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Migration and Health

Exploring the role of migrant status through register-based studies

Marie Nørredam

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Official opponents: Birgit Babitsch & Anders Foldspang

Correspondence: Section of Health Care Services, Department of Public Health, University of Copenhagen, Øster Farimagsgade 5B, 1014 Copenhagen, Denmark

E-mail: mano@sund.ku.dk

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THIS THESIS IS BASED ON THE FOLLOWING PUBLICATIONS CONCERNING THE HEALTH OF MIGRANTS IN DENMARK (NUMBERED IN ORDER OF APPEARANCE IN THE THESIS):

I. Norredam M, Garcia-Lopez A, Keiding N, Krasnik A. Risk of mental disorders in refugees and native Danes: a register-based retrospective cohort study. Soc Psychiatry Psychiatr Epidemiol. 2009 Dec;44(12):1023-9.
II. Norredam M, Garcia-Lopez A, Keiding N, Krasnik A. Risk of mental disorders in family reunification migrants and native Danes: a register-based historically prospective cohort study. Int J Public Health. 2010 Oct;55(5):413-9.
III. Norredam M, Krasnik A, Pipper C, Keiding N. Cancer incidence among 1st generation migrants compared to native Danes- A retrospective cohort study. Eur J Cancer. 2007 Dec;43(18):2717-21. Epub 2007 Nov 5.
IV. Norredam M, Garcia-Lopez A, Keiding N, Krasnik A. Excess use of coercive measures in psychiatry among migrants compared with native Danes. Acta Psychiatr Scand. 2010 Feb;121(2):143-51. Epub 2009 Jul 9.
V. Norredam M, Krasnik A, Pipper C, Keiding N. Differences in stage of disease between migrant women and native Danish women diagnosed with cancer: results from a population-based cohort study. Eur J Cancer Prev. 2008 Jun;17(3):185-90.
VI. Norredam M, Olsbjerg M, Petersen JH, Laursen B, Krasnik A. Are there differences in injury mortality among refugees and immigrants compared with native-born? Inj Prev. 2012 May 24. (Epub).
VII. Norredam M, Olsbjerg M, Petersen JH, Juel K, Krasnik A. Inequalities in mortality among refugees and immigrants compared to native Danes – a historical prospective cohort study. BMC Public Health 2012 10;12(1):757 (Epub).
VIII. Norredam M, Olsbjerg M, Petersen JH, Bygbjerg I, Krasnik A. Mortality from infectious diseases among refugees and immigrants compared to native Danes: a historical prospective cohort study. Trop Med Int Health 2012 Feb;17(2):223-30. (Epub 2011 Oct 27).

Paper V was included as one out of four papers upon which my PhD thesis is built (1). Papers I-IV and VI-XIII have not previously been assessed for an academic degree.

1. INTRODUCTION

1.1. Why explore migrant status?

The total number of international migrants in the world in 2010 amounted to 214 million, equivalent to 3% of the world's population, of which Europe hosted around 70 million (2,3). In Denmark, immigrants (7.9%) and their descendants (2.5%) constituted 10.4% (580,461) of the population on 1 January 2012 (4). Migrants thus constitute a significant and increasing proportion of the population on an EU level and in Denmark. One of the great challenges of migration is managing migrants' health needs. This is especially important because migrants may: a) have been exposed to a number of health risks related to migration, b) differ in disease profiles from non-migrants, and c) experience barriers to accessing health services in immigration countries.

I argue that investigating determinants of migrants' health outcomes is a significant issue to address for several reasons: It is important not only in order to promote the health of individual migrants but also so that the non-migrant population can benefit from lessons learned about the health protective factors associated with being a migrant. In addition, clinicians, health administrators, and politicians who work with migrant health require more knowledge within the area as a basis for informed care and decision making. Moreover, immigration countries have an interest in promoting migrants' health because poor health hinders the ability to integrate and thus to participate in and contribute to society. Finally, equity in health is a policy objective in Danish health law and that of many other EU countries. This implies that the health of all groups in society, including migrants, should be advanced in order to obtain equity in health for the entire population.

This thesis concerns one aspect of migrants' health, namely the role of migrant status. The intention of this thesis has been to document how migrant status affects health-related outcomes within a register-based cohort of migrants. In this thesis, migrant status is defined by the legal grounds for obtaining a residence permit, i.e. refugees versus family reunification immigrants, although other definitions do exist. I chose to explore migrant status for the following reasons. Firstly, migrant status is of interest as an indicator of migration processes including whether migration was forced or voluntary, which entail a series of exposures that may affect migrants' health in immigration countries.

