residence within the immediate living environment (<500 meter), and within one specific district in Amsterdam West. Advanced spatial methods are needed to map and understand how co-residence of ethnic minority groups affects their health.

Introduction

European societies have become increasingly ethnically diverse over the last decades, and this demographic shift is likely to continue given the relatively high influx of immigrants. (Lee & Guadagno, 2015; StatLine, 2015). Evidence indicates that ethnic minority groups overall tend to have worse self-rated health than the ethnic majority group in European countries (Nielsen & Krasnik, 2010). This has been attributed to low individual socioeconomic status (SES) and psychosocial factors (e.g. discrimination, acculturation, social network) (Finch & Vega, 2003; Harris et al., 2006; Lindström et al., 2001; Reijneveld, 1998), amongst other factors.

Contextual factors such as characteristics of the residential environment may also shape the health of ethnic minority groups. One such characteristic is ethnic composition, which is conceptualized as ethnic diversity or as own-group density (i.e. the presence of the same-ethnic group in the residential environment) (Mair et al., 2008). The association between ethnic composition of the residential environment and health presumably operates through social capital and exposure to discrimination (Pickett & Wilkinson, 2008). However, evidence from the United States (US) and Europe is equivocal, in that the strength and direction (both negative and positive) of the association vary by ethnic minority group, spatial scale, and outcome measure (Bécares et al., 2012; Mair et al., 2008; Pickett & Wilkinson, 2008; Shaw et al., 2012; Schrier et al., 2014).

Furthermore, the existing literature on this topic has three potential limitations. First, most epidemiological studies have focused on own-group density or ethnic diversity, while relatively few studies have assessed other-group density (i.e. co-presence of a specific other ethnic group). This might be particularly relevant for some cities in which two or more (large-sized) ethnic minority groups reside. Other-group density might affect health through material and psychosocial processes. The association could be either positive or negative, largely depending on the inter-relationship the groups have (e.g. mutual trust, discrimination, sharing job information) (Veldhuizen et al., 2015; Damm, 2009; Damm, 2014).

Second, previous studies have used large spatial scales (e.g., census tracts, electoral wards), making it potentially difficult to assess the associations with health outcomes accurately (Diez Roux & Mair, 2010). Most inter-ethnic interaction and the underlying material and psychosocial processes are likely to occur at smaller spatial scales in the direct environment. Hence using smaller spatial scales could possibly better capture the associations between ethnic composition of residential environment and health (Diez Roux & Mair, 2010).

Third, most studies have presented the aggregated effects of ethnic composition on health at city-level (Bécares et al., 2012; Mair et al., 2008; Pickett & Wilkinson, 2008; Shaw et al., 2012). This may possibly obscure the spatial variation within a city. Different parts of a city may differ in the opportunities they provide for social interaction between groups. These opportunities might be different due to differences in physical environments (e.g., built environment) and social environments (e.g., social cohesion, local institutions) (Diez Roux & Mair, 2010). So far, it is unknown whether the association between ethnic composition of

residential environment and health differs within a city.

In the present study, we aimed to fill these gaps in the literature. First, we aimed to investigate the association between other-group density of the residential environment and self-reported health outcomes in two ethnic minority groups. We further considered other measures of ethnic composition of residential environment: ethnic heterogeneity and own-group density. Second, we assessed the associations at different spatial scales (both small and large). Third, we explored spatial variation, by assessing whether the associations differed by city district.

We focused on Turkish and Moroccan adults residing in Amsterdam, the Netherlands. These two groups are considered the largest ethnic minority groups in Europe, and tend to co-exist in many different cities (e.g. Paris, Berlin). Our study extended previous studies on this topic conducted in Amsterdam. A 2014 study found own-group density was not associated with psychological distress in Turks and Moroccan adults living in the four largest Dutch cities (including Amsterdam) (Schrier et al., 2014). A more recent study from Amsterdam suggested that a high density of Moroccan residents was associated with poor self-rated health among Turkish residents, but not vice versa (Veldhuizen et al., 2015). In the present study, we delve into these findings by using a much larger dataset, more health outcomes and different spatial scales, as well as by assessing variation by city district.

Methods

Study population

The data were obtained from the HELIUS (Healthy Life in an Urban Setting) study. The aims and design of the HELIUS study have been described elsewhere (Stronks et al., 2013). Briefly, HELIUS is a large-scale cohort study on health and healthcare among different ethnic groups living in Amsterdam. It included individuals aged 18–70 years from the six largest ethnic groups living in Amsterdam, i.e. those of Dutch, South-Asian Surinamese, African Surinamese, Ghanaian, Moroccan and Turkish origin. Participants were randomly sampled from the municipal registers, stratified by ethnicity. Data were collected by questionnaire and a physical examination. At the end of 2014, response rates were estimated between 20-40% with some variations across ethnic groups. The study protocols were approved by the AMC Ethical Review Board and all participants provided written informed consent prior to study inclusion.

For the current study, baseline data collected from January 2011 until December 2014 were used, including 2962 Turkish and 3000 Moroccan participants. Individuals with missing data on self-reported health, individual characteristics, area ethnic composition or area socioeconomic position, and individuals living at locations with less than 25 inhabitants within a buffer of 50 metres were excluded from the analysis (n=600). Our final sample comprised 5362 participants: 2701 Turks and 2661 Moroccans.

Individual level measurements

Participant's ethnicity was defined according to the country of birth of the participant as well as that of his/her parents. Specifically, a participant is considered of Turkish/Moroccan origin if: 1) he or she was born in Turkey/Morocco and has at least one parent born in Turkey/Morocco; or 2) he or she was born in the Netherlands but both his/her parents born in Turkey/Morocco (Stronks et al., 2009).

Three measures of self-reported health are used: self-rated health and generic physical and mental health (PCS and MCS). Self-rated health was measured by the response to the question, 'In general, would you say your health is excellent, very good, good, fair or poor?' The answers were classified into two categories: excellent/very good/good and fair/poor. In the remainder of the paper we refer to the first category as better self-rated health. Generic mental and physical health were assessed using the component summary measures of physical (PCS) and mental health (MCS) from the Medical Outcomes Study Short Form 12 (SF-12) (Ware et al., 1996). Scores range from 0 to 100 with higher scores reflecting better health.

From the same survey, we obtained data on characteristics of the participants that were used as control variables at the individual level. These include age, sex, marital status, household composition, educational level, and a measure of general wealth (whether the participant experienced difficulties living on his or her current household income). See table 1 for a description of these variables.

Area-level measurements

For area-level measurements we used integral demographic and socio-economic registries at the level of full 6-digit postcodes maintained by the Department of Research and Statistics of the Municipality of Amsterdam. Data on the spatial level of 6-digit postcode area is the most detailed data available. On average, these units are sized 50 x 50 metres and include 10 to 20 households.

To describe the ethnic composition for each participant, we constructed three variables: own-group density (i.e., percentage of co-ethnics), other-group density (i.e., percentage of the other ethnic group – Turks or Moroccans) and ethnic heterogeneity described by the Herfindahl-index. This index yields the probability of two randomly selected individuals from the same neighbourhood being of different ethnic origin. The theoretical range of the index runs from 0 to 1,with 0 representing an area in which every individual is from the same ethnic group and 1 representing an area in which every individual is from a different ethnic group. To calculate this index, we sum the squared proportion of each ethnic group (Surinamese, Antilleans, Ghanaians, Turks, Moroccan, other non-western migrants, other western migrants and Dutch) and subtract this total from one.

When studying the association between ethnic composition and health, it is not enough to control for individual characteristics only. Veldhuizen et al. (2015) showed that it is necessary to control for the socio-economic environment as well, because this variable can act as a confounder. To describe the socio-economic environment we constructed two socio-economic variables: the percentage of residents living on a minimum income and the

average property value of houses.

Within a Geographical Information System (ArcGIS) we created buffers of varying sizes, with radiuses ranging from 50 to 1000 metres, around the central point location of each participant's 6-digit postcode area. The ethnic composition and socioeconomic characteristics of each of these buffers were estimated by aggregating the postcode data to the buffers. For a more detailed description of the procedure see Veldhuizen et al. (2013).

Statistical analysis

The associations between ethnic composition of the residential environment and self-rated health were assessed using multilevel logistic regression analysis, with better self-rated health as the dependent variable and 6-digit postcode as the variable indicating the higher level (participants living in the same postcode area have identical buffers). We adjusted for the individual characteristics age, sex, marital status, household composition, education and wealth and for socio-economic environment measured by the percentage of households living on minimum income and average property value.
To enable comparison of the results of these analyses between different predictors and the different buffer sizes, we present standardised odds ratios of the three measures of ethnic composition. These odds ratios can be interpreted as the change in the odds of better self-rated health if a predictor variable increases with one standard deviation. The odds ratios take into account the differences in standard deviation according to predictor and buffer size (table 2).

The associations between neighbourhood ethnic composition and PCS and MCS were assessed using multilevel linear regression analysis, adjusting for the same individual and environmental variables as mentioned above. We present standardised regression coefficients. These coefficients can be interpreted as the change in the standardised dependent variable in case the predictor variable increases with one standard deviation.

Geographical analysis

Additionally, we used logistic Geographically Weighted Regression (GWR) within the software GWR4 to explore whether the most important association we found from the multilevel regression analyses spatially differed within Amsterdam. GWR is a local form of (in this case logistic) regression to model spatially varying relationships. It constructs a separate equation for every participant incorporating the dependent and explanatory variables of all participants living within a distance of 500 metres around the target participant. We considered 500 metres as a reasonable compromise between two conflicting demands: (1) to include sufficient participants in the analyses, and (2) to allow for sufficient spatial variation. We mapped the resulting odds ratios to visually explore spatial patterns.
Based on the results of the GWR analyses, we performed additional regression analyses stratified by district in order to quantify the results. We included only districts with a substantial number of Turkish and Moroccan participants (which are 'Nieuw-West', 'West' and 'Oost').

Results

Table 1 describes the characteristics of the study population in both ethnic groups. In general, no substantial differences in poor self-rated health, PCS and MCS were observed between Turkish and Moroccan participants. The two groups also had similar scores on most other characteristics although more Turkish participants were lower educated and had a little more difficulties in making ends meet.

Table 1. Characteristics of participants and their socio-economic environment, per ethnic group

Variable	Moroccan	Turkish
N	2661	2701
Self-rated health (%)		
excellent	4.7	4.0
very good	9.7	10.8
good	48.1	49.6
fair	30.5	26.4
poor	7.1	9.3
Physical Component Score		
mean	46.0	45.3
standarddev	10.2	10.7
Mental Component Score		
mean	46.1	44.8
standarddev	10.9	11.3
Age (%)		
18-29	28.3	25.0
30-39	22.3	21.1
40-49	22.4	29.5
50-64	24.4	22.7
>=65	2.6	1.7
Sex (%)		
Male	36.6	46.3
Marital status (%)		
married couple	57.6	62.6
unmarried couple	2.3	3.4
never been married	28.4	21.5
divorced	10.1	10.2
widow/widower	1.7	2.3
Household composition (%)		
single	7.2	9.2

couple without children	7.3	10.3
family	49.2	52.1
other (living with parents, parents in law, institution)	36.3	28.4
Education (%)		
no/elementary	33.1	33.3
lower secondary	18.0	25.5
intermediate/higher secondary	33.1	27.5
higher	15.9	13.6
Living on household income (%)		
no problems at all	22.3	16.8
no problems, but I have to watch what I spend	35.6	25.4
some problems	26.3	31.3
lots of problems	15.7	26.5
Property value of houses at postcode of residence		
mean	198216	193880
standard dev	55915	53692
% Households living on a minimum income at postcode of residence		
mean	28.4	25.9
standard dev	14.4	15.5

Table 2 shows the average levels and standard deviations of own-group density, other-group density and ethnic heterogeneity by spatial scale for the two ethnic groups. Compared to Turkish participants, the residential environment of Moroccan participants was characterized by a higher share of co-ethnics. Levels and standard deviations of own-group density decreased with increasing buffer size, especially among Moroccans. Turkish participants had a higher percentage of Moroccans in their residential environment than vice versa. The difference between Turkish and Moroccan participants on the measures was approximately 10 percent points at all buffer distances. Levels and standard deviations of other-group density decrease with increasing buffer size, especially among Turkish participants. The level of ethnic heterogeneity of the residential environment of Moroccan and Turkish participants is comparable. Ethnic heterogeneity increases for buffers up to 500 metres.

Table 2. Characteristics of the participant's neighbourhood ethnic composition per ethnic group and spatial scale

Ethnic group	Moroccan		Turkish	
	mean	std dev	mean	std dev
Own ethnic density (%)				
Buffer50	26.6	16.5	17.2	10.5
100	23.5	14.9	15.0	8.6
150	22.2	14.1	14.3	7.9
300	19.7	11.7	12.9	6.8
500	18.3	10.3	12.2	6.3
750	17.2	9.0	11.7	6.0
1000	16.3	8.3	11.3	5.9
Other ethnic density (%)				
(Turks resp. Moroccans)				
50	12.6	9.9	22.9	15.3
100	12.3	8.6	22.6	13.4
150	12.0	8.1	22.2	12.6
300	11.1	7.1	20.7	10.5
500	10.5	6.5	19.7	9.0
750	10.0	6.1	18.7	8.0
1000	9.6	5.9	18.0	7.5
Ethnic heterogeneity				
(range 0-1)				
50	0.711	0.085	0.722	0.083
100	0.721	0.079	0.735	0.072
150	0.723	0.079	0.738	0.070
300	0.728	0.078	0.744	0.066
500	0.729	0.077	0.747	0.064
750	0.728	0.075	0.745	0.063
1000	0.725	0.073	0.742	0.062

Table 3 shows the association of own-group density, other-group density and ethnic heterogeneity with self-rated health per ethnic group. Overall, own-group density and ethnic heterogeneity were not significantly related to self-rated health in both groups. For other-group density, a higher percentage of Turks in the neighbourhood was associated with higher odds of reporting better self-rated health among Moroccans. These results were consistent with more significant relations found for smaller buffers. Self-rated health of Turks was not significantly associated with higher density of Moroccans in the neighborhood.

Table 3. Association of density of Moroccans, density of Turks and ethnic heterogeneity with better self-rated health, per ethnic group and spatial scale

Ethnic group	Moroccan	Turkish
	Standardised OR[$] (CI[#])	Standardised OR[$] (CI[#])
Density of Moroccans (%)		
Buffer50	1.01 (0.90;1.14)	1.06 (0.94;1.19)
100	1.09 (0.96;1.25)	1.09 (0.96;1.23)
150	1.11 (0.97;1.27)	1.06 (0.92;1.21)
300	1.10 (0.96;1.26)	1.05 (0.92;1.20)
500	1.10 (0.97;1.25)	1.05 (0.93;1.19)
750	1.12 (0.99;1.27)	1.09 (0.96;1.23)
1000	1.16 (1.03;1.32)*	1.09 (0.96;1.23)
Density of Turks (%)		
50	1.20 (1.08;1.34)**	1.10 (1.00;1.22)
100	1.17 (1.05;1.31)**	1.06 (0.95;1.18)
150	1.18 (1.05;1.33)**	1.07 (0.96;1.19)
300	1.16 (1.03;1.31)*	1.05 (0.95;1.18)
500	1.15 (1.02;1.29)*	1.09 (0.98;1.21)
750	1.14 (1.02;1.29)*	1.09 (0.97;1.22)
1000	1.17 (1.03;1.32)*	1.07 (0.95;1.21)
Ethnic heterogeneity		
50	0.98 (0.89;1,08)	0.98 (0.89;1.08)
100	1.03 (0.93;1.15)	0.97 (0.88;1.07)
150	1.03 (0.92;1.15)	0.98 (0.89;1.09)
300	1.10 (0.97;1.24)	0.97 (0.86;1.08)
500	1.16 (1.01;1.32)*	1.03 (0.92;1.16)
750	1.11 (0.97;1.27)	1.06 (0.94;1.20)
1000	1.14 (1.00;1.31)	1.09 (0.96;1.24)

[$] OR represents the standardised Odds Ratio (i.e. change in odds of having better self-rated health with one standard deviation increase in the predictor variable)
[#] CI represents 95% confidence interval
* significant at the 0.05 level
** significant at the 0.01 level

Table 4 shows the associations of own-group density, other-group density and ethnic heterogeneity with PCS and MCS per ethnic group. Among Moroccans a higher density of Turks within 50 and 100 metre buffers was significantly associated with a healthier PCS. Among Turks, higher ethnic heterogeneity was significantly associated with worse PCS at buffer sizes up to 300 metres and with worse MCS from 150 to 500 metre buffers.

Table 4. Association of density of Moroccans, density of Turks and ethnic heterogeneity with Physical and Mental Component Score per ethnic group and spatial scale

Ethnic group	Moroccan		Turkish	
	Standardised b[$] (CI[#])		Standardised b[$] (CI[#])	
	PCS	MCS	PCS	MCS
Density of Moroccans (%)				
Buffer50	0.01 (-0.04;0.05)	0.02 (-0.03;0.07)	0.01 (-0.04;0.05)	-0.01 (-0.06;0.04)
100	0.02 (-0.03;0.07)	-0.00 (-0.05;0.05)	0.01 (-0.04;0.06)	-0.02 (-0.07;0.04)
150	0.01 (-0.04;0.06)	-0.00 (-0.06;0.05)	0.01 (-0.04;0.06)	-0.04 (-0.10;0.02)
300	0.01 (-0.04;0.06)	0.01 (-0.05;0.06)	-0.01 (-0.06;0.04)	-0.01 (-0.07;0.04)
500	0.00 (-0.05;0.05)	0.01 (-0.05;0.06)	-0.00 (-0.05;0.05)	-0.03 (-0.08;0.03)
750	0.01 (-0.04;0.06)	-0.00 (-0.05;0.05)	0.01 (-0.03;0.06)	-0.02 (-0.07;0.03)
1000	0.01 (-0.03;0.06)	-0.00 (-0.05;0.05)	0.02 (-0.02;0.07)	-0.01 (-0.07;0.04)
Density of Turks (%)				
50	0.04 (0.00;0.08)*	0.01 (-0.03;0.05)	0.01 (-0.03;0.05)	-0.01 (-0.05;0.03)
100	0.04 (0.00;0.09)*	0.01 (-0.04;0.05)	0.01 (-0.03;0.05)	-0.01 (-0.06;0.03)
150	0.04 (-0.00;0.09)	0.00 (-0.04;0.05)	0.01 (-0.03;0.05)	-0.02 (-0.06;0.03)
300	0.03 (-0.01;0.07)	0.01 (-0.04;0.05)	0.01 (-0.03;0.05)	-0.02 (-0.07;0.02)
500	0.01 (-0.03;0.05)	0.00 (-0.04;0.05)	0.02 (-0.02;0.06)	-0.01 (-0.06;0.03)
750	0.01 (-0.03;0.06)	-0.01 (-0.06;0.04)	0.02 (-0.02;0.06)	-0.01 (-0.06;0.04)
1000	0.01 (-0.03;0.06)	-0.01 (-0.06;0.04)	0.03 (-0.01;0.08)	-0.02 (-0.07;0.03)
Ethnic heterogeneity				
50	-0.02 (-0.05;0.02)	-0.02 (-0.06;0.02)	-0.06 (-0.09;-0.02)**	-0.01 (-0.05;0.03)
100	0.00 (-0.04;0.04)	-0.01 (-0.05;0.03)	-0.05 (-0.09;-0.02)**	-0.02 (-0.06;0.02)
150	0.00 (-0.04;0.04)	-0.02 (-0.07;0.02)	-0.04 (-0.08;-0.00)*	-0.05 (-0.09;-0.01)*
300	0.04 (-0.00;0.09)	-0.02 (-0.06;0.03)	-0.06 (-0.10;-0.02)**	-0.07 (-0.11;-0.02)**
500	0.05 (-0.00;0.10)	-0.00 (-0.05;0.05)	-0.02 (-0.06;0.03)	-0.06 (-0.10;-0.01)*
750	0.03 (-0.02;0.08)	-0.02 (-0.07;0.04)	-0.02 (-0.07;0.02)	-0.05 (-0.10;0.01)
1000	0.04 (-0.01;0.09)	-0.01 (-0.06;0.04)	-0.00 (-0.05;0.04)	-0.03 (-0.08;0.02)

[$] b represents the standardised regression coefficient (i.e. change in the dependent variable with one standard deviation increase in the predictor variable)
[#] CI represents 95% confidence interval
* significant at the 0.05 level

** significant at the 0.01 level

Based on the results of Table 3, we performed additional GWR-analyses to explore the spatial variation in the association of the density of Turks within 50 metre buffers with self-rated health of Moroccans. The map in Figure 1 shows some degree of spatial variation in this association. In the district Nieuw-West, for example, the association of the density of Turks with self-rated health of Moroccans is more positive in the northern part of the district than in the southern part. In the district West mainly positive associations cluster and in East positive as well as negative associations were observed.

To further examine spatial variations, Table 5 assesses associations per district. Positive significant associations of density of Turks with self-rated health of Moroccans were found in the district Nieuw-West and mainly in the sub-district Geuzenveld. The density of Moroccans was significantly positively associated with self-rated health of Turks in Geuzenveld as well. For both groups, no significant association of own-group density with self-rated health was found in any district.

Figure 1. Association of percentage of Turks in buffers of 50 metre with better self-rated health of Moroccans (odds ratios)

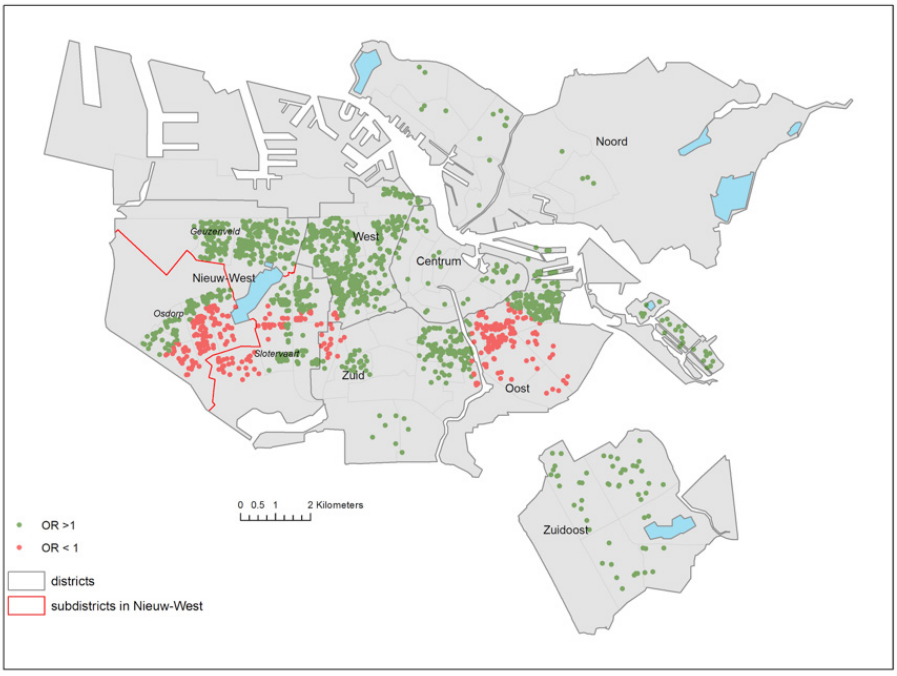

Table 5. Association of other- and own-group density within 50 metres buffer with better self-rated health, per ethnic group and district

Ethnic group			Moroccan		Turkish	
			Standardised OR[$] (CI[#])		Standardised OR[$] (CI[#])	
Density of			Turks (%)	Moroccans (%)	Moroccans (%)	Turks (%)
District	N Mor	N Tur				
Nieuw-West	1238	1365	1.17 (1.00;1.36)*	0.92 (0.76;1.12)	1.03 (0.86;1.24)	1.10 (0.96;1.27)
Geuzenveld	433	626	1.36 (1.03;1.81)*	0.86 (0.62;1.19)	1.32 (1.02;1.70)*	1.06 (0.86;1.29)
Osdorp	388	383	1.11 (0.85;1.45)	0.96 (0.67;1.39)	0.87 (0.59;1.28)	0.99 (0.74;1.32)
Slotervaart	416	356	1.03 (0.76;1.38)	1.00 (0.70;1.44)	0.84 (0.55;1.28)	0.99 (0.73;1.35)
West	636	749	1.18 (0.92;1.51)	0.93 (0.71;1.22)	1.02 (0.80;1.31)	1.08 (0.87;1.34)
Oost	466	423	0.96 (0.75;1.24)	0.78 (0.59;1.04)	0.91 (0.66;1.25)	0.92 (0.70;1.21)

[$] OR represents the standardised odds ratio (i.e. change in odds with one standard deviation increase in the predictor variable)

[#] CI represents 95% confidence interval

* significant at the 0.05 level

Discussion

In this study, we assessed associations between ethnic composition of the residential environment and self-reported health among people of Turkish and Moroccan origin living in Amsterdam. At the city-scale of Amsterdam, own-group density and ethnic heterogeneity were not associated with self-rated health for either Moroccan or Turkish participants. For Turks significant associations between ethnic heterogeneity and PCS and MCS were found, suggesting more negative health outcomes with increasing heterogeneity. With regard to other-group density, for Moroccans, greater density of Turks was significantly associated with higher odds of reporting better self-rated health and higher scores on PCS. Such associations were not found for Turks.

Additional geographical analyses suggest that the relationship between the density of the other group and self-rated health varies within Amsterdam. Associations were particularly observed in the sub-district Geuzenveld within the district Nieuw-West. In this specific area, other-group density is positively associated with self-rated health for both groups.

Evaluation of data and methodology

A major strength of our study is that the HELIUS data provides a large number of participants from different ethnic groups and detailed health measurements and socio-demographic data. We further derived precise data about place of residence using the 6-digit postcode of the home addresses of the participants, and we accessed detailed socio-economic and demographic data from registries at the level of 6-digit postcodes. On average, 6-digit postcode areas in Amsterdam include no more than 10 to 20 households and are sized 50 by 50 metres. The large number of participants and information on their precise place of residence enabled us to use advanced geographic techniques to explore varying associations

within the city. The importance of using environmental variables at small spatial scales derives from the fact that most of the significant associations were found at small spatial scales. It suggests that no associations could have been demonstrated if the environmental characteristics of administrative areas were used because these areas may be too large to detect any health effects.

This study has some limitations as well. First, because buffers partly overlap, observations are not entirely independent. This results in a slight overestimation of significance levels. However, this problem of partial overlap applies particularly to larger buffers and less to smaller buffers, for which we found the most significant associations. Second, because our data are cross-sectional, our interpretations ought to refer to associations rather than to causal relationships. Nevertheless, we might interpret these associations as evidence for environmental influences on health. Reverse causality should refer to selective migration, which in our study would imply that healthy Moroccans would move to places with a lot of Turks or unhealthy Moroccans would leave such areas, which is not very plausible. Third, since we focused on two specific ethnic minority groups living in Amsterdam, our findings could possibly not be generalized to other populations or areas. Nonetheless, numerous large European cities have large migrant populations from Turkey and Morocco, so our findings might have relevance for these cities as well. Finally, PCS and MCS have not been validated among Turkish and Moroccan participants. However, these instruments have been positively validated across other cultures and countries (Jenkinson et al., 2001; Gandek et al., 1998).

Interpretation and comparison with previous studies

For Turks and Moroccans in Amsterdam we did not find associations of own-group density with self-rated health, PCS or MCS. These findings are not in line with 'classic' ethnic density theory which suggests better health if a high proportion of the own ethnic group lives in the neighbourhood. This positive influence on health is presumably due to increased social support and less discrimination if your own group lives around (Smaje, 1995; Halpern, 1993, Hunt et al., 2007, Bécares, 2009). Several studies in the US and UK found effects of own-group density on health, sometimes positive (Veling et al., 2007; Pickett & Wilkinson, 2008; Das-Munshi et al., 2010), but sometimes negative (LeClere et al., 1997; White & Borrell, 2006; Grady, 2006). However, similar to our results, Schrier et al. (2014) found no association between own-group density and psychological distress for Surinamese, Turks, and Moroccans in the four largest Dutch cities (including Amsterdam).

The absence of an ethnic own-group density effect especially among Turks is surprising considering that the Turks are known as a group with a strong orientation towards their co-ethnics. It might be explained by segmentation within the Turkish community. Turks are a heterogeneous group, divided along often crosscutting lines associated with political, ethnic, religious and geographical differences (Inglis et al., 2009). Our measure for own-group density, which is based on the country of birth of the participants or their parents, may fail to comprehensively capture the own-group effects. If the subgroups would have lived entirely segregated, an own-group density effect for the Turkish participants might be expected. However, probably the subgroups live mixed because most of the Turks and

Moroccans depend on social housing which means little room for own choice regarding place to live (Van Praag & Schoorl, 2008). Unfortunately we miss the essential accurate information about the home location of subgroups for further examination.

The negative influence of ethnic heterogeneity on PCS and MCS among Turks accords with conclusions of Putnam's study in the US (2007) which suggested worse health conditions in heterogeneous neighbourhoods because of lower social capital in these neighbourhoods. For the Netherlands, Lancee & Dronkers (2010) also found that more heterogeneous neighbourhoods are characterized by less social capital. However, our study did not find a negative effect of heterogeneity among Moroccans. Recently, it has been suggested that Putnam's theory may not be generalizable to all ethnic groups (Abascal & Baldassarri, 2015), but depend on ethnic group identities and specific inter-group relations. In Amsterdam, for Turks a heterogeneous environment might be experienced as negative, because Turks are known as a group with a strong orientation towards (some of) their co-ethnics. Moroccans are known to have lower levels of co-ethnic cohesion (Slootman & Duyvendak, 2015). Hence it could be suggested that Turks rely more on 'bonding' social capital (relations within the own group), while Moroccans may find it easier to link with other ethnic groups and thus rely on 'bridging' social capital (relations with other groups).

We found a positive influence of density of Turks on self-rated health of Moroccans. A previous study, based on a smaller survey among six ethnic groups in Amsterdam (Veldhuizen et al., 2015), found a negative influence of the density of Moroccans on self-rated health of Turks. Although the findings of the two studies are not identical, both imply that co-residence with Turks has no negative effect on self-rated health of Moroccans, and the Moroccans have no positive effect on Turks. This asymmetric relation might be explained by a lesser positive opinion of Turks towards Moroccans, partly because Moroccans are more stigmatized in Dutch politics and media than Turks (Groenewold, 2008;Slootman & Duyvendak, 2015). In such a context it is less favourable for Turks to be associated with Moroccans living in the same neighbourhood than vice versa. Another reason might be that Turks seems more oriented on the own group unlike Moroccans as already mentioned in the previous paragraph.

The positive influence of other-group density in the direct residential environment on self-rated health of both groups in Geuzenveld might be related to specific conditions in this area. Geuzenveld is an area with a relatively strong sense of community among Turkish and Moroccan inhabitants. Compared to other administratively defined areas in Amsterdam, Geuzenveld is smaller in size and the ethnic composition is dominated by only a few groups. Turks and Moroccans together comprise almost 50 percent of the population. This implies a relatively high degree of dependency and interaction between the two groups, with possibly stronger social support systems between these groups. This is reinforced by a low number of relocations and outmigration among ethnic groups in ethnic concentration areas such as Geuzenveld (Musterd & de Vos, 2007). Moreover, the two groups may have forged stronger alliances with each other, given the context of strong tensions between ethnic minorities and those of Dutch origin in Geuzenveld (Boers et al., 2012), and relatively low socio economic position of Geuzenveld residents as compared to most other parts of Amsterdam (Municipality of Amsterdam, 2015).

Conclusion

Our study suggests that in studies on the influence of neighbourhood ethnic composition on health three aspects are important. First, other-group density, the density of a specific ethnic group, deserves attention aside from common measures such as own-group density and ethnic heterogeneity. Additionally, it is important to use area measurements at small spatial scales. Finally, to improve our understanding of the underlying mechanisms, it might help to examine the spatial variation in the relationship within urban areas. The relationship between ethnic composition and health may depend on specific local factors influencing relations and ties between ethnic groups.

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PART 4

Policy context

CHAPTER 11

Association between integration policies and immigrant's mortality: an explorative study across three European countries

Published

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Abstract

Background: To integrate immigrants into their societies, European countries have adopted different types of policies, which may influence health through both material and psychosocial determinants. Recent studies have suggested poorer health outcomes for immigrants living in countries with poorly rated integration policies. We aimed to analyse mortality differences of immigrants from the same country of origin living in countries with distinct integration policy regimes.

Methods: From the mortality dataset collected in the Migrant Ethnic Health Observatory (MEHO) project, we chose the Netherlands (linked data from 1996-2006), France (unlinked; 2005-2007) and Denmark (linked; 1992-2001) as representatives of the inclusive, assimilationist and exclusionist policy model, respectively, based on the Migrant Integration Policy Index. We calculated for each country sex-and age-standardized mortality rates for Turkish-, Moroccan- and local-born populations aged 20-69 years. Poisson regression was used to estimate the mortality rate ratios (MRRs) for cross-country and within-country comparisons. The analyses were further stratified by age group and cause of death.

Results: Compared with their peers in the Netherlands, Turkish-born immigrants had higher all-cause mortality in Denmark (MRR men 1.92; 95% CI 1.74-2.13 and women 2.11; 1.80-2.47) but lower in France (men 0.64; 0.59-0.69 and women 0.58; 0.51-0.67). A similar pattern emerged for Moroccan-born immigrants. The relative differences between immigrants and the local-born population were also largest in Denmark and lowest in France (e.g., Turkish-born men MRR 1.52; 95% CI 1.38-1.67 and 0.62; 0.58-0.66, respectively). These patterns were consistent across all age groups, and more marked for cardiovascular diseases.