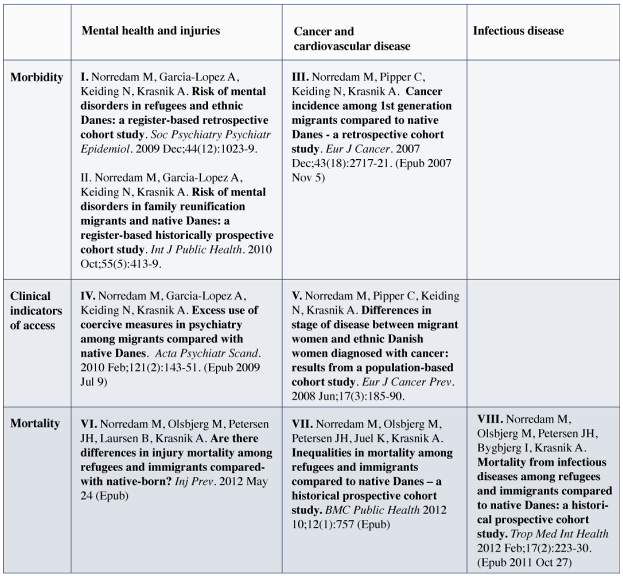
Consequently, exploring migrant status is of great importance for understanding migrants' health situation in Denmark and other immigration countries. Indeed, novel explanatory hypotheses concerning migrants' health outcomes revolve around migration processes and include perspectives related to life course epidemiology. Documenting the effect of migrant status may substantiate these hypotheses. Secondly, previous research within the field has to a very large extent focused on ethnicity including cultural characteristics as the main determinant of migrants' health whereas migrant status has been somewhat unexplored. This thesis, however, aims to document that migrant status may also contribute to the understanding of migrants' health outcomes. The papers of the thesis focus on migrant status but also include ethnicity, acknowledging that the two factors interact and are both of importance to migrants' health outcomes. Finally, through an exceptional cooperation with the Danish Immigration Service, it has been possible to explore migrant status according to legal grounds and hence to establish a unique migrant cohort (the AdultMigCohort) and a comparison group of native Danes due to the unique opportunities for performing register-based research in Denmark.

1.2. Background and structure of thesis

The papers of the thesis are all built around the population of the AdultMigCohort. The idea for the migrant cohort was conceived in 2004 in relation to my PhD dissertation (1). The aim of the PhD dissertation was to follow a cohort of asylum seekers prospectively from arrival in Denmark and onwards, using both survey and registry data. Among other reasons, this idea was abandoned because the number of new asylum seekers began to decrease during these years (in addition to which, fewer asylum seekers obtained residence permits), following the implementation of restrictive immigration policies. Instead, a historically prospective cohort was designed, using the opportunities for performing register-based research in Denmark. However, establishing the cohort was a lengthy endeavour, which limited time for analysis. Consequently, a series of papers built upon the cohort emerged in the years following my PhD defence in 2008. These papers are now part of the thesis.

he underlying assumption behind the papers of this thesis is that factors related to migration processes may influence migrants' health outcomes, explored through migrant status alone and in interplay with ethnicity. This abstract perspective is investigated through eight studies, which explore the problem from different disease perspectives, including: 1) mental health and injuries, 2) cancer and cardiovascular disease, and 3) infectious disease. These areas were chosen as they concern diseases of relevance to the study populations and because some of them allowed for investigation of clinical indicators of access to health care. In this thesis, I have chosen to present and discuss papers across disease entities according to three themes: 1) morbidity, 2) clinical indicators of access, and 3) mortality. Morbidity reflects factors related to the whole migration process whereas clinical indicators of access to health care are mainly related to factors in the immigration country. Finally, mortality may be viewed as an outcome of both morbidity and access to health care. Papers I-III focus on morbidity patterns for mental disorders and cancer. Papers IV and V investigate clinical indicators of access to health care, using the examples of mental disorders and cancer. Finally, Papers VI - VIII concentrate on all-cause as well as cause-specific mortality patterns from injuries, cancer, cardiovascular disease, and infectious disease respectively. Table 1 shows the included papers, divided thematically according to health-related outcomes and disease categories. This cross-comparison presentation of results was chosen in an attempt to emphasise commonalities according to migrant status across disease categories and to make a life course perspective more visible.

Table 1. Papers included in the thesis divided thematically according to health-related outcomes and disease categories



	Mental health and injuries	**Cancer and cardiovascular disease**	**Infectious disease**
Morbidity	**I.** Norredam M, Garcia-Lopez A, Keiding N, Krasnik A. **Risk of mental disorders in refugees and ethnic Danes: a register-based retrospective cohort study**. *Soc Psychiatry Psychiatr Epidemiol*. 2009 Dec;44(12):1023-9. II. Norredam M, Garcia-Lopez A, Keiding N, Krasnik A. **Risk of mental disorders in family reunification migrants and native Danes: a register-based historically prospective cohort study**. *Int J Public Health*. 2010 Oct;55(5):413-9.	**III.** Norredam M, Pipper C, Keiding N, Krasnik A. **Cancer incidence among 1st generation migrants compared to native Danes - a retrospective cohort study**. *Eur J Cancer*. 2007 Dec;43(18):2717-21. (Epub 2007 Nov 5)	
Clinical indicators of access	**IV.** Norredam M, Garcia-Lopez A, Keiding N, Krasnik A. **Excess use of coercive measures in psychiatry among migrants compared with native Danes**. *Acta Psychiatr Scand*. 2010 Feb;121(2):143-51. (Epub 2009 Jul 9)	**V.** Norredam M, Pipper C, Keiding N, Krasnik A. **Differences in stage of disease between migrant women and ethnic Danish women diagnosed with cancer: results from a population-based cohort study**. *Eur J Cancer Prev*. 2008 Jun;17(3):185-90.	
Mortality	**VI.** Norredam M, Olsbjerg M, Petersen JH, Laursen B, Krasnik A. **Are there differences in injury mortality among refugees and immigrants compared-with native-born?** *Inj Prev*. 2012 May 24 (Epub)	**VII.** Norredam M, Olsbjerg M, Petersen JH, Juel K, Krasnik A. **Inequalities in mortality among refugees and immigrants compared to native Danes – a historical prospective cohort study.** *BMC Public Health* 2012 10;12(1):757 (Epub)	**VIII.** Norredam M, Olsbjerg M, Petersen JH, Bygbjerg I, Krasnik A. **Mortality from infectious diseases among refugees and immigrants compared to native Danes: a historical prospective cohort study.** *Trop Med Int Health* 2012 Feb;17(2):223-30. (Epub 2011 Oct 27)

1.3. Terminology and definitions of migrants

This subchapter introduces basic terminology and definitions of relevance to the thesis. Terminology regarding migrants is often inconsistently used nationally and internationally in the public, academic, and political spheres. Overall, this reflects differences in national immigration histories as well as the great diversity of the populations in question, who may, for example, be defined by self-perceived ethnicity, legal status, or country of birth. Individuals of foreign background in European countries are, typically referred to as either immigrants or ethnic minorities. According to Statistics Denmark, immigrants are individuals born abroad to parents born abroad who are not Danish citizens, and descendants are individuals born in Denmark to parents born abroad (5). Migrants may come for education, work, refuge, or social ties, as addressed below, and stay for longer or shorter periods of time. Migrants as referred to in a Danish context are mainly international long-term migrants, defined by the United Nations (UN) as "a person who moves to a country other than that of his or her usual residence for a period of at least a year, so that the country of destination effectively becomes his or her new country of usual residence" (6). Ethnic minority (group) normally refers to a non-White population; or it may be used to describe a specific identifiable group, i.e. Romas (7). Ethnic minority (groups) differ from immigrants in the sense that they have often been settled for generations in the immigration countries and thus include descendants, the children of descendants, etc. whereas immigrants are 'newcomers'. Ethnic minorities may, however, also refer to indigenous populations that have never migrated, such as Roma or Inuit.