Conclusions: Although confounders and data comparability issues (e.g., French cross-sectional data) may affect the findings, this study suggests that different macro-level policy contexts may influence immigrants' mortality. Comparable mortality registration systems across Europe along with detailed socio-demographic information on immigrants may help to better assess this association.

Introduction

Immigrants' integration policy models in Europe

In the context of decolonisation and economic expansion in the decades following World War II, Western European countries welcomed large numbers of immigrants to meet the increasing labour demand. Governments adopted legislations and policies with the aim to control the influx and successfully integrate these immigrants and their families into the new host environment. Interestingly, no shared set of policies was implemented, rather the policies tended to differ by country, probably due to different political ideologies, national histories and cultural traditions.

Several authors have identified, with different names, three models of integration policies in Europe. First, the 'ethnic minorities', 'multicultural' or 'individualistic-civic' model combines social and political tolerance and respect of cultural differences with facilities to acquire citizenship through residence or place of birth (ius soli), with the UK, Netherlands and Sweden consistently classified in this group. Second, the 'guest worker', 'differential exclusionist' or 'collectivistic-ethnic' model, with Germany as historical prototype, assumes a conjunctural presence of immigrants based on the labour market needs. This model bases citizenship on ancestry (ius sanguinis), puts in place few active integration policies, and goes along with low levels of social and political tolerance. Third, the 'assimilation' or 'collectivistic-civic' model, with France as an example, facilitates citizenship through the ius soli principle, but is not keen on public manifestations of cultural differences and requires adhesion to republican values [1,2].

It is important to note that through confrontation to similar problems, policy orientations have sometimes changed and increasingly converged, especially in the European Union context. For example, Germany has been very similar in practice to France, and has reformed and opened its nationality law [3,4]. It might therefore be important to characterise policies as they have developed in practice. An example of country typology based on a systematic evaluation of current policies is that proposed by Meuleman [5] using the Migrant Integration Policy Index (MIPEX), an up-to-date comparison across Europe of policies related to immigrant populations based on the assessment by independent scholars and practitioners in migration law of the country's publicly available documents [6]. Through a latent class analysis of the scores on specific dimensions of MIPEX 2007 edition, Meuleman identified three groups: a more inclusive one scoring highest on all dimensions and including the three traditional representatives of the multicultural model, among others; one with low scores, consisting of Austria, Denmark, Greece and the Eastern bloc, that shares characteristics of the differential exclusionist model; and a small cluster that the author considers an evolution of the assimilationist model, with scores similar to exclusionist countries on residence and access to labour market but similar to inclusive countries on nationality and political participation (including France and "former exclusionists" like Germany and Switzerland).

From integration policy to immigrants' health and mortality

As policies largely determine the social environments in which individuals work and live,

these contrasting integration policies may have created disparate socioeconomic contexts for immigrants, including employment opportunities, income and housing conditions. These factors are known to have an impact on morbidity and mortality (i.e. material pathway) [7,8] and to contribute to ethnic inequalities in mortality [9,10]. In addition, the institutional arrangements and policies may be reciprocally linked to the host population's attitudes towards immigrants [2,5,11], all of which might affect immigrants' health through chronic negative daily stressors such as experiences of social exclusion, intolerance and discrimination (i.e. psychosocial pathway) [7,12]. In the US, studies have indicated an impact of racial discrimination policies and their abolition on mortality of racial minorities [13,14]. Given these potential pathways, immigrants' health might differ according to the country of residence integration policies. In two recent European studies, the global MIPEX score failed to show a relationship with depression in immigrants [12], while it was found to be related with a smaller disadvantage as compared to non-migrants in subjective wellbeing [15]. In a more recent study, the policy model approach, as proposed by Meuleman with the three types, gave more consistent results. It found that in countries with exclusionist policy model immigrants had poorer self-rated health and larger inequalities, as compared to countries with other policy models. [16].

In the present study we aimed to explore whether such relationship could be observed with all-cause mortality and various causes of death. Based on the available cross-country mortality data from the Migrant and Ethnic Health Observatory (MEHO) project [17], we selected countries belonging to the different typologies of integration policies according to the MIPEX 2007 analysis [5]: Netherlands as 'inclusive', France as 'assimilationist', and Denmark as 'exclusionist'. For these three countries we had a substantial representation of immigrants from two countries of origin – Turkey and Morocco (see Table 1 for person-years at risk in each country). Across the three countries, these immigrants had similar background (e.g., little education, unskilled, rural origin), and similar reasons for migration, being recruited to fill up the Western European labour shortages in 1960-1970s with subsequent family reunifications [18,19]. By restricting the comparison to immigrants from the same country of origin, we reduced the differences potentially attributable to pre-migration exposures, with a relevant influence on immigrants' mortality [17,20].

We hypothesized that all-cause mortality levels and the mortality gap with the local-born would be the highest for immigrants residing in Denmark, followed by France and then Netherlands. To formulate our hypotheses on how this relationship would vary by main cause of death, age and sex, we drew parallels with the literature on socioeconomic inequalities in mortality, suggesting that socioeconomic inequalities tend to be the largest for injury-related causes (e.g., homicide and suicide), cardiovascular diseases (CVD), and respiratory diseases [21]. In addition, socioeconomic inequalities in mortality are generally consistent across age and sex, but largest among men younger than 45 years [22]. Thus, we hypothesized the former association between country of residence and immigrants' mortality to be stronger in younger men and for the abovementioned causes.

Methods

Study design, population and data sources

Population and mortality data were used from the MEHO project. Detailed information on data acquisition has been published elsewhere [23]. We drew data from the Netherlands, France, and Denmark. We included the local-born populations and two immigrant populations – i.e., Turkish- and Moroccan-born – residing in the three countries and aged 20-69 years, since relatively few deaths were observed among immigrants aged below and above this range.

In the Netherlands and Denmark, linked data were collected using linkages between records of the population register and subsequent mortality data. An open cohort design was used, so participant could enter and exit the study at any point in time during the follow-up period. Data from Denmark were collected between 1992-2001 and from the Netherlands between 1996-2006. In France, unlinked data were used; we derived numbers of deaths by country of birth, sex, and age from the national mortality register and calculated the corresponding person-years at risk (PYR) using population census information. Data from France were collected between 2005-2007. Since we used anonymized data, no ethical approval was required.

Variables

All-cause mortality and main causes of death were assessed. We included the following main causes of death (with International Classification of Diseases codes in brackets): suicide (ICD-9 E950-959; ICD-10 X60-X84, Y87.0); homicide (ICD-9 E960-E969; ICD-10 X85-Y09, Y87.1); CVD (ICD-9 390-459, 250; ICD-10 I0-I99, E10-E14); respiratory diseases (ICD-9 161-163, 165, 487, 480-486, 490-494, 496; ICD-10 J40-47, J10-18, C30-34, C39); infectious diseases (ICD-9 279.5, 001-139; ICD-10 B20-B24, A00-B99); cancer (ICD-9 140-239 [excluding 161-163, 165]; ICD-10 C00-D48 [excluding C30-34, C93]); unintentional injuries (ICD-9 E800-E915; ICD-10 V01-V99, W00-X59); and other causes (rest).

Country of residence, country of birth, sex and age (categorised into five-year age groups) were the other variables used.

Data analysis

We calculated the age-standardised mortality rates (ASMR) by sex, country of residence and country of birth applying direct standardisation using the WHO World Standard Population.

Poisson regression was used to estimate the age-adjusted mortality rate ratios (MRRs). The MRRs were calculated in two ways. First, the mortality rates were compared within a population residing across the three countries (cross-country comparison between peers), with those residing in the Netherlands, the country with the best integration policy score, as the reference group. Second, we compared the mortality rates of Turkish- and Moroccan-born immigrants with those of the local-born populations within each country (within-country comparison). The models used the number of deaths as the dependent variable; five-year age groups and country of residence/birth (depending on the comparison) as independent variables; and PYR as the offset variable. We first used sex-stratified models.

Second, similar models were employed but with further stratification for the age groups 20-44 and 45-69 years. Finally, we ran separate models for the main causes of death, adjusted for age and sex – no important differences between men and women were observed (data not shown). SPSS version 21.0 and Microsoft Excel 2011 were used for analysis.

Results

In Table 1 total deaths and ASMRs are presented by sex, country of residence, and country of birth. Turkish- and Moroccan-born immigrants residing in Denmark had the highest ASMR, followed by those residing in the Netherlands and then France. This pattern was also observed in local-born women, while Dutch men had the lowest mortality rate.

Table 2 presents MRRs for all-cause mortality with cross-country and within-country comparisons. Compared with their peers in the Netherlands, Turkish- and Moroccan-born had higher mortality in Denmark – the MRRs were 1.92 (95% confidence interval [CI] 1.74-2.13), 2.11 (1.80-2.47), 2.13 (1.68-2.69), and 1.39 (0.86-2.25), respectively. By contrast, mortality among Turkish- and Moroccan-born immigrants residing in France was consistently lower.

Within-country comparisons showed that immigrants in Denmark had an unfavourable mortality pattern, compared to the local-born population (Table 2). For immigrants residing in the Netherlands and France, the mortality pattern tended to be more favourable. Specifically, the MRRs for Turkish-born men and women residing in Denmark were 1.52 (95% CI 1.38-1.67) and 1.34 (1.15-1.55) and for Moroccan-born men 1.31 (1.04-1.65). By contrast, in France the MRRs for both Turkish- and Moroccan men and women varied between 0.62 and 0.78. In the Netherlands only Turkish-born men had higher mortality than the local-born population (MRR 1.17; 95% CI 1.13-1.21), while others had lower mortality (MRRs varying between 0.81 and 0.89).

Table 3 presents age-stratified analysis. In both age groups mortality for immigrants was generally lower in France but higher in Denmark than their peers in the Netherlands. For Turkish-born in Denmark, the MRR was higher in the age group 45-69 years than 20-44 years, compared both with the their peers in the Netherlands and with the local-born. Cross-country comparisons, for example, showed that Turkish-born men and women in Denmark had MRRs of 2.22 (95% CI 1.98-2.49) and 2.41 (2.00-2.91), respectively, in the age group 45-69 years versus 1.28 (1.03-1.59) and 1.54 (1.13-2.10) in the younger age group. This pattern was less consistent in the Moroccan-born.

Age- and sex-adjusted analyses by main cause of death are shown in Table 4. Mortality for suicide, respiratory diseases, cancer and unintentional injuries were generally lower in immigrants compared to local-born, with little cross-country differences. Homicide mortality was especially higher for both Turkish-born and Moroccan-born in the Netherlands as compared to local-born, and a similar pattern, with smaller differences, held for infectious diseases. Compared to their peers in the Netherlands, CVD mortality for the immigrants was lowest in France and highest in Denmark (significant for Turkish-born only). Compared to the local-born, Turkish-born in Denmark and the Netherlands had higher CVD mortality, while

Table 1. Person-years at risk (PYR), total deaths, and age-standardized mortality rate (ASMR) in local-born, Turkish-born and Moroccan-born immigrants aged 20-69 years in three European countries, stratified by sex

	Men			Women		
	PYR	Total deaths (n)	ASMR (per 100,000 PY)	PYR	Total deaths (n)	ASMR (per 100,000 PY)
Local-born						
Netherlands	48,030,138	206,576	364.0	47,104,706	129,458	224.5
France	48,978,090	235,814	417.0	50,729,854	108,66	177.2
Denmark	17,369,353	100,76	513.6	17,103,404	67,07	325.0
Turkish-born						
Netherlands	1,113,842	3,319	424.6	997,062	1,254	203.3
France	340,123	743	271.8	287,037	242	121.3
Denmark	105,719	431	897.0	88,042	173	467.3
Moroccan-born						
Netherlands	926,149	2,183	285.8	771,189	882	183.8
France	1,130,385	3,967	261.7	1,053,177	1,733	141.2
Denmark	21,442	73	811.5	14,794	17	232.2

PYR=person-years at risk. PY=person-years. ASMR=age-standardized mortality rate.

Table 2. All-cause mortality rate ratios (MRRs) in Turkish- and Moroccan-born immigrants in three European countries, compared with the local-born population[a] and with peers in the Netherlands, stratified by sex

	Men				Women			
	vs. peers		vs. local-born		vs. peers		vs. local-born	
	MRR[b]	95% CI	MRR[b]	95% CI	MRR[b]	95% CI	MRR[b]	95% CI
Local-born								
Netherlands	1.0	ref.			1.0	ref.		
France	1.13	1.12-1.14			0.78	0.77-0.78		
Denmark	1.40	1.39-1.41			1.46	1.45-1.48		
Turkish-born								
Netherlands	1.0	ref.	1.17	1.13-1.21	1.0	ref.	0.89	0.84-0.94
France	0.64	0.59-0.69	0.62	0.58-0.66	0.58	0.51-0.67	0.62	0.54-0.70
Denmark	1.92	1.74-2.13	1.52	1.38-1.67	2.11	1.80-2.47	1.34	1.15-1.55
Moroccan-born								
Netherlands	1.0	ref.	0.81	0.78-0.85	1.0	ref.	0.83	0.77-0.88
France	0.91	0.87-0.96	0.62	0.60-0.64	0.78	0.72-0.85	0.78	0.74-0.82
Denmark	2.13	1.68-2.69	1.31	1.04-1.65	1.39	0.86-2.25	0.88	0.54-1.41

MRR=mortality rate ratios. CI=confidence interval.
[a]The reference group was the local-born population in the respective country of residence.
[b]Mortality rate ratios were adjusted for age.

Table 3. All-cause mortality rate ratios (MRRs) with 95% confidence intervals in Turkish- and Moroccan-born immigrants in three European countries, compared with the local-born population[a] and with peers in the Netherlands, stratified by sex and age group

	Men				Women			
	20-44 years		45-69 years		20-44 years		45-69 years	
	MRR[b] vs. peers	MRR[b] vs. local-born	MRR[b] vs. peers	MRR[b] vs. local-born	MRR[b] vs. peers	MRR[b] vs. local-born	MRR[b] vs. peers	MRR[b] vs. local-born
Local-born								
Netherlands	1.0 (ref.)		1.0 (ref.)		1.0 (ref.)		1.0 (ref.)	
France	1.49 (1.47-1.52)		1.08 (1.08-1.09)		0.95 (0.93-0.97)		0.75 (0.74-0.76)	
Denmark	1.70 (1.66-1.73)		1.36 (1.35-1.37)		1.28 (1.24-1.32)		1.49 (1.48-1.51)	
Turkish-born								
Netherlands	1.0 (ref.)	1.13 (1.06-1.22)	1.0 (ref.)	1.18 (1.14-1.23)	1.0 (ref.)	0.85 (0.77-0.95)	1.0 (ref.)	0.90 (0.84-0.96)
France	0.76 (0.64-0.89)	0.57 (0.49-0.67)	0.61 (0.56-0.67)	0.63 (0.58-0.69)	0.63 (0.48-0.83)	0.56 (0.43-0.72)	0.57 (0.49-0.67)	0.64 (0.55-0.74)
Denmark	1.28 (1.03-1.59)	0.89 (0.72-1.09)	2.22 (1.98-2.49)	1.88 (1.69-2.09)	1.54 (1.13-2.10)	1.07 (0.80-1.43)	2.41 (2.00-2.91)	1.47 (1.24-1.75)
Moroccan-born								
Netherlands	1.0 (ref.)	1.12 (1.03-1.21)	1.0 (ref.)	0.73 (0.70-0.77)	1.0 (ref.)	0.96 (0.86-1.08)	1.0 (ref.)	0.78 (0.71-0.84)
France	0.90 (0.80-1.02)	0.65 (0.59-0.71)	0.92 (0.86-0.97)	0.62 (0.60-0.64)	0.74 (0.62-0.88)	0.70 (0.61-0.80)	0.79 (0.72-0.87)	0.79 (0.75-0.84)
Denmark	1.93 (1.33-2.80)	1.34 (0.93-1.92)	2.28 (1.69-3.08)	1.29 (0.96-1.74)	1.18 (0.56-2.49)	0.93 (0.44-1.95)	1.58 (0.85-2.95)	0.84 (0.45-1.56)

[a]The reference group was the local-born population in the respective country of residence.
[b]Mortality rate ratios were adjusted for age. MRR=mortality rate ratios. CI=confidence interval

Table 4. Cause-specific mortality rate ratios (MRR) comparing with the local-born population[a] and with peers in the Netherlands among Turkish- and Moroccan-born, both men and women