This thesis focuses on immigrants, as reflected in the choice of terminology, where I use migrants as an umbrella term for all groups of first generation immigrants including refugees unless

more specific distinctions are relevant. I chose to focus on non-Western long-term international migrants because: 1) they stay for a lengthy period or even all life in the immigration country; 2) non-Western migrants have increased by six fold in the population since 1980 and today compose the majority (59%) of migrants in Denmark (5);3) non-Western migrants mainly come from low or middle income countries with different disease patterns than are present in high income countries; 4) non-Western migrants' cultures differ most from native Danes, which may affect health and impede access to health care services. Two subgroups of long-term international migrants of mainly non-Western origin (including from the former Yugoslavia) are of concern to this thesis: refugees and family reunification immigrants. I will use these two terms when alluding to these groups.
Concerning refugees the Universal Declaration of Human Rights and other human rights documents affirms that all people have a fundamental right to seek asylum from persecution (8). Further, based on the 1951 UN Refugee Convention, a person can obtain asylum if she/he has "…a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality, and is unable to or, owing to such fear, is unwilling to avail himself of the protection of that country or return there because there is a fear of persecution" (9). In practice, the management of the highly politicised area of national asylum laws may differ over time within each country and the EU and also in comparison to the original UN documents, for example leaving room for granting refugee in scenarios that the convention does not take into account but also for more restrictive approaches due to shifts in governmental policies (10,11). Refugees may enter Denmark as spontaneous asylum seekers or as quota refugees. Asylum seekers are people who have crossed international borders in search of protection but whose claim for refugee status has not yet been decided (12). Asylum seekers arrive by their own means and live in asylum centres until a residence permit has been granted or denied. In contrast, quota refugees have already have been granted a residence permit upon arrival. Approximately 500 quota refugees arrive annually under an agreement between the Danish State and the United Nations High Commissioner for Refugees (UNHCR)(13). Contrary to refugees, family reunification immigrants constitute a group of voluntary migrants. In Denmark, family reunification may be granted to spouses, children, and other family members. Family reunification immigrants constitute a more heterogeneous subgroup, originating from high, middle, and low-income countries. The common denominator is that they immigrate primarily due to social ties. There is no clear definition of this group, and the grounds for granting family reunification differ between countries and with changing national policies. However, the right to family reunification is stated in the Universal Declaration of Human Rights and other international conventions (14-16).
The terminology for the background population in the immigration countries is also often unclear. I use the general term non-migrants, but when referring to the comparison group of the AdultMigCohort, I will use the term native Danes as they were specifically chosen on account of their being Danish born by Danish born parents. The decisions on terminology in the thesis and the individual papers are the outcome of a dynamic process involving many reflections and discussions, which have evolved over time. This is also mirrored by the somewhat different terminology that has been employed in the papers that constitute the thesis.

1.4. The Danish context

On 1 January 2012, the majority of immigrants in Denmark were from non-Western countries (59%). The most frequent non-Western countries of origin were: Turkey, Iraq, Bosnia, Iran, Lebanon, Pakistan, and the former Yugoslavia. Approximately a quarter of all immigrants living in Denmark were refugees (107,000) (17). New residence permits in 2011 were distributed as follows: skilled workers (9,389); students (15,358); EU-27 citizens (27,395); family reunification immigrants (3,396); and asylum, including quota refugees (2,249) (18).
Denmark is a relatively 'new' immigration country compared with former colonial countries like France and the United Kingdom. In 1952, Denmark was the first country in the world to adopt the United Nations Refugee Convention, and in 1956, about 1,000 Hungarians fleeing the Russian invasion became the first convention refugees to Denmark . In the late 1960s, the populations that we generally speak of today as migrants began to arrive. Due to the economic boom in this period, 'guest workers' were invited to Denmark, especially from Turkey, Pakistan, Morocco, and Yugoslavia. In 1973, the authorities put a stop to labour migration (19). Ten years later in 1983, Denmark passed the most liberal immigration law in Europe, for example making family reunification a legal right for individuals who had obtained asylum and during the asylum process. And introducing the de facto concept (20). Hence, in the 1980s and 1990s, the majority of migrants entering Denmark were refugees from Iran, Afghanistan, the former Yugoslavia, Somalia, and Iraq as well as family reunifications with refugees and labour migrants (21). The latest restrictions in the Alien Act came into force in 2002 implying that refugees obtain temporary residence permit for seven years and only permanent residence if they cannot be repatriated after these years. Moreover, the concept of de facto refugees were annulled and replaced by the more restrictive B-staus concept (22, 23). This resulted in a dramatic decrease in the number of residence permits for family reunification immigrants and asylum seekers and an increase in the number of residence permits for study and special skilled workers.
The migrant cohort forming the foundation of the papers in this thesis is based on migrants who came to Denmark in the 1990s. This period in Danish immigration history therefore deserves special attention. In the 1990s, two special laws were passed. In agreement with United Nations High Commissioner for Refugees, the Danish government in November 1992 implemented the so-called "Yugoslav Special Law", which entitled temporary residence for two years in Denmark to 20,00 Bosnians (24). After those two years, individual asylum procedures began, and a total of 17,000 Bosnians were granted asylum. The Yugoslav Special Law did not include any recommendations regarding individuals in ill health. In addition, the "Kosovo Special Law" was passed in 1999, entitling temporary residence in Denmark for six months at a time to 3,000 Kosovo-Albanians, who were evacuated from refugee camps in Macedonia in particular (25). Evacuated individuals were selected by a delegation from the Danish Immigration Service on the grounds of vulnerability, including whether individuals were elderly, ill, families with children, individuals with family in Denmark, and families from the same cities (26). The proportion of ill individuals among the 3,000 evacuated individuals is not available. The possible impact of this on the results of the papers is covered in the discussion.