	Suicide		Homicide		Cardiovascular diseases[c]		Respiratory diseases[d]	
	MRR[b] vs. peers	MRR[b] vs. local-born	MRR[b] vs. peers	MRR[b] vs. local-born	MRR[b] vs. peers	MRR[b] vs. local-born	MRR[b] vs. peers	MRR[b] vs. local-born
Local-born								
Netherlands	1.0 (ref.)		1.0 (ref.)		1.0 (ref.)		1.0 (ref.)	
France	1.84 (1.80-1.88)		0.82 (0.75-0.91)		0.58 (0.58-0.59)		0.82 (0.81-0.83)	
Denmark	1.64 (1.59-1.69)		1.50 (1.35-1.68)		1.33 (1.31-1.34)		1.37 (1.34-1.39)	
Turkish-born								
Netherlands	1.0 (ref.)	0.62 (0.52-0.73)	1.0 (ref.)	6.15 (5.11-7.40)	1.0 (ref.)	1.15 (1.08-1.21)	1.0 (ref.)	0.67 (0.61-0.74)
France	0.91 (0.64-1.30)	0.29 (0.21-0.40)	0.48 (0.21-1.08)	1.40 (0.66-2.94)	0.56 (0.49-0.64)	1.04 (0.92-1.18)	0.91 (0.75-1.11)	0.65 (0.54-0.77)
Denmark	0.91 (0.52-1.61)	0.42 (0.24-0.72)	0.18 (0.09-0.39)	1.92 (0.86-4.31)	1.93 (1.62-2.28)	1.77 (1.51-2.08)	1.41 (0.99-1.99)	0.77 (0.55-1.07)
Moroccan-born								
Netherlands	1.0 (ref.)	0.53 (0.43-0.64)	1.0 (ref.)	5.83 (4.74-7.18)	1.0 (ref.)	0.73 (0.68-0.79)	1.0 (ref.)	0.54 (0.48-0.61)
France	1.44 (1.12-1.85)	0.38 (0.33-0.44)	0.22 (0.13-0.35)	1.26 (0.81-1.94)	0.60 (0.55-0.66)	0.75 (0.70-0.79)	1.13 (0.99-1.29)	0.65 (0.60-0.69)
Denmark	1.32 (0.42-4.16)	0.48 (0.16-1.50)	1.22 (0.39-3.83)	5.00 (1.61-15.58)	1.25 (0.69-2.26)	0.74 (0.41-1.34)	1.49 (0.66-3.34)	0.80 (0.36-1.78)

	Infectious diseases[e]		Cancer[f]		Unintentional injuries[g]		Other causes	
	MRR[b] vs. peers	MRR[b] vs. local-born	MRR[b] vs. peers	MRR[b] vs. lo-cal-born	MRR[b] vs. peers	MRR[b] vs. lo-cal-born	MRR[b] vs. peers	MRR[b] vs. local-born
Local-born								
Netherlands	1.0 (ref.)		1.0 (ref.)		1.0 (ref.)		1.0 (ref.)	
France	1.52 (1.46-1.58)		0.97 (0.97-0.98)		2.00 (1.96-2.05)		1.52 (1.50-1.54)	
Denmark	1.58 (1.50-1.67)		1.20 (1.18-1.21)		2.34 (2.28-2.40)		1.92 (1.90-1.95)	

Turkish-born								
Netherlands	1.0 (ref.)	1.48 (1.18-1.84)	1.0 (ref.)	0.63 (0.60-0.67)	1.0 (ref.)	0.81 (0.70-0.92)	1.0 (ref.)	2.36 (2.24-2.48)
France	0.84 (0.54-1.33)	0.83 (0.55-1.23)	1.01 (0.90-1.13)	0.62 (0.56-0.68)	1.38 (1.07-1.77)	0.58 (0.47-0.72)	0.31 (0.26-0.36)	0.45 (0.38-0.52)
Denmark	1.39 (0.64-3.01)	0.77 (0.37-1.61)	1.26 (1.01-1.56)	0.70 (0.57-0.86)	1.00 (0.62-1.60)	0.35 (0.23-0.56)	3.02 (2.67-3.43)	3.45 (3.08-3.87)
Moroccan-born								
Netherlands	1.0 (ref.)	1.72 (1.38-2.15)	1.0 (ref.)	0.52 (0.49-0.56)	1.0 (ref.)	0.97 (0.84-1.11)	1.0 (ref.)	1.69 (1.58-1.80)
France	0.83 (0.63-1.10)	0.98 (0.83-1.16)	1.39 (1.29-1.51)	0.68 (0.66-0.71)	1.55 (1.30-1.85)	0.71 (0.64-0.78)	0.56 (0.51-0.61)	0.60 (0.57-0.64)
Denmark	1.62 (0.40-6.59)	1.08 (0.27-4.30)	1.70 (1.08-2.68)	0.84 (0.54-1.32)	2.15 (1.14-4.06)	0.96 (0.52-1.78)	2.90 (2.12-3.97)	2.46 (1.81-3.34)

MRR=mortality rate ratios. CI=confidence interval.

[a]The reference group was the local-born population in the respective country of residence.

[b]Mortality rate ratios were adjusted for age and sex.

[c]Cardiovascular diseases include hypertension, ischaemic heart disease, chronic rheumatic heart disease, other heart disease, cerebrovascular disease, other circulatory disease and diabetes.

[d]Respiratory diseases include COPD, asthma, pneumonia, influenza, and lung cancer.

[e]Infectious diseases includes HIV and TB.

[f] Cancer denotes total cancer mortality including lung cancer.

[g]Unintentional injuries are traffic and non-traffic injuries and other external causes.

Moroccan-born had lower mortality in the Netherlands and France. Finally, mortality due to other causes was especially lower for both Turkish-born and Moroccan-born living in France and higher for those living in Denmark as compared to their peers in the Netherlands.

Discussion

This study aimed to assess differences in mortality between immigrants residing in countries with different integration policy models. We found that in Turkish- and Moroccan-born immigrants all-cause mortality was highest in Denmark (exclusionist model), followed by the Netherlands (multiculturalist) and France (assimilationist). Further, compared with the local-born population, immigrants in Denmark had higher mortality pattern while those in France had lower mortality. These patterns were generally more pronounced in the Turkish-born and older age group, but similar across sexes. By main cause of death, these patterns were, to some extent, observed for mortality of cardiovascular diseases (CVD), but not for suicide and homicide.

Limitations

This study had several limitations. First, methods of data collection differed across the countries. For the Netherlands and Denmark we used linked data collected for around ten years while for France unlinked data from two years. Previous studies have raised concerns about the underestimation of mortality of immigrants [24,25] due to phenomena labelled as 'mobility bias', where frequent home country returns or even remigrations go unregistered thus inflating the time or population at risk [26,27]. Some of these problems are more likely to affect unlinked data due to a discrepancy between the mortality register (numerator) and population census (denominator) [28]. However, unlinked data may also suffer from an overestimation as deaths of irregular immigrants, who are absent in population registers, are otherwise recorded in the national mortality statistics [24].

The inclusion only of immigrants enumerated in the population registers limits generalisation of findings to undocumented migrants. It should be noted, however, that this group is arguably less affected by integration policies covered by MIPEX and more by immigration control policies [29].

The sample sizes for the immigrant populations in Denmark were rather small, particularly for the Moroccan-born. The pattern of higher mortality for immigrants in Denmark may therefore be more accurately assessed in the Turkish-born than the Moroccan-born. In a recent publication by Statistics Denmark, Turkish-born mortality in 2005-2009 was slightly lower than for native Danes [30]. However, the discrepancy with our results may be explained by the fact that this other study used unlinked data, included population aged until 89 years and excluded deaths outside Denmark.

An innovation of this study is the possibility to compare immigrants born in the same country that live in different European countries. Still, despite the common origin, there might be unmeasured confounding regarding both pre- and post-migration factors. As noted in the Introduction, as far as we know, the socioeconomic background, reasons for

migration and regions of origin were fairly similar for Turkish and Moroccan immigrants to the three countries [18,19]. As such, we don't expect important differences in pre-migration risk factors, including poverty, diet or other health-related behaviours. We lack measures of socioeconomic conditions or cardiovascular risk factors in the host country, which could partially explain inequalities between natives and immigrants [9]. However, these conditions should not be regarded as confounders but as potential intermediary factors between integration policies and health. An earlier study showed that these conditions were poorer for immigrants in 'exclusionist' countries [16].

Potential relationship with policies

Residence in Denmark, a country with a pattern of integration policy that can be classified as 'differential exclusionist' [5], is associated with relatively unfavourable mortality pattern among immigrants compared to both local-born Danes and immigrants elsewhere. This corresponds to the findings of previous cross-country comparisons of self-reported health among non-EU immigrants [16] and neonatal mortality for offspring of Turkish mothers [31]. Denmark became a net immigration country in the 1950s, when it started receiving labour migration, mainly from Turkey and Yugoslavia, but at a small scale compared to its neighbours. In the 1980s, when legal reforms increased the possibilities of family reunification and asylum, Denmark immigration policy became pronouncedly humanitarian. However, since 1992 this legislation was progressively restricted, increasing the requirements for permanent residence and reunification, including tests on Danish language and the signature of an integration contract [32]. Nowadays, Denmark generally performs worse than France and especially the Netherlands across multiple indicators of integration policy [6] and outcomes such as social tolerance [2], immigrants' experience of discrimination [33], naturalisation rates and material standards of living [16,34] (see Supplementary Table for a selection of these indicators).

In contrast with our hypothesis, and with the rather poor socioeconomic outcomes for immigrants in France (see Supplementary Table), we found that residence in France, the 'assimilationist' country, was associated with the lowest all-cause mortality in the Turkish- and Moroccan-born. In a previous cross-country comparison of CVD mortality with MEHO data, the low mortality for both local-born and immigrants in France as compared to other countries was viewed as an extension of the 'French paradox' [23]. However in the present study, immigrants to France were also found to have the lowest mortality risk as compared to local-born in France. A recent study on self-rated health found that immigrants had poorer health than natives both in France and in the Netherlands, and that ethnic inequalities were greatest among women in the Netherlands [16]. As commented in the Introduction, the adhesion of countries to policy models has not been unequivocal and rigid over time [3]. While France has been slightly moving from assimilationism to inclusiveness and multiculturalism, the Netherlands has walked the opposite path. The Dutch 1998 integration of newcomers act was considered a sharp critique to multiculturalism, while the 2003 citizenship act introduced integration tests for naturalisation [35]. Moreover, Turkish and Moroccan migrants in the Netherlands have historically received a less inclusive, 'guest workers' treatment as compared to migrants from former Dutch colonies [36].

We hypothesised that the correspondence between integration policy model and immigrants' mortality would be greater for causes of death that are more sensitive to material and psychosocial conditions and larger socioeconomic inequalities in mortality. We found indeed higher mortality due to cardiovascular and respiratory diseases for immigrants in Denmark. However, this partly reflected the pattern in the local-born population, suggesting a shared exposure to adverse environmental factors [37]. As this is an explorative study, we grouped causes of death rather broadly: future studies may dig into more specific causes to understand specific pathways.

Alternative explanations

We should acknowledge that differential exposures in the host country other than the policy environment might also explain the mortality patterns observed in this study. First, previous studies have related ethnic density with reduced mortality in US Blacks and Hispanics [38]. It may be relevant that the share of Turkish and Moroccans on the total population is lower in Denmark than in the Netherlands. However, it is also low for Turkish in France, who show an even more favourable mortality pattern than the much 'denser' Moroccans.

Second, it is often argued that mortality rates of immigrant populations are strongly determined by health selection processes both at immigration (the 'healthy migrant effect') and at remigration (the 'salmon bias' or 'unhealthy remigrant effect'), although a recent series of Danish studies has cast doubts on their real extent [39,40]. Cross-national variations in the mortality rates of Turkish or Moroccan immigrants could be influenced by variations in the strength of such selection effects. Though such variations are possible in theory (e.g. because of varying distance to the country of origin), we have no data to support this possibility.
Third, the uptake of the western lifestyle and related cardiovascular risk factors such as diet or smoking are important in shaping immigrants' mortality risk. As most immigrants have lived for many decades in their destination countries, it is not surprising that their mortality differences across countries of residence partly mirror those of the local-born population [23]. However, we have also found country differences in inequalities between immigrants and local populations. Previous reviews have shown that in the Netherlands, both Turkish and Moroccan men and women had in general higher metabolic risk factors [40], and Turkish men had high prevalence of smoking [42], which may explain our finding of higher mortality in these two groups as compared to the native Dutch. Similar studies from France and Denmark are lacking, besides one study showing high prevalence of diabetes among Turkish in Denmark [40] and a healthier diet and similar smoking levels as natives among Moroccans in France [43]. Nevertheless, it is important to consider that these behaviours can be a response to unfavourable material and psychosocial conditions [7,44].

Similarly, differences in healthcare access are another factor resulting from different integration policies that might explain the cross-country differences in immigrants' mortality. However, in the three countries we studied, legally registered immigrants have the same rights in access to healthcare as country nationals [45]. Cross-country studies on healthcare access and use of immigrant populations are lacking, and in a systematic review of such studies at the country level, no French study was identified, while Danish and Dutch studies

found similar patterns of higher GP use for immigrants [46]. As such, we cannot conclude that healthcare access is likely to be an important explanatory factor.

Conclusions and further research

We found that residence in Denmark, a country with an 'exclusionist' integration model, is associated with the highest mortality rates for immigrants from Turkey and Morocco, followed by the 'inclusive' Netherlands and then the 'assimilationist' France. This pattern was particularly observed among Turkish-born immigrants, in the age group 45-69 years, and for mortality due to cardiovascular diseases. Problems of data comparability and unmeasured confounding restrict our ability to make causal inferences on the role of different policies. Yet, these findings, combined with previous comparative studies [16,31] may be a wake-up call for Danish authorities to consider the possibility that the restrictive turn in the immigration-related policy, politics and social climate [32] might have contributed to higher mortality rates of Moroccan and Turkish immigrants.

This study is explorative and encourages more research in several ways. First, this study underlines the need for comparable mortality registration systems across Europe, including detailed socio-demographic information and reason for migration of immigrant populations. Second, it shows the potential of conducting cross-national comparisons on immigrant populations with same origins to raise hypotheses on the health impact of different host country environments. Third, such studies could benefit from the inclusion of classical immigration countries such as US, Australia, Canada as they represent yet another integration model – namely the 'pluralist', which is absent in Europe [47,48]. Fourth, while in this study we assessed broad integration models, further studies should assess the associations of specific aspects of integration policies, including healthcare policies, with immigrants' health.

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Supplementary Table. Overview of policy indicators and outcomes in France, the Netherlands, and Denmark

Dimension	Indicator	Source	Year of data	Denmark	France	Netherlands
Policy indicators						
Integration policy	MIPEX total score (0 worst, 100 best)	MIPEX	2007	51	54	71
Legal status	Long-term residence policy score	MIPEX	2007	64	46	68
Naturalisation	Access to nationality score	MIPEX	2007	33	59	65
Discrimination	Anti-discrimination policy score	MIPEX	2007	42	74	68
Policy outcomes						
Naturalisation	% naturalised foreign-born (non-recent)	OECD	2005-06	52	60	76
Population attitudes	Social tolerance (0 intolerant, 100 tolerant)	Eurobarometer [2]	1997	51	55	72
Discrimination	% Discriminated against last year	EU-MIDIS	2008	42	25	30
Socioeconomic segregation	% Low-skilled level of employment	OECD	2009-11	15 (7)	18 (9)	15 (10)
Employment conditions	% Unemployment rate (born in low-income country, aged 15-64)	OECD	2009-10	13 (7)	17 (9)	9 (5)
Material standards	% At risk of poverty or social exclusion (non-EU born aged 25-54)	Eurostat [47]	2008	36 (23)	40 (26)	25 (12)
Material standards	% Households in lowest decile of income	OECD	2008	32	27.8	30.4
Material standards	% living in a deprived dwelling	OECD	2009	10 (0)	9 (4)	8 (5)

MIPEX=Migrant Integration Policy Index [6]. OECD=Organisation for Economic Cooperation and Development [34]. EU-MIDIS=European Union Minorities and Discrimination Survey [33]. Numbers in brackets indicate the difference compared to natives, or to the total population (brackets and italics).

CHAPTER 12

Inequalities by immigrant status in depressive symptoms in Europe: the role of integration policy regimes

Resubmitted after revision

Davide Malmusi, Laia Palència, Umar Z Ikram, Anton E Kunst, Carme Borrell. Inequalities by immigrant status in depressive symptoms in Europe: the role of integration policy regimes

Abstract

Background: Integration policies may impact the mental health of immigrants, but this has been scarcely studied. We aimed to study whether country integration policy regimes were related to inequalities by immigrant status in depressive symptoms in Europe.

Methods: This is a cross-sectional study using data from 17 countries in the sixth wave of the European Social Survey (2012), comparing subjects born either in the country of residence (non-immigrants, N=28,333) or in a country not classified as 'advanced economy' by the IMF (immigrants, N=2,041). Depressive symptoms were assessed with the 8-item version of the Center for Epidemiologic Studies-Depression scale. Countries were grouped into three integration policy regimes (Inclusive, Assimilationist, Exclusionist). Linear regressions were fitted adjusting first by age, sex and education level, then sequentially by citizenship, perceived discrimination and socio-economic variables.