1.5. Why migrant status is of interest to migrants' health

This subchapter serves to contextualise why migrant status is of interest in research on migrants' health. First, the concept of migration is defined, and the importance of migration processes for health outcomes is outlined. Next, an analytical life course model for analysing problems of migration and health is defined. Lastly, the relationship between the concepts and operational definitions of ethnicity and migration is delineated.

1.5.1. The nexus between migration and health

Migration can be defined as a movement of a person or group of persons for any length of time and includes both long-term and temporary migration as well as remigration and circular migration. Moreover, migration may take place across an international border or within a State (27,28). Also, a distinction must be made between forced and voluntarily migration, though the division between the two may sometimes be hazy, i.e. poverty may force people to immigrate. Forced migration implies that people have been forced to flee their homes to seek refuge elsewhere. Reasons include war, persecution, and natural disasters (29). In contrast, voluntary migration signifies leaving one's home of one's own free will in search of a better life elsewhere. In this context, the forces behind migration are often described as a combination of push and pull factors. Push factors include poverty, demographic growth, war, and political repression while pull factors include demand for labour, good economic opportunities, political freedom, and social ties (30). In short, migration is a multifaceted phenomenon that does not merely entail a geographical move but forms a complex dynamic social, economic, environmental, and cultural process of change. Migration may thus be viewed as a fundamental biographical life experience resulting in a change in life circumstances by which the migrant's life comes to differ from that of non-migrants (31).

Migration processes may be divided into different phases, each of which entails a number of health risks(32-38). The pre-migration stage involves exposures in utero and later in life and may include infectious agents, starvation, and malnutrition as well as lack of access to health care. Moreover, it may involve factors leading to migration such as poverty, war, violence, trauma, and torture. The second stage, migration itself, is the physical relocation of individuals from one place to another, which may also involve health hazards, including physical and mental stress. The third stage is the post-migration stage, which concerns the adjustment of the migrant to the social, political, economic, and cultural framework of the immigration country. Post-migration risk factors for ill health include uncertainty and waiting during asylum procedures, isolation, social marginalisation, loss of identity, language problems, barriers to health care, and discrimination. As a result of these migration-related exposures, migrants carry different risk factors and disease profiles than do non-migrants in immigration countries. Migrants may simultaneously experience more challenges in accessing health care services associated with 'newness' as well as language and communication barriers, which may lead to delays in diagnosis and treatment (1,39). Moreover, some experience legal barriers to access to health care (40, 41).

1.5.2. An analytical model of migration and health, based on a life course approach

Analytical understandings of migrants' health problems tend to focus on the context of the immigration country, excluding past exposures during migration and in the emigration country. This deficiency is overcome by applying a life course approach as a theoretical model for studying migrant health. Originally developed by social scientists, the approach has more recently been adapted by epidemiologists (42,43). Life course epidemiology provides an aetiological model that integrates biological and psychosocial exposures during gestation, childhood, adolescence, and adult life with the aim to examine their effects on later-life health outcomes. Migration fits well into a life course perspective because migration forms an event or, rather, a series of events that evolve over time (44,45). The geographical migration itself is a defined event in time, and the events leading up to and following migration, including their health consequences, are spread out over a life course. Thus, migrants' health is in part determined by exposures during the pre-migration, migration and postmigration stages, which are not experienced by non-migrants in the immigration country.

Spallek et al. (45) have developed a life course-based analytical model of migration and health to determine which factors and exposures in the life course of migrants should be considered by researchers in migrant studies in order to better understand migrants' current health situation. The analytical model, which is in line with the aforementioned classic division of risk factors according to migration stages, helps clarify the health situation of migrants and the health differentials they experience compared with non-migrants. In this context, it should be noted that migration also entails positive effects on health, i.e. migrants may experience a positive health transition as they often move from low income countries to high income countries with more advanced access to health care. Figure 1 shows an adaption of the model proposed by Spallek et al. (45). The model has been altered to include the health outcome themes of the papers of this thesis: morbidity, clinical indicators of access, and mortality. In addition, descendants have been excluded. Arrows have been added to Figure 1 to indicate that although this thesis emphasises international migration from emigration countries to immigration countries, it is important to keep in mind that migration processes are not always unidirectional but include remigration and circular migration. The arrows also signify that although the general tendency for migrants is to move from low and middle income countries to high income countries, reverse economic migration from high income countries to low and middle income countries increasingly takes place due to the economic crisis in Europe and the growing new economies in Africa and South America. On this note, some international migration processes are very likely similar to intranational migration processes from rural to urban areas in relation to health exposures and outcomes. Intranational migration processes are not, however, included in the figure. Finally, ethnicity and socio-economic status is included in the time line to stress their interaction with migration processes.

Figure 1 shows that the health situation of migrants is influenced by factors operating during the different periods of migration. A few examples will illustrate this. Firstly, in the country of origin, migrants may be exposed to a high incidence of infectious agents, which may lead to increased morbidity in later life, such as cancers (46-48) and stroke (49) related to infectious diseases. Another example is that the pre-migration period may include malnutrition and restricted foetal growth, which, according to the "thrifty phenotype hypothesis", may influence the occurrence of adult metabolic and other diseases (50). This relates to more general theories about and documentation on the "developmental origins of health and disease", which propose that a wide range of environmental conditions during embryonic development and early life determine susceptibility to disease during adult life (51,52). This is also related to the increasing evidence that environmental exposures from early life and on are associated with changes in epigenetic features of the individual's genome (53,54). Secondly, in relation to the migration stage, physical and mental stress – including violence, abuse and lack of access to medical care – may occur, potentially leading to chronic disease and mental disorders later in life. Thirdly, in the post-migration period, prolonged asylum-seeking, low socio-economic status, discrimination, psychological stress, change in health behaviour, and problems accessing care may be associated with an increase in mental and chronic disease.

Figure 1. An analytical model of exposures and health outcomes among migrants related to international migration processes based on a life course approach. The model is adapted by the author from Spallek et al. 2011.

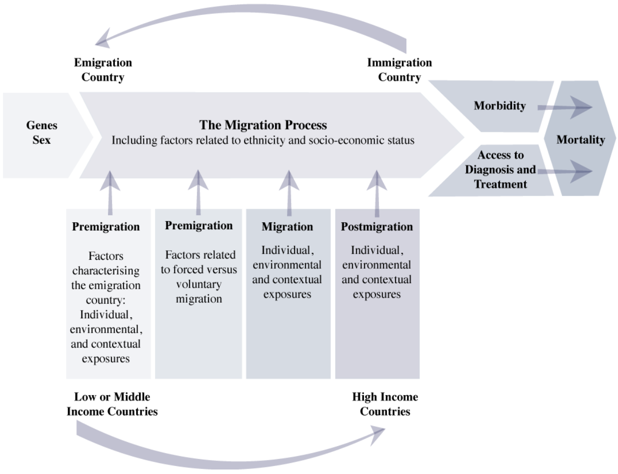


Figure 1 shows that the relationship between migration and health is complex and multifaceted. Ideally, the analysis of migrants' health should include all aspects mentioned in the figure because only if all individual and contextual factors are understood may the influence of a single factor be appropriately analysed. This scenario is regrettably unrealistic in its most ideal version as it would require a longitudinal prospective follow-up study following a birth cohort of migrants in the emigration country and onwards. Instead, researchers generally have to disentangle as many factors as possible using the data available in the immigration country. Consequently, this thesis is built on a cohort of migrants who came to Denmark at different ages and only migrant status and ethnicity are used as proxies of past and present exposures. It is important to be explicit about these limitations; however, this approach does not make a life course perspective less relevant as an analytical framework.