Results: In all integration regimes, immigrants report significantly more depressive symptoms than non-immigrants. The gap is largest in exclusionist countries (immigrants score 1.16, 95%CI 0.65-1.68, points higher than non-immigrants in the depression scale), followed by assimilationist countries (0.85, 0.57-1.13) and inclusive countries (0.60, 0.36-0.84). Financial strain explains all the association in inclusive countries, most of it in assimilationist countries, but only a small part in exclusionist countries.

Conclusion: Across most European countries, immigrants seem to experience more depressive symptoms than the population born in the country, mostly reflecting their poorer socio-economic situation. Inequalities are larger in countries with more restrictive policies. Despite some limitations, this study adds new evidence to suggest that immigrants' health is shaped by integration policies in their host country.

Introduction

Immigrants' health results from the complex interplay of origin, travel and destination factors [1, 2]. The mental health of immigrant populations has been an area of particular interest for researchers and practitioners considering the risk factors for mental illness represented by forced departure and traumas [3], threats to cultural identity and alienation [4] as well as socio-economic deprivation [5, 6]. Cross-national surveys in Europe have reported higher rates of depression for immigrants [7–9], partly explained by socio-economic conditions in the destination countries [7, 8]. These exposures, such as employment conditions and material deprivation, as well as other psychosocial exposures in the host country such as discrimination or social support, can be influenced by integration policies. These policies can create a context of institutional support and acceptance - or on the contrary a context of barriers and exclusion -, which may either buffer or act as a chronic stressor that influences immigrants' risk of depression.

Several attempts have been made in recent years to analyse the association of country-level integration policies with indicators of immigrants' health and well-being, particularly since the appearance of a systematic comparison of these policies, the Migrant Integration Policy Index (MIPEX) [10]. A study on pooled 2002-10 European Social Survey (ESS) data found lower migration-related inequalities in subjective well-being in countries with a MIPEX score above the median (indicating good integration policies) [11]. A similar study on depressive symptoms using the ESS 2006 was unable to replicate this finding, as the linear MIPEX score was not associated with the level of inequalities between migrants and non-migrants [8]. Nevertheless, it is important to note that in this latter study MIPEX was only introduced once having controlled for individual socioeconomic factors, which could be the mediators of this association. Moreover, this application of multilevel modelling, testing for a cross-level interaction between total MIPEX score and immigrant status, would require a larger number of countries, and especially a sufficient sample of immigrants in all of them, to obtain robust results [12].

Compared to the continuum approach, the typological approach assumes that countries adhere to policy models or regimes whose influence on immigrants' health accumulates over time through different socio-economic and psychosocial conditions. Scholars have described three models of integration policies in Europe. The inclusive model, also labelled as "multicultural" or "individualistic-civic", facilitates the acquisition of citizenship through birth or residence, and respects cultural differences. At the other end of the spectrum, the exclusionist model ("guest worker" or "collectivistic-ethnic") assumes a conjunctural presence of migrants, bases citizenship on ancestry and puts in place few active integration policies. In the middle, the assimilation model (or "political integration" or "collectivistic-civic") facilitates citizenship but requires adhesion to republican values and restricts public manifestations of cultural differences [13, 14]. More recently, two studies classifying European countries into these three models based on their scores on the different dimensions of MIPEX [14] showed larger inequalities in "exclusionist" countries both in self-rated health, using EU-SILC 2012 [15], and mortality, with MEHO project data from three countries [16].

The present study replicates this typological approach focusing on inequalities by immigrant status in depressive symptoms, which seemed unrelated to country integration policy considered as a continuum [8]. Therefore, the objectives of this study are 1) to estimate inequalities in depressive symptoms according to immigrant status by country and by country integration policy regime in Europe, and 2) to analyse the contribution of citizenship, discrimination and a wide range of socioeconomic conditions to these inequalities.

Methods

Design, study population and information sources

A cross-sectional study was performed using data from the European Social Survey (ESS) 2012 [17]. The study population consisted of residents in 17 European countries (those countries included in MIPEX 2007 and with at least 1% of their sample in the survey consisting of immigrant population – according to the definition below), aged >=15 years, born either in the country of residence (N=28,333) or in a country not classified as "advanced economy" by the IMF in the year of the survey (N=2,041) [18]. Foreign-born residents born in advanced economies (high-income countries) were excluded from the analyses, as well as those who moved to Estonia from former Soviet Union or to Slovenia from former Yugoslavia before the independence. Response rates of the ESS 2012 in these 17 countries varied between 33.8% (Germany) and 77.1% (Portugal) with a median of 55.1% (the Netherlands) [17].

Variables

Our main dependent variable was the presence of depressive symptoms, measured with the self-reported short version of the Center for Epidemiologic Studies Depression Scale CES-D, including 8 items: felt depressed, felt that everything you did was an effort, sleep was restless, were happy, felt lonely, enjoyed life, felt sad, could not get going. Values of this variable ranged from 0 (absence of depressive symptoms) to 24 (presence of all symptoms all or almost all of the time) and was treated as continuous following previous studies [7, 8, 19]. The CES-D-20 has been shown to have measurement equivalence in different immigrant and ethnic groups [7] and the CES-D-8 has demonstrated validity across European countries and in both sexes [19].

Our main independent variable at the individual level was immigrant status, considering as non-immigrants those born in the country of residence, and immigrants those born abroad.

At the country level we considered the integration policy regime following the classification by Meuleman [14]: Inclusive: Belgium, Spain, Finland, UK, Netherlands, Norway, Portugal, Sweden; Assimilationist: Switzerland, Germany, France, Ireland; Exclusionist: Cyprus, Denmark, Estonia, Slovenia. These three groups emerged from a latent class analysis of countries' summary scores in the six dimensions of MIPEX 2007: Labour market access; Family reunion; Long-term residence; Political participation; Access to nationality and Anti-discrimination [14].

Other explanatory variables used were:

-Having the citizenship of the country of residence (yes/no)

-Perceive oneself as a member of a discriminated group, measured though the question "Would you describe yourself as being a member of a group that is discriminated against in this country on grounds of race, religion, nationality, language, ethnic group? Yes/no".

-Employment status, classified as being: in paid work, in education, unemployed, disabled or retired, doing housework, others.

-Occupational social class, based on the current or last occupation coded with ISCO-08: managers or professionals (first digit 1 or 2), technicians (3), clerks (4), skilled manual workers (5-8), elementary occupation (9), armed forces (0).

-Job control in the current or last occupation, measured by the question "Please say how much the management at your work allows/allowed you to decide how your own daily work is/was organised?". This variable had values from 0 (I have/ had no influence) to 10 (I have/ had complete control).

-Household's total net income: the respondent is shown a card with 10 ranges, approximating income deciles of each country based on official sources, and reports the range where his/ her own household's total income falls.

-Financial strain, based on the feeling about household's income: living comfortably, coping, finding it difficult, or finding it very difficult on present income.

Other adjustment variables used were age as a continuous variable, sex and education level (primary or lower secondary, ISCED levels I-II; upper secondary or post-secondary non tertiary, ISCED III-IV; tertiary, ISCED V-VI), which most immigrants acquire in the country of origin.

Finally, an additional variable used was the length of residence in the country of destination, classified as: less than 5 years, 5-9, 10-19 and 20 or more. As we found that this variable was unrelated with depressive symptoms in models adjusted by age and country, it was not included in the final analyses.

Analyses

We first described the study variables by immigrant status and integration regime. Next we calculated age-adjusted CES-D-8 scores by running linear regressions adjusted by age and a dummy variable combining immigrant status and country (or integration regime) and predicting CES-D-8 at age 45. To look at the association between immigrant status and the CES-D-8 scores, we ran, for each country or integration regime, linear regressions adjusted by age, sex and education level (and country when looking at the association within integration regimes). Finally, for each integration regime, we ran the same models but adjusting by explanatory variables one by one and then all together.

We used sampling weights in all analyses. For country-by-country analyses, we used individual-level post-stratification weights. For analyses by integration regime, and to account for the different sizes of the countries within integration regimes, this weight was multiplied by a country-level weight and the resulting weight was divided by its average within each group of countries (for more information on ESS sampling weights see [20]). Missing values in explanatory variables were treated as dummies in regression analysis in order to lose the least possible number of subjects.

Results

Table 1 shows the distribution of the sample and independent variables by integration regime and immigrant status. In all integration regimes, immigrants are over-represented in the 30-49 years group and under-represented in those aged 65 and over. Immigrants in assimilationist countries are older, with longer duration of residence and a higher proportion has acquired citizenship than those in other regimes. Notably, about half of immigrants or more are citizens of the host country in all the typologies. Over 10% of immigrants perceive belonging to a group discriminated against for origin-related reasons; this proportion was lower in assimilationist countries. In all regimes, immigrants are less likely than non-immigrants to be retired or disabled and more likely to be unemployed. Despite being more likely to have high levels of education, immigrants are more likely than non-immigrants to have an elementary or skilled manual occupation and low control at work (with the largest gaps in assimilationist countries), lower household income and more difficulties to cope on present income (with the largest gaps in inclusive countries).

Table 1. Descriptive data by integration regime and immigrant status

	Inclusive countries		Assimilationist countries		Exclusionist countries	
	Non-immigrants	Immi-grants	Non-immigrants	Immi-grants	Non-immigrants	Immigrants
N	14928	1151	7791	697	5614	193
N weighted	14808	1271	7689	799	5605	202
Sex. Women (%)	52.0	49.5	52.3	51.4	51.8	59.9
Age (%)						
15-29	19.0	22.2	19.2	19.3	21.1	17.2
30-49	30.0	45.8	27.1	43.5	28.7	54.4
50-64	25.5	22.9	27.2	22.2	26.2	21.6
65 and over	25.5	9.1	26.5	15.0	24.0	6.8
Length of residence (%)						
Less than 10 years		39.6		13.3		28.4
10-19 years		28.1		28.9		36.1
20 or more years		32.3		57.8		35.5
Education level (%)						
ISCED I-II	47.4	44.5	29.7	37.0	24.5	19.8
ISCED III-IV	32.6	28.5	53.0	38.5	51.8	49.4
ISCED V-VI	18.8	21.1	17.2	24.4	23.6	30.4

Not available	1.2	5.9	0.1	0.1	0.1	0.4
EU citizenship (%)	99.7	54.2	99.1	68.4	98.9	48.8
Perceived membership to a discriminated group (%)	2.5	17.3	1.8	11.9	1.8	18.5
Activity status (%)						
Employed	45.3	51.5	45.3	49.9	48.5	49.7
Unemployed	8.4	14.8	4.7	11.0	5.2	15.0
Disabled or retired	27.4	11.5	30.4	17.7	13.0	3.8
Housework	8.0	11.2	8.1	12.4	8.5	13.4
Education	8.9	8.5	10.4	6.5	12.9	10.9
Others	2.0	2.5	1.1	2.5	11.9	7.2
Never employed (%)	12.0	15.5	8.5	7.0	6.5	5.9
Social class, current or last employment (%)						
Managers/professionals	22.8	19.7	21.2	17.2	25.8	21.3
Technicians	13.7	9.6	20.0	12.2	11.8	11.3
Clerks	27.9	25.9	28.0	21.5	28.9	34.9
Skilled manual	21.8	25.7	19.8	25.9	19.6	16.8
Elementary occupations	10.5	15.3	9.1	21.8	10.8	14.7
Armed forces	0.3	0.1	0.5	0.2	0.2	0.0
Not available	3.0	3.7	1.4	1.2	2.9	1.0
Control over work, current or last employment (%)						
High control (7-10)	62.4	58.1	66.6	47.1	69.4	54.2
Average control (5-6)	14.1	16.1	12.4	16.0	10.2	16.0
Low control (0-4)	21.3	22.0	20.6	36.7	18.3	27.3
Not available	2.2	3.8	0.4	0.2	2.1	2.5
Income quintile (%)						
Highest	13.0	8.7	13.9	8.5	15.2	8.4
2nd	13.6	10.1	17.4	12.9	16.0	13.3
3rd	13.8	10.4	19.0	21.4	18.0	19.9
4th	15.6	15.7	17.3	22.4	17.3	19.0
Lowest	18.8	30.9	18.8	22.8	16.2	21.1
Not available	25.2	24.2	13.6	12.0	17.3	18.3
Income adequacy (%)						
Living comfortably	30.6	22.7	34.9	20.0	48.8	28.4
Coping	45.0	36.1	50.4	52.4	36.2	48.5
Difficult	17.6	28.3	11.6	23.1	9.8	14.5
Very difficult	5.0	11.3	2.7	4.5	4.3	6.9
Not available	1.8	1.6	0.4	0.0	0.9	1.7

Immigrants: foreign-born subjects, excluding those born in 'advanced economy' countries [18].

Table 2 shows, in each integration regime and country, the distribution of the sample, age-adjusted CES-D-8 score in non-immigrants and immigrants, and inequalities in depressive symptoms. In all integration regimes, immigrants report significantly more depressive symptoms than non-immigrants. The gap is largest in exclusionist countries (immigrants score 1.16, 95%CI 0.65-1.68, points higher than non-immigrants on the depression scale), followed by assimilationist countries (0.85, 0.57-1.13) and inclusive countries (0.60, 0.36-0.84). Nevertheless, there is also a large heterogeneity between countries of the same policy regime in this association, with the largest gap (1.75) observed in Switzerland, classified as assimilationist, and an inverse non-significant gap (-0.05) in Cyprus, an exclusionist country.

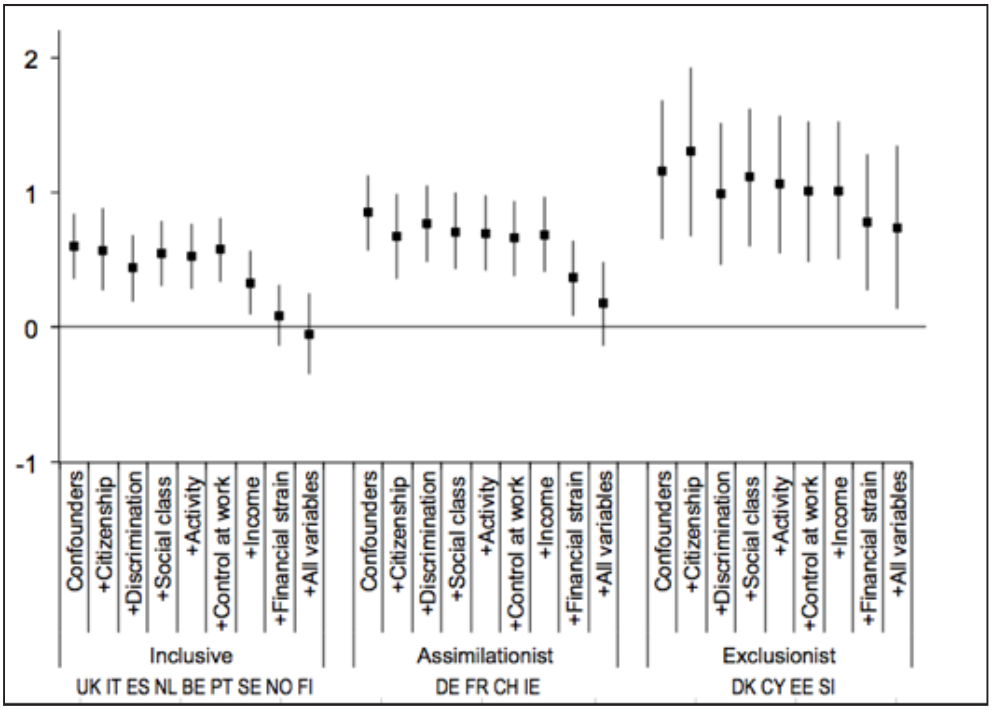
Table 2. Sample size, age-adjusted depression score and depression inequalities by immigrant status for each integration regime and country

	Non-immigrants			Immigrants			Inequalities
	N1[a]	N2 [b]	CES-D8 [c]	N1[a]	N2 [b]	CES-D8 [c]	Beta (95%CI) [d]
Inclusive countries	**14921**	**14808**	**5.74**	**1158**	**1271**	**6.23**	**0.60 (0.36, 0.84)**
United Kingdom	1962	3920	5.26	218	435	5.54	0.21 (-0.35, 0.77)
Spain	1676	3037	5.98	168	305	7.14	1.27 (0.58, 1.97)
Italy	848	4031	6.78	54	256	6.85	0.05 (-1.21, 1.32)
The Netherlands	1680	1103	4.49	122	80	6.01	1.49 (0.84, 2.15)
Belgium	1604	687	5.13	158	68	6.14	0.93 (0.28, 1.58)
Sweden	1609	599	4.53	144	54	5.13	0.35 (-0.26, 0.97)
Norway	1409	308	3.84	159	35	5.16	0.99 (0.46, 1.52)
Portugal	2045	748	6.31	78	29	6.34	0.18 (-0.76, 1.12)
Finland	2087	375	4.60	58	10	4.94	0.49 (-0.41, 1.40)
Assimilationist countries	**7721**	**7689**	**5.29**	**767**	**799**	**6.22**	**0.85 (0.57, 1.13)**
Germany	2586	4057	5.40	303	476	6.46	0.90 (0.45, 1.35)
France	1747	3092	5.28	151	266	5.80	0.65 (-0.03, 1.32)
Switzerland	1157	340	4.41	138	40	6.39	1.75 (1.13, 2.37)
Ireland	2231	200	4.36	175	16	5.73	1.20 (0.60, 1.81)
Exclusionist countries	**5621**	**5605**	**4.70**	**186**	**202**	**5.77**	**1.16 (0.65, 1.68)**
Denmark	1534	3212	4.31	60	126	5.99	1.39 (0.52, 2.27)
Cyprus	981	479	5.30	69	34	4.79	-0.05 (-1.11, 1.02)
Slovenia	1141	1203	4.58	32	34	5.59	1.31 (0.01, 2.60)
Estonia	1966	710	6.17	24	9	7.22	0.97 (-0.60, 2.54)

Immigrants: foreign-born subjects, excluding those born in 'advanced economy' countries [18].
[a] weighted sample size for country-specific analysis.
[b] weighted sample size for integration regime analysis.
[c] prediction at age 45 after a linear regression adjusted by age and a dummy variable combining immigrant status and country (or integration regime).
[d] coefficient of immigrants (reference: non-immigrants) from a linear regression adjusted by age, sex and education level (and country in integration regimes models).

Figure 1 shows, for each integration regime, the association of immigrant status with depressive symptoms, adjusted by age, sex, educational level and country of residence, and adding explanatory variables, one by one then all together. Again, we can see graphically that inequalities are highest in exclusionist countries, followed by assimilationist and inclusive countries. In addition, in inclusive countries, income - especially financial strain - explains all the association. In assimilationist countries, it explains most of the association, which becomes no longer significant when including all variables. In exclusionist countries, income and other socioeconomic variables explain only a small part of the association.

Figure 1. Association of immigrant status with CES-D8 depression score (Beta coefficient from linear regression with 95% confidence intervals) by integration regime, adjusted by confounders (age, sex, educational level, country of residence) and explanatory variables



Discussion

In most European countries, immigrants experience more depressive symptoms than the local population. The gap between immigrants and non-immigrants varies across different integration policy regimes, being highest in exclusionist countries and lowest in inclusive countries, although with substantial heterogeneities between countries in the same regime. In general, these inequalities mostly reflect immigrants' poorer living conditions, specifically economic difficulties, although in the exclusionist regime, differences persist even after adjustment by socioeconomic variables.

The results mostly confirm the findings of previous studies showing an association between integration regimes and self-rated health [15] or mortality [16], with the largest inequalities in exclusionist countries. This study included in the exclusionist regime relatively less wealthy countries such as Cyprus, Slovenia and Estonia, where the comparison with the local population may be less unfavourable for immigrants. However, in Denmark, which is more comparable to other Western European countries, a clear disadvantage for immigrants is found. Similarly, Meuleman's cluster classification [14] includes in the assimilationist regime the once exclusionist Germany [13] or a country such as Switzerland, faring poorly in more recent immigration policy assessments [10] and in this study presenting the largest gap between immigrants and non-immigrants in terms of depressive symptoms.

As mentioned in the introduction, a previous study measuring integration policy with the total MIPEX score found no effect of this variable on the gap in depressive symptoms, having already adjusted for individual socioeconomic factors [8]. In the present study, financial difficulties accounted for most of the gap, and after controlling for this factor, the differences between regimes persisted, or even increased. By using a typological approach, the present study seems to capture the long-term adhesion of countries to a set of policies with cumulative consequences on immigrants' wellbeing, although this adhesion has not been unequivocal and rigid over time [21], and to better characterise a set of countries with "unhealthy" policies – those adopting the exclusionist model. Another study described a geographic pattern, with a smaller gap in Southern Europe [9]: this occurs also in the present study for Cyprus, Italy and Portugal, but not for Spain. Excluding these countries doesn't alter our main findings; indeed inequalities increase in the exclusionist regime. Nevertheless, the large heterogeneity between countries within the same regime reveals that the typology is not capturing all the contextual factors that influence health inequalities. For example, in Spain the economic crisis has especially hit the immigrant population and probably influenced the deterioration of its mental health [22], and the Netherlands have been slightly introducing in the last two decades policies that have been regarded as critiques to multiculturalism [23]: these factors may contribute to the relatively large inequalities observed in these two "inclusive" countries.

How might we explain why integration policy models make a difference to depressive symptoms? As previously described [8, 16], policies that facilitate or restrict immigrants' labour market integration, long-term residence, welfare entitlements, naturalisation, cultural tolerance and political rights can have consequences on both material and psychosocial aspects of immigrants' lives in the host country, such as poverty, working conditions and residential segregation, or experiences of discrimination, exclusion, stressful events and lack of control over life. These effects seem to occur both directly and through the impact (at times reciprocal) of policies on the host population perception and attitude towards newcomers [24]. While in our study differences with the local population remained in exclusionist countries after adjusting for several material and psychosocial factors, other factors or dimensions, which we have not included in our analyses may possibly help to understand these residual differences.

This study also shows that financial strain appears strongly related to depressive symptoms, and the strongest individual-level explanatory factor of the excess of symptoms in immigrants. Although part of this association could be due to reverse causality, this finding goes in line with previous studies [5, 7], and points to the role of the actual experience of material hardship and economic difficulties, more than an issue of status perception as the location in the occupational hierarchy or job control. Therefore, it is important to consider such differences related to immigrant status as the reflection of social and economic inequalities, and not merely some sort of acculturative stress [6]. Perceived membership of a discriminated group also appears as a relatively important explanatory factor especially in exclusionist countries: in a previous study this variable presented associations with health outcomes, which differed depending on the integration regime [25]. We might speculate that in countries where immigrants have opportunities to integrate and equal civil rights, material resources tend to be more relevant for mental health, while given the unfavourable environment in exclusionist countries, discrimination might be at least equally important as income.

The results should be interpreted with caution considering a number of limitations: a relatively lower participation and representation of immigrants in population surveys [26], differences between countries in the composition of their immigrant populations (e.g. origins or reasons for migration), and possible cross-cultural differences in responses to the depressive symptoms scale. While valid for comparison across European countries [17], CES-D validity in different immigrant groups still deserves testing [7, 27]). Moreover, Meuleman's typology of country integration policies has not been replicated with other datasets: the correct affiliation of countries to a specific typology over time should be corroborated with data on past policies that are unfortunately not available before 2007 in a form permitting comparison, such as the MIPEX. Nevertheless, both the typology and the survey use data from a large number of European countries that were collected in a standardised way, and the results largely correspond with previous studies using the same typology and other health indicators such as self-rated health and mortality [15, 16].

Therefore, this study adds to the existing evidence on integration policies and immigrants' health in Europe, reinforcing hypotheses that will need further corroboration through both quantitative studies with larger and more comparable samples of immigrant population and qualitative studies. In the meanwhile, policymakers should be aware that political choices on immigration not only have dramatic consequences for people trying to reach Europe, but may also matter for the physical and mental health of regular immigrants. Mental health practitioners should consider the legal barriers that their immigrant patients encounter as potential risk factors for psychopathology, and advocate for integration policies as health policies.

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CHAPTER 13

General discussion

This chapter consists of four sections. First, we provide an interpretation of the main findings. We then link the different parts of the thesis and present a comprehensive model. Third, we discuss the implications for research and policy. Finally, we provide an overall conclusion of this thesis.

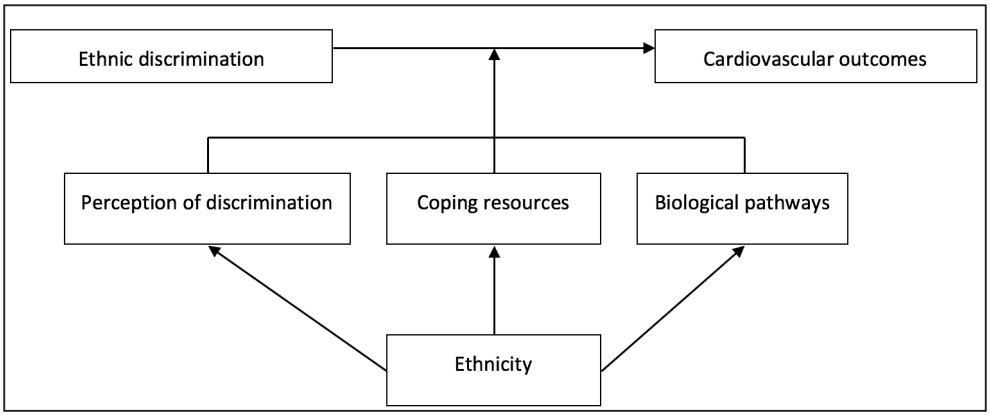
Interpretation of the findings

Ethnic variation in the association between perceived ethnic discrimination and health

Generally, PED, considered a chronic psychosocial stressor[1-4], was associated with poor mental and cardiovascular health in ethnic minority groups in Amsterdam. For depression the associations were consistently positive while for cardiovascular outcomes the associations were weaker and varied by ethnicity. This difference might be related to the differential underlying pathways and to reporting bias. Experiences of discrimination negatively affect self-esteem and identity formation and lead to more rumination[5-7]. These psychological factors, in turn, are considered risk factors for depression[5,7]. The link with cardiovascular risk factors, however, is less clear and depends on several factors[1]. It presumably operates through a complex interplay of various biological systems (e.g. HPA-axis, autonomic nervous system), health behaviours, and depressive symptoms[1,5]. In addition, PED and depression were both self-reported while cardiovascular health outcomes were objectively measured, so maybe reporting bias could partly explain the consistent findings for depression. However, when we adjusted for neuroticism, which is a personality trait characterised by a negative view of oneself and the world[8,] the association with depression remained intact.

Furthermore, we observed that the associations between PED and cardiovascular risk factors differed by ethnicity. However, the associations generally tended to be consistently positive for Surinamese subgroups, but for the other groups the associations were either positive or absent depending on the outcome. The specific reasons for this ethnic variation are unclear, but three possible explanations may help understand this variation (as depicted in Figure 1).

Figure 1. Conceptual model to understand the ethnic variation in the association between ethnic discrimination and cardiovascular outcomes



First, the ethnic variation might be due to differences in how potential discriminatory experiences are perceived by the groups (e.g. humiliating, painful, acceptance). The perceptual differences might be related to socio-historical links with racism, which is a highly sensitive topic for Surinamese subgroups given their Dutch colonial past[9]. The relationships with the host country might also be relevant in this regard. For example, most Ghanaians, Moroccans and Turks arrived in the Netherlands from 1970s as labour migrants[10], whereas Surinamese subgroups have colonial links with the Netherlands[11]. This difference between the groups could possibly lead to differences in how discriminatory experiences are perceived in the host society.

The second explanation is related to the ethnic differences in the available psychosocial coping resources. We found that strong ethnic identity, religiosity, and large ethnic social network buffered the association between PED and depressive symptoms, although the effects differed by ethnicity (Chapter 8). This suggests that different ethnic minority groups might employ different coping resources to effectively deal with PED. It could also be possible – though we did not assess this – that ethnic minority groups have different levels of effective coping resources at their disposal, which in turn might lead to differential capacity to cope with stressors such as PED[12-14].

Third, the ethnic variation could be due to ethnic differences in the underlying biological pathways, which might be attributable to differential epigenetics[15] and early-life exposures to stressors[2,16,17]. For example, a US study showed that perceived discrimination is associated with weaker diurnal cortisol rhythms in White Americans, but with stronger diurnal cortisol rhythms in African Americans[18]. Hence we speculate that the differential biological pathways might lead to different health responses to PED for the ethnic minority groups.

Different levels of social context in relation to ethnic minority health

At family level, adult offspring's smoking behaviours were strongly determined by parental smoking, with the impact being stronger in gender-concordant pairs (Chapter 10). The impact may be explained by heritability[19,20] and social learning processes (e.g. role modelling, parenting practices)[21,22]. The stronger associations for gender-concordant suggest that these underlying social processes might be gender-specific, such that fathers act as role model for their sons and mothers for their daughters[22]. The current literature on smoking in ethnic minority groups has largely focused on societal factors (e.g. integration into host society), while ignoring family influences such as parental smoking. Our findings suggest that, to better understand the smoking behaviours of ethnic minority groups, parental smoking should be explicitly considered along with societal factors.

At residential level, we found that in Amsterdam Moroccans had better self-rated health with higher co-presence of Turks – but not vice versa (Chapter 9). These contradictory findings might be understood by the bridging and bonding theory, as proposed by Robert Putnam[23]. If the associations were causal, it could be that Moroccans are better able to 'bridge' with other ethnic groups (in this case Turks), so the relationship with members of other ethnic groups are perceived as positive, resulting in increased social cohesion and community trust – factors that are associated with better health[24]. On the other hand, as

Turks tend to be more inward-oriented (thus stronger in 'bonding')[25], it might be possible that they do not necessarily benefit from the co-presence of other minority groups in their residential environment.

Ethnic minority health determined by integration policies

We showed that integration policies in the host country could be an important factor for the health of migrants in Europe. Specifically, we found higher mortality and depression rates in migrants and greater differences with the host group in an exclusionist policy context, compared to assimilationist or inclusive policy context (Chapters 11-12). As income and discrimination partly explained the depression gap with the host groups in Europe (Chapter 12), we found support for the theory suggesting that national integration policies shape ethnic minority health through material and psychosocial pathways. However, our studies were explorative and had some important limitations, so definitive conclusions cannot be made.

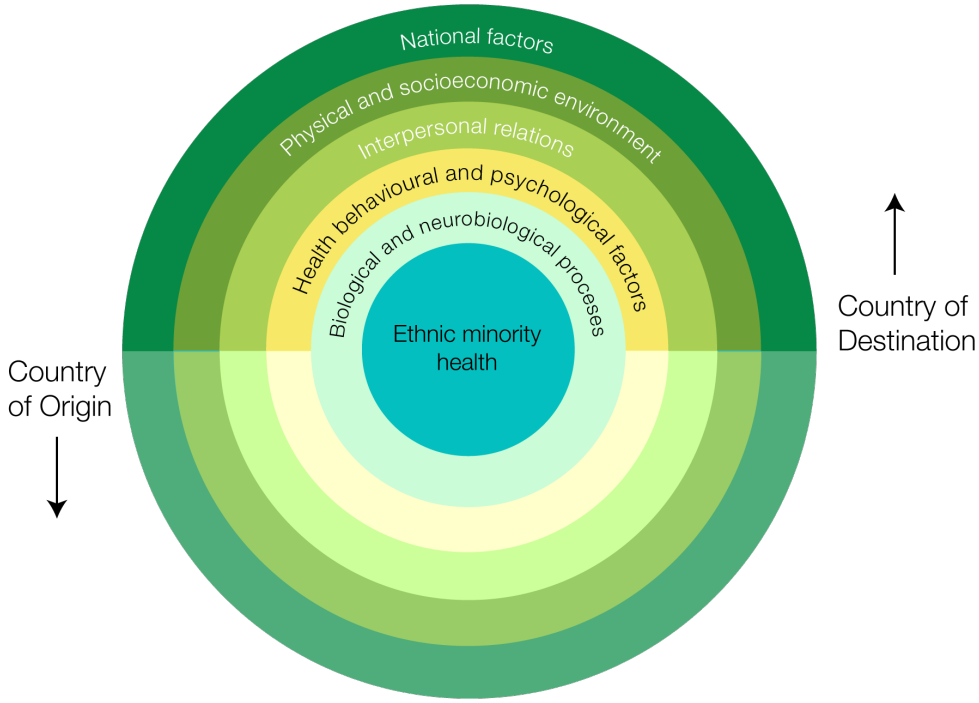
Linking the dots: a comprehensive model

The determinants assessed in this thesis do not act as separate or secluded determinants but are actually interlinked, and together they shape the health of ethnic minority groups. Inspired by Dahlgren and Whitehead's model[26], we propose a model that is specifically relevant for ethnic minority health, with the aim to understand the determinants and their interlinks more comprehensively. This may potentially help formulating new hypotheses and guide developing preventive policies and interventions.

Figure 2 depicts this model that shows how determinants at different levels are interlinked and how they collectively may impact health. We argue that this model is universally relevant for all ethnic minority groups, although the specific determinants within each level might differ by ethnicity – which was also observed in this thesis. Some determinants included in this model have explicitly been assessed in the thesis (Parts 2-4) while others have not. Our model varies from Whitehead and Dahlgren's model in two ways. First, we explicitly consider determinants from two different contexts: country of origin and country of destination. Evidence from refugee health studies indicates that both contexts impact health[27]. Hence this model adopts a life-course perspective, with the moment of migration as a life-changing event. Second, we specifically include ethnic-specific determinants, i.e. determinants that are specific to the lives of ethnic minority groups such as integration, racism, and ethnic identity. Various studies have shown that these determinants are relevant for the health of ethnic minority groups[1,28,29].

Starting from the most proximal factors in the model, we suggest that biological and neurobiological processes may determine ethnic minority health. These processes represent several biological systems, including, inter alia, hypothalamus-pituitary-adrenal (HPA) axis and autonomic nervous system. A new class of biomarkers, -omic biomarkers such as epigenetics and metagenome (e.g. intestinal microbiome), is increasingly receiving scientific evidence[30] and might also prove relevant in this research field, but to our knowledge evidence from ethnic minority groups is lacking. This also applies to research

Figure 2. Model on ethnic minority health and its determinants at different levels, both in the country of destination and country of origin.



on neurobiological processes (e.g. stress responsivity, neurochemistry), although it should be noted that the field of (social) neuroscience and public health is relatively new[31]. It seems that neurobiological processes are associated with health outcomes, as observed in studies conducted in white majority groups[31]. The relatively little research on biological and neurobiological processes conducted among ethnic minority groups show differences with white majority groups[17,32-34], hence evidence derived from latter groups might not be generalizable to ethnic minority groups.

These biological and neurobiological processes could, in turn, be influenced by other proximate factors such as health behaviours (e.g. physical activity, smoking) and psychological factors (e.g. mastery, self-esteem)[17,31]. Current health might be shaped by health behavioural patterns in both country of origin and country of destination[35,36]. Possibly, previous health behaviours in the country of origin, e.g. poor nutrition during childhood, may have lifelong health consequences in the country of destination[12].

At a level higher, interpersonal relations could impact health behaviours and psychological factors, as shown in Part 2 (PED) and Part 3 (parental smoking) of this thesis. We found associations of PED with behavioural factors (though variably across the groups). Unhealthy behaviours might be a way of coping with negative interpersonal relations[13,37]. Similarly, negative interpersonal relations may negatively impact psychological factors[5,7]. One of our

studies (not included in this thesis) found that PED was negatively associated with mastery, which in turn had a positive association with depression[38]. In another study, we observed that adult offspring's smoking is determined by parental smoking, which could be regarded as a proxy measure of interpersonal relations within a family. In addition, interpersonal relations not only in the country of destination may have health impact but also those in the country of origin. Evidence indicates that ethnic minority groups have depressive symptoms when their family's wellbeing is at jeopardy in the country of origin[39,40].

The next level comprises the physical and socioeconomic environment, which was partly addressed in Part 3 of this thesis. The physical and socioeconomic environment may include socio-economic status (SES), working conditions, food environment, and residential factors (e.g. segregation, housing conditions) both in the country of destination and country of origin. In Chapter 9, for example, we showed that other-group density in the residential environment is (though inconsistently) associated with ethnic minority health. Research suggests that the association between ethnic density of residential environment and health operates through interpersonal relations, amongst other factors[41]. Furthermore, as life-course studies have suggested that early childhood environment may shape adult health[17,42], it is possible that pre-migration physical and socioeconomic environment (e.g. low SES, lived in a polluted area) in the country of origin may influence ethnic minority health in the country of destination.

Moving more upstream, national factors (i.e. macro-social) both in the country of destination and country of origin may influence ethnic minority health. In Part 4 of the thesis, we assessed the association of national integration policies with mortality and depression in migrant groups in Europe. In Chapter 12, we showed that the gap in depression between host group and migrants was largest in countries with exclusionist policies, and this gap was reduced substantially after adjusting for income and discrimination. This suggests, consistent with our model, that socioeconomic environment and interpersonal relations possibly mediate the association between integration policies and ethnic minority health. We also showed that several social indicators (see Supplementary Table on pp. 252) are worse for migrants living in countries with exclusionist policies (vs. countries with other policy regimes), which is indicative of the role integration policies play in shaping physical and socioeconomic environments.

The different levels of determinants require, of course, different types of interventions. For the first three proximal levels, individual-based clinical and psychological interventions might prove beneficial. These interventions might be culturally adapted to better meet the needs of ethnic minority groups, and/or they may aimed at improving the intercultural competencies of those who provide care to an ethnic diverse patient population. So far, the evidence base for such interventions is rather weak[43,44].

For the more upstream levels, population-based interventions are required, that is, social policies in the country of destination. These policies could be those that specifically focus on ethnic minority groups (e.g. compulsory language courses, immigration policies) but also those that are relevant for the general population, such as anti-poverty measures or new taxation policies. Social policies may impact health behaviours, interpersonal relations,

physical and socioeconomic environment, and national factors. Currently, studies assessing the effects of social policies (including ethnic-specific policies) on ethnic minority health are scarce[45,46].

Implications

Research

Over the last two decades, research from Europe in this field has made great progress, but yet it is lagging far behind the US. This might be due to the higher influx of migrants and stronger socio-political representation of ethnic minority groups (e.g. Civil Rights movement) in the US, at a time in which public health research was emerging[47]. These demographic and social phenomena may have contributed to the institutionalisation of this topic in public health scholarship in the US[47].

Indeed, European researchers can draw inspiration from the US research and consider replicating it to examine its relevance for Europe. However, they should also acknowledge what unique perspectives they have to offer in this research field. The majority of the ethnic minority groups residing in Europe arrived in 1970-80s[48], so the European-based ethnic minority groups are relatively recent compared to those in the US (especially African Americans who constitute the main focus of much research[47]). The recent high influx of refugees and asylum seekers further contributes to this ethnic diversity[49]. This relatively recent demographic change has two benefits for scientific research: 1) it allows to investigate the direct health impact of migration processes (e.g. reason of and age at migration, duration of the migration process, migration journey to Europe); 2) it enables researchers to follow different ethnic minority groups over a long period, so the post-migration trajectory can be fully scrutinised to better understand how their health changes over time.

Another unique perspective European researchers can offer is the difference with the US in terms of social policies, and how that impacts ethnic minority health. It is generally known that there are more extensive welfare states in Europe than in the US[50]. Moreover, there seems to be considerable between-country variation in social policies within Europe, which makes it possible to assess the impact of this variation on the health of a particular ethnic minority group living in different European countries. Taking these unique European perspectives into consideration, we make four recommendations to advance this field.

First, more longitudinal studies are needed so that temporality can be better assessed. The longitudinal studies should aim to unravel the underlying mechanisms of the association between social determinants and ethnic minority health, with a specific focus on the biological and neurobiological processes. Understanding these processes would help to understand how social determinants such as discrimination 'get under the skin'[42,51,52], and how they ultimately impact health. This may strengthen the causal claims (i.e. biological plausibility) as well as provide potential entry-points for intervention.

Second, cross-national analyses are required in order to better understand how and through what factors macro-social determinants such as national integration policies impact ethnic

minority health. For such analyses, different comparative groups can be selected for various purposes (vs. country of origin, host group, similar group in other host countries). Comparisons with country of origin may assess the effects of migration, while comparisons with the host group in different host countries may identify 'local' health differences. Comparing the same group residing in different host countries may help assess the health impact of different contexts, but it would also allow overcoming the so-called 'healthy migrant effect'[53,54], assuming that the group would have experienced the same selective processes for the different host countries.

Third, more interventionistic studies are needed to create the evidence-base for policy aimed at improving ethnic minority health. For interventionistic studies we identify two themes: culturally-adapted interventions and social interventions or evaluation of social policies. Culturally-adapted interventions should only be conducted if the etiological drivers of the disease are culturally shaped. For example, diet and physical activity are important factors for diabetes, and evidence suggests that culture plays a crucial role in determining both factors through norm setting, cultural pride and expression[55]. Studies such as DHIAAN[56] and PODOSA[57] have assessed culturally-adapted interventions aimed at reducing diabetes and obesity rates among South-Asian migrants through culturally-adapted behavioural support. These studies serve as examples.

Studies on social interventions are also needed, by evaluating the health effects of policy changes or by using natural experiments. As mentioned, the policies studied should not only be those that specifically focus on ethnic minority groups, but also universal policies applicable to the general population. It could be possible that at the population-level the universal policies might have a worse or greater health impact for ethnic minority groups than for the white majority group. US studies, for example, have evaluated the impact of the Affordable Care Act on the access to medications and insurance rates, and found the effects to be more beneficial for racial/ethnic minority groups[58,59]. Similar approaches can be employed in European countries, to evaluate the health impact of social policies by using a before-after design and by stratifying data by ethnicity.

The last recommendation is to build transatlantic collaborations in this field, with the goal to align European and US research agendas in a transatlantic research agenda on ethnic minority health. Although the unique perspectives of Europe and US each should be cherished and fully utilised, a transatlantic agenda would help bring researchers with diverse experiences together to learn from each other and to develop fresh, innovative ideas. This may lead to better use of the available data and the limited resources. Such unified agenda has the potential to advance the field at a much higher pace, which might considerably benefit ethnic minority groups in Western countries.

Being more specific, transatlantic collaborations would allow conducting comparative studies regarding the biological and neurobiological processes and social policies. For example, in Part 2 of this thesis we often referred to similar US studies on PED. It might be interesting to assess how experiences of discrimination 'get under the skin' in different settings, and whether generalizable patterns on these processes can be identified. Interestingly, African Americans and African Surinamese have somewhat similar history with slavery and racism[9],

and for both groups experiences of discrimination seem to be consistently associated with adverse health outcomes. In addition, transatlantic collaborations may provide the opportunity to evaluate the health impact of social policies. US states and the European countries encompass an important variation in social policies (e.g. immigration laws) – possibly much greater variation than within Europe –, so it is interesting to assess whether and how these policies differently shape ethnic minority health. This would greatly expand our understanding and help inform future policies.

Policy

This thesis may have some policy implications. Findings from Part 1 of the thesis may have implications for priority setting in health policy and healthcare. Migrants from Eastern Europe, North Africa and Sub-Saharan Africa (women only) tend to have higher mortality than the host groups, mainly driven by higher mortality due to infectious diseases and CVD (including diabetes). As such, European countries that have a large number of people from these regions should have health policies and proper healthcare systems in place, to effectively respond to their higher burden of infectious diseases and CVD. Among migrants from Eastern Europe, for example, high rates of smoking or large alcohol consumption is of considerable concern[60,61] and require adequate and timely public health response.

In addition, for Amsterdam we estimated that the disease burden is likely to increase strongly in ethnic minority groups over the period 2010-2030. This increase is mainly driven by the ageing of ethnic minority groups who mostly arrived in the 1970s, and it becomes apparent especially in an increasing burden of cardiovascular and mental diseases. This has implications for the local public health department, general practitioners and local hospitals that are serving these groups. Based on the evidence regarding the factors driving the high rates of these diseases, policies and interventions should be developed to adequately address the health needs of these groups. Given the somewhat similar demography in other large cities in Netherlands (e.g. Rotterdam, Utrecht), we expect our recommendations to be relevant for these cities as well.

Conclusion

This thesis showed that ethnic minority health is shaped by social determinants in the country of destination in Europe. Unfavourable interpersonal relations as measured by perceived ethnic discrimination are associated with depression and cardiovascular risk factors. Social contextual factors at family, community, and residential level may determine ethnic minority health as well. Further, national integration policies may shape mortality and depression patterns in migrant groups, including the differences with the host groups. In order to obtain deeper understanding of ethnic minority health, longitudinal studies on biological and neurobiological processes, cross-national studies, and interventionistic studies are needed. This research field might benefit from collaboration with US researchers to explore new avenues and develop innovative ideas. This would not only help to advance the field but also to inform policymaking, with the ultimate goal of improving the health of ethnic minority groups in Europe and beyond.

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Summary

This thesis aims at assessing the association between social determinants and ethnic minority health in Europe. We examine social determinants at different levels and for each level we use at least one example. The thesis consists of four parts: i. overview of ethnic minority health, ii. perceived ethnic discrimination, iii. social context, and iv. policy context.

Part 1 provides an overview of the health of ethnic minority groups, by estimating the disease burden in 2011-2030 in Amsterdam (*Chapter 2*) and mortality in six European countries (*Chapter 3*). In *Chapter 2* we conclude that the disease burden for different ethnic minority groups will increase strongly in Amsterdam by 2030, while the disease burden for the Dutch host group will remain stable over the years. This strong increase in ethnic minority groups is mainly attributable to cardiovascular (especially diabetes) and mental health diseases. In *Chapter 3*, we observe that mortality patterns differ by migrant groups in European countries. Compared with the host groups, some migrant groups tend to have higher mortality whereas others had similar or lower mortality.

Part 2 examines the association between perceived ethnic discrimination (PED) and ethnic minority health. Overall, we show that PED is associated with depression and cardiovascular risk factors in ethnic minority groups in Amsterdam. However, as summarised in Table 1, the associations tend to differ by ethnicity and outcome, particularly for cardiovascular risk factors. The findings are most consistent for Surinamese subgroups, showing positive associations between PED and various health outcomes. This part makes two things clear. First, although few European studies have considered this ethnic-specific social determinant so far, our results indicate that PED is particularly relevant for ethnic minority health in Europe. Second, the ethnic variation in the associations, as observed, underscores the need to include various ethnic minority groups in epidemiological studies, as the results found in one group might not be generalised to other groups.

Table 1. Summary on the findings on perceived ethnic discrimination (PED) in relation to ethnic minority health in Amsterdam, the Netherlands

Chapter	Outcome	South-Asian Surinamese	African Surinamese	Ghanaian	Turkish	Moroccan
4	Depression	+	+	+	+	+
5	Smoking	+	+	+/-	0	0
5	Alcohol consumption	0	+	+	0	0
6	Obesity	+	+	0	+	0
7	Metabolic syndrome	+	+	0	0	+

+: Positive association. +/-: Inconsistent findings. 0: no association.

This thesis deepens our understanding on the associations between different aspects of social context and ethnic minority health, as examined in **Part 3**. We consider relatively new aspects that have received little attention in this research field (e.g. other-group density in residential environment, parental smoking). We show that ethnic minority health is shaped by aspects of the social context at the family, group, and residential level. At family level (*Chapter 8*), we find that parental smoking is strongly associated with adult offspring's

smoking behaviours in ethnic minority groups. The association is consistently strong in different socio-demographic strata (e.g. offspring's cultural orientation, co-habitation with parent) and in various groups, but stronger in gender-concordant pairs (e.g. mother-daughter). At group level (*Chapter 9*), we observe that a strong ethnic identity, religiosity, and larger ethnic social network weaken the association between PED and depressive symptoms, although the buffering effects differ by ethnicity. This helps to understand under what conditions (and for which groups) the mental health impact of PED is weaker. At residential level (*Chapter 10*), we show that the co-presence of Turks is associated with better self-rated health among Moroccans in Amsterdam, but not vice versa.

The final part of this thesis focuses on the association between integration policy context at national level and ethnic minority health in Europe (**Part 4**). We compare three policy contexts: inclusive, assimilationist, and exclusive. In *Chapter 11*, we observe that the mortality of Turkish and Moroccan migrants is higher in the country with an 'exclusive' policy context (characterised by few active integration policies and low levels of social and political tolerance), as compared to their counterparts residing in the countries with 'assimilationist' or 'inclusive' policy context. Moreover, the mortality differences with the host group are largest in the exclusive policy context. Similar findings are observed for depressive symptoms across migrant groups in Europe (*Chapter 12*). Additionally, we observe that in the exclusive policy context, income and discrimination explain most of the difference in depressive symptoms between migrants and host groups.

Samenvatting

Het doel van deze thesis om de associatie tussen sociale determinanten en de gezondheid van etnische minderheidsgroepen in Europa te onderzoeken. We kijken naar sociale determinanten op verschillende niveaus, waarbij we voor elk niveau ten minste een determinant onderzoeken. Deze thesis bestaat uit 4 delen: i. overzicht van de gezondheid van etnische minderheidsgroepen, ii. ervaren etnische discriminatie, iii. de sociale context en iv. het integratiebeleid.

Deel 1 geeft een overzicht van de gezondheid van etnische minderheidsgroepen, waarbij we kijken naar de ziektelast in de periode 2011-2030 in Amsterdam (*Hoofdstuk 2*) en de sterfte in zes Europese landen (*Hoofdstuk 3*). In *Hoofdstuk 2* concluderen wij dat de ziektelast voor verschillende etnische minderheidsgroepen sterk zal toenemen in 2030 in Amsterdam, terwijl de ziektelast voor autochtone Amsterdammers vrijwel stabiel blijft. Deze sterke toename is grotendeels toe te schrijven aan de toename van cardiovasculaire (vooral diabetes) en psychiatrische ziekten onder etnische minderheidsgroepen. In *Hoofdstuk 3* constateren we dat de sterftecijfers variëren naar etnische minderheidsgroep in Europa. Sommige groepen hebben hogere sterfte terwijl andere groepen juist lagere sterfte hebben, in vergelijking met de autochtone groepen.

In **Deel 2** onderzoeken we de associatie tussen ervaren etnische discriminatie (EED) en de gezondheid van etnische minderheidsgroepen. Over het algemeen zien we dat EED geassocieerd is met zowel depressie als cardiovasculaire risicofactoren in etnische minderheidsgroepen in Amsterdam. Echter, de associaties variëren naar etnische minderheidsgroep en uitkomstmaat, met name voor cardiovasculaire risicofactoren (zie Tabel 1). De resultaten zijn het meest consistent voor de Surinaamse subgroepen; voor bijna alle uitkomstmaten wordt er een positieve associatie met EED gevonden. **Deel 2** maakt twee dingen duidelijk. Ten eerste, onze resultaten suggereren dat EED relevant is voor de gezondheid van etnische minderheidsgroepen, terwijl tot dusver weinig Europese studies hier aandacht aan hebben besteed. Ten tweede, de geobserveerde variatie in de associaties onderstreept het belang om verschillende etnische minderheidsgroepen te includeren in zulke studies, omdat de resultaten van de ene groep niet per se gegeneraliseerd kunnen worden naar de andere groep.

Tabel 1. Samenvatting van onze resultaten over de associaties tussen ervaren etnische discriminatie (EED) en de gezondheid van etnische minderheidsgroepen in Amsterdam

Hoofdstuk	Uitkomst	Hindoestaanse Surinamers	Creoolse Surinamers	Ghanezen	Turken	Marokkanen
4	Depressie	+	+	+	+	+
5	Roken	+	+	+/-	0	0
5	Alcohol consumptie	0	+	+	0	0
6	Obesitas	+	+	0	+	0
7	Metabool syndroom	+	+	0	0	+

+: Positieve associatie. +/-: Inconsistente bevindingen. 0: Geen associatie.

Deze thesis geeft ons een dieper inzicht in de associaties tussen verschillende aspecten van de sociale context en de gezondheid van etnische minderheidsgroepen (**Deel 3**). We

onderzoeken relatief nieuwe aspecten die tot nu toe weinig aandacht hebben gekregen in dit onderzoeksveld, zoals de aanwezigheid van een andere etnische minderheidsgroep in de woonomgeving en ouderlijk rookgedrag. We laten zien dat de gezondheid van etnische minderheidsgroepen gevormd wordt door verschillende aspecten van de sociale context, op het niveau van familie, groep en woonomgeving. Op familieniveau vinden wij dat het ouderlijk rookgedrag sterk geassocieerd is met het rookgedrag van de volwassenen (*Hoofdstuk 8*). De associatie is consistent binnen de etnische minderheidsgroepen en verschillende sociaal-demografische strata. Ter illustratie, de associatie is even sterk, ongeacht of de volwassene wel of niet cultureel georiënteerd is op de Nederlandse cultuur, of wel of niet samenleeft met de ouder. We vinden niettemin dat de associatie sterker is in gender-concordante paren (bijv. moeder-dochter) dan gender-discordante paren (bijv. moeder-zoon). Op groepsniveau laten wij zien dat sterke etnische identiteit, religiositeit en een groter etnisch sociaal netwerk de associatie tussen EED en depressieve symptomen verzwakken (*Hoofdstuk 9*). Echter, het verzwakkende effect varieert naar etnische minderheidsgroep. Deze resultaten helpen ons om te begrijpen onder welke omstandigheden (en voor welke groepen) de impact van EED op mentale gezondheid zwakker is. Op het niveau van woonomgeving vinden wij dat de aanwezigheid van Turken geassocieerd is met betere ervaren gezondheid van Marokkanen in Amsterdam (maar niet andersom) (*Hoofdstuk 10*).

Het laatste deel van deze thesis onderzoekt de associatie tussen integratiebeleid op nationaal niveau en de gezondheid van etnische minderheidsgroepen in Europa (**Deel 4**). We vergelijken drie verschillende typologieën wat betreft integratiebeleid: inclusief, assimilationist en exclusief. Het inclusieve integratiebeleid wordt gekenmerkt door sociale en politieke tolerantie, respect voor culturele verschillen en mogelijkheden voor het verkrijgen van burgerschap op basis van geboorte- en woonplaats (Nederland wordt hiertoe gerekend). Het assimilationist integratiebeleid heeft vergelijkbare voorwaarden voor burgerschap, maar ontmoedigt de zichtbaarheid van culturele verschillen en verlangt het naleven van de republikeinse waarden (bijvoorbeeld Frankrijk). De kenmerken van het exclusieve integratiebeleid zijn: weinig actieve integratiebeleidsmaatregelen en beperkte sociale en politieke tolerantie (bijvoorbeeld Denemarken). In *Hoofdstuk 11* laten we zien dat de sterfte van Turkse en Marokkaanse migranten hoger is in het land met exclusief integratiebeleid, vergeleken met hun landgenoten woonachtig in landen met inclusief en assimilationist integratiebeleid. De sterfteverschillen met de autochtone groep zijn het grootst in het land met exclusief integratiebeleid. Vergelijkbare resultaten worden gevonden voor depressieve symptomen voor migrantengroepen in Europa (*Hoofdstuk 12*). Voorts laten we zien dat bij exclusief integratiebeleid (*Hoofdstuk 12*) inkomen en discriminatie het verschil in depressieve symptomen tussen migranten en autochtone groep grotendeels verklaren.

PhD Portfolio

Name PhD student: Umar Ikram

PhD period: March 2012 – June 2016

Name PhD supervisors: Prof Dr Karien Stronks, Prof Dr Anton Kunst and Dr Marieke Snijder

1. PhD training	**Year**	**ECTS[a]**
MSc Public Health at the London School of Hygiene and Tropical Medicine, London	2014-2015	180.0
Introduction to Health Economics		10.0
Principles of Social Research		10.0
Health Promotion Theory		10.0
Basic Statistics for Public Health and Policy		10.0
Issues in Public Health		10.0
Basic Epidemiology		10.0
Sociological Approaches to Health		15.0
Statistical Methods in Epidemiology		15.0
Social Epidemiology		15.0
Ethics, Public Health and Human Rights		15.0
Principles and Practice of Public Health		15.0
Project report		45.0
Courses at the AMC Graduate School for Medical Sciences, Amsterdam	2012-2013	5.2
Practical Biostatistics		1.1
Clinical Epidemiology		0.6
Advanced Topics in Clinical Epidemiology		1.1
PsycInfo		0.6
Reference Manager		0.6
Evidence-based Searching		0.6
AMC World of Science		0.6
Other courses	2014-2015	1.7
Causal Inference (Erasmus Summer Program, Erasmus University, Rotterdam)		0.7
Business Course (McKinsey & Co, Amsterdam)		1.0
Presentations		4.4
PvdA jongerencongres – topic: Ethnic health inequalities in Amsterdam	2013	0.5
Presentation for the Humanity in Action Summer Program – topic: Discrimination, racism and health	2013-2015	1.0
Talks in migrant community centres as part of HELIUS PR	2012-2014	2.0
Presentation for the Board of Directors of the AMC	2014	0.2
Presentations for HELIUS interviewers	2014	0.5
Presentation for the GGD Amsterdam on refugee mental health	2016	0.2
(Inter)national conferences		1.2
Oral presentation, ZonMw, Den Haag – topic: Discrimination and depression in ethnic minority groups in Amsterdam	2012	0.2

Poster presentation, 7th European Public Health Conference, Edinburgh, Scotland – topic: Integration policies and mortality in Europe	2014	0.2
Poster presentation, 7th European Public Health Conference, Edinburgh, Scotland – topic: Discrimination and health: the buffering effects of religion, ethnic social network and ethnic identity	2014	0.2
Poster presentation, EuroPrevent, Lisbon, Portugal – topic: The association between perceived ethnic discrimination and the metabolic syndrome	2015	0.2
Oral presentation, ADAPT meeting, Amsterdam – topic: Integration policies and immigrants' health in Europe	2015	0.2
Oral presentation, 6th European Conference on Migrant and Ethnic Minority Health, Oslo – topic: The association of parental smoking with adult offspring's smoking behaviours in ethnic minority families	2016	0.2
Other		
Registered scientific epidemiologist	2015	-
Peer-reviewed for several journals	2014-2016	-
2. Teaching		
Lecturing		3.7
Mini-symposium on diabetes & ethnicity for first-year medical students	2014-2015	0.2
Practicals on cultural differences in clinical practice; health literacy; professional language interpreters for medical interns	2013-2015	2.0
Practicals on diagnosing public health problems; social anamnesis for third-year medical students	2015-2016	1.0
Lecture on ethnic health inequalities in the Netherlands for sixth-year medical students (honours program)	2016	0.5
Supervising		9.0
MSc thesis entitled "The role of mastery in the relationship between perceived ethnic discrimination and depression" (Anne Slotman, Migration, Ethnic Relations and Multiculturalism, University of Utrecht)	2014	0.5
Thesis entitled "Homosexuality and mental health", as part of the elective global health course (Michelle Alders & Stella Vrijmoed, Medicine, University of Amsterdam)	2014	0.5
BSc thesis entitled "The association of perceived ethnic discrimination with abdominal and general obesity in ethnic minority groups – the HELIUS study" (Heiko Schmengler, Sciences, Amsterdam University College)	2015	2.0
BSc thesis entitled "The role of sexism and racism in the mental health of ethnic minority women: a review" (Stella Vrijmoed, Medicine, University of Amsterdam)	2015	2.0
BSc thesis entitled "Perceived ethnic discrimination in relation to smoking and alcohol consumption in ethnic minority groups in Amsterdam, the Netherlands: a cross-sectional analysis (Marlies Visser, Health and Life Sciencies, VU Amsterdam)	2015	2.0
MSc thesis entitled "The relationship between acculturation and psychological wellbeing among Ghanaians in Europe: the RODAM study" (Billie Kwayie, Health Sciences, VU Amsterdam)	2015	1.0
MSc thesis entitled "Intergenerational cultural dissonance and depressive symptoms in migrant families: a mixed-methods study" (Praiseldy Sasongko, Global Health, VU Amsterdam)	2016	1.0

3. Grants & Awards		
AMC Young Talent Grant	2012	-
McKinsey & Co Talentenbeurs	2013	-
Scholarship from Prins Bernard Cultuurfonds & Banning-de Jong Fonds	2013	-
Scholarship from Fundatie van Renswoude	2013	-
Scholarship from Hendrik Muller Fonds	2013	-
TOTAL ECTS		205.2

[a] 1 ECTS=28 hours of workload

List of publications

Articles included in this thesis

Umar Z. Ikram, Anton E. Kunst, Madja Lamkaddem, Karien Stronks. The disease burden across different ethnic groups in Amsterdam, the Netherlands, 2011-2030. Eur J Public Health 2013;24:600-605.

Umar Z. Ikram, Johan P. Mackenbach, Seeromanie Harding, Grégoire Rey, Raj S. Bhopal, Enrique Regidor, Michael Rosato, Knud Juel, Karien Stronks, Anton E. Kunst. All-cause and cause-specific mortality of different migrant populations in Europe. Eur J Epidemiol 2016;31:655-665.

Umar Z. Ikram, Marieke B. Snijder, Thijs J.L. Fassaert, Aart H. Schene, Anton E. Kunst, Karien Stronks. The contribution of perceived ethnic discrimination to the prevalence of depression. Eur J Public Health 2014;25:243-248.

Marlies Visser, **Umar Z. Ikram**, Eske M. Derks, Marieke B. Snijder, Anton E. Kunst. Perceived ethnic discrimination in relation to smoking and alcohol consumption in ethnic minority groups in the Netherlands: the HELIUS study. [In review]

Heiko Schmengler, **Umar Z. Ikram**, Marieke B. Snijder, Anton E. Kunst, Charles Agyemang. The association of perceived ethnic discrimination with general and abdominal obesity in ethnic minority groups – the HELIUS study. [In review]

Umar Z. Ikram, Marieke B. Snijder, Charles Agyemang, Aart H. Schene, Ron J.G. Peters. The association between perceived ethnic discrimination and the metabolic syndrome in ethnic minority groups: the HELIUS study. Psychosom Med 2016. [Epub ahead of print]

Umar Z. Ikram, Marieke B. Snijder, Matty A.S. de Wit, Aart H. Schene, Karien Stronks, Anton E. Kunst. Perceived ethnic discrimination and depressive symptoms: the buffering effects of ethnic identity, religion and ethnic social network. Soc Psychiatry Psychiatr Epidemiol 2016;51:679-688.

Eleonore Veldhuizen, **Umar Z. Ikram**, Marieke B. Snijder, Sjoerd de Vos, Anton E. Kunst. The relationship between ethnic composition of the residential environment and self-reported health among Turks and Moroccans in Amsterdam. [In review]

Umar Z. Ikram, Marieke B. Snijder, Eske M. Derks, Ron J.G. Peters, Anton E. Kunst, Karien Stronks. Parental smoking and adult offspring's smoking behaviours in ethnic minority groups: an intergenerational analysis. [In review]

Umar Z. Ikram, Davide Malmusi, Knud Juel, Grégoire Rey, Anton E. Kunst. Association between integration policies and immigrant's mortality: an explorative study across three European countries. Plos One 2015;10:e0129916. doi: 10.1371/journal/pone.0129916.

Davide Malmusi, Laia Palència, **Umar Z. Ikram**, Anton E. Kunst, Carme Borrell. Social, economic and political determinants of inequalities by immigrant status in depressive symptoms in Europe. [Resubmitted after revision]

Articles not included in this thesis

Umar Z. Ikram, Marieke B. Snijder, Thijs J.L. Fassaert, Aart H. Schene, Anton E. Kunst, Karien Stronks. Discriminatie en depressie bij etnische minderheden. Nederlands Tijdschrift voor Geneeskunde 2015;159:954-959.

Anne Slotman, Marieke B. Snijder, **Umar Z. Ikram**, Aart H. Schene, Gonneke W.J.M. Stevens. The role of mastery in the relationship between perceived ethnic discrimination and depression: the HELIUS study. Cultur Divers Ethnic Minor Psychol 2016. [Epub ahead of print]

Carme Borrell, Laia Palència, Xavier Bartoll, **Umar Z. Ikram**, David Malmusi. Perceived discrimination and health among immigrants in Europe according to national integration policies. Int J Environ Res Public Health 2015;12:10687-99. doi: 10.3390/ijerph120910687.

Umar Z. Ikram, Marie-Louise Essink-Bot, Jeanine Suurmond. How we developed an effective e-learning module for medical students on using professional interpreters. Med Teach 2015;37:422-427.

Charles Agyemang, Irene E. van de Vorst, Michiel L. Bots, Huiberdina L. Koek, Azizi Seixas, Marie Norredam, **Umar Z. Ikram**, Karien Stronks, Ilonca Vaartjes. Ethnic variation in prognosis of patients with dementia: a prospective nationwide registry linkage study in the Netherlands. [Accepted for publication in Journal of Alzheimer's Disease]

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Karien Stronks, Brigit C.A. Toebes, Aart C. Hendriks, **Umar Z. Ikram**, Audrey R. Chapman, Mariël Droomers, Paul Hunt, Ronald Labonte, Sridhar Venkatapuram. Equity, equality and human rights, the European Social Determinants of Health Review. Copenhagen: WHO Europe [In press]

About the author

Umar Ikram was born on 18 March 1986 in Amsterdam, the Netherlands. Umar is second-generation Pakistani-Dutch, whose parents migrated for socioeconomic reasons to the Netherlands in 1970s. He is the youngest of the five children. He grew up in a disadvantaged area of Amsterdam, and decided to study medicine with the dream to help vulnerable people across the globe.

During his studies, he became interested in public health, as he believed that it provided the tools to bring about social change. He co-founded a student organisation that aimed to increase awareness on public health issues among medical students through community health projects, debates and international study trips. He also co-founded a homework support group for migrant children in low-income areas of Amsterdam. To deepen his understanding, he gained international experience. He did a fellowship on human rights and minority issues in New York. He also did clinical internships in Pakistan and Namibia. He was further involved in coordinating a free eye project in rural areas of Pakistan for several years. In 2011, he obtained his medical degree (Cum Laude) from the University of Amsterdam.

He started his PhD at the Department of Public Health at the University of Amsterdam in 2012. During his PhD, he also did a Master in Public Health at the London School of Hygiene and Tropical Medicine. Along his PhD, he co-authored a chapter on ethics and human rights for the European Review on Social Determinants of Health for WHO Europe. He further co-authored a report on refugee mental health for the Health Council of the Netherlands, which was recently presented to the Dutch Minister of Health.

In the future, Umar aspires to become policymaker, so that he can fulfil his dream by developing policies and programs to address the structural factors that create social injustice and inequality.