1.5.3 .On ethnicity and its relationship to migration

So far, research on migrant health in Europe has largely focused on ethnicity as a determinant of health outcomes among migrants and ethnic minorities (55,56). Ethnicity is often seen as an attribute of minority groups, but in reality, everyone has an ethnic background, defined as a sense of group belonging, based on ideas of common origins, history, cultures, experiences, and values (57). Thus, ethnicity refers to linguistic and cultural practices through which collective identity is produced and transmitted – and sometimes changed – from generation to generation. This explanation is in line with the concept of 'situational' ethnicity developed by the Norwegian anthropologist Frederik Barth, which views ethnicity as a heterogeneous and dynamic concept (58). This is in contrast to a 'primordial' static concept that individuals are born into. The concept of 'situational ethnicity' fits well within the framework of migration in that ethnicity can be seen as resulting from the novel boundaries that migration entails. Migration processes thus shape ethnicity (1).

This thesis adheres to the theory of ethnicity as 'situational ethnicity' but builds on the pragmatic reality of epidemiology, where register-based measurements of ethnicity are closer to the concept of 'static ethnicity'. This is also reflected in the definition of ethnicity proposed by Bhopal in the context of epidemiological research on migrants' health, where "ethnicity is the social group a person belongs to, and either identifies with or is identified with by others, as a result of a mix of cultural and other factors including language, diet, religion, ancestry, and physical features traditionally associated with race" (59). This thesis builds on Bhopal's definition, which is relevant when using register-based 'static' data. However, it is important to recognise that measuring ethnicity in epidemiological studies is a great challenge for researchers. Overall, the literature classifies individuals according to ethnicity based either on objective or subjective criteria (60). The most used objective definition is country of birth and nationality, and the most used subjective definition is self-assessed ethnicity. Self-assessed ethnicity has gained favour for reasons of validity, yet such data is not available in Danish registers. In this thesis, nationality upon arrival is used as a proxy for ethnicity.

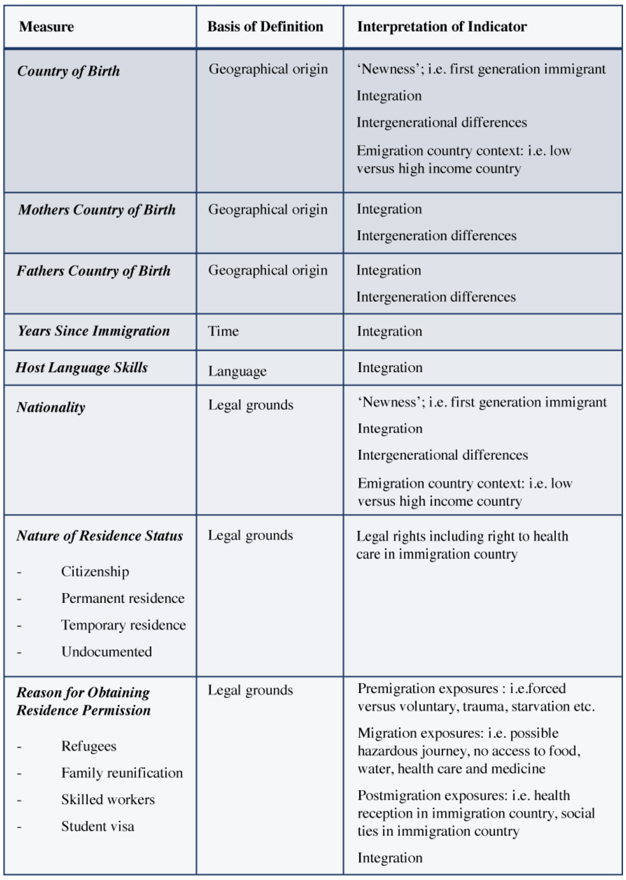
Ethnicity is indeed relevant when studying cultural, normative, and behavioural aspects, especially among migrants and ethnic minority groups that are well established in immigration countries, but I argue an explanatory dimension linked to migration processes has been lacking in epidemiological studies. From my perspective, ethnicity and migrant status represent equally important but different epidemiological determinants when exploring 'the effect on health' of being a migrant. Unfortunately, they are often treated separately and are rarely described as interconnected processes. The intention of this thesis is not to marginalise the importance of ethnicity. Indeed, nationality as a proxy for ethnicity is included in all papers. Rather, an original approach of this thesis lies in its investigation of how migrant status alone and in interplay with ethnicity affects migrants' health outcomes and access to health care.

1.6. Migrant status as a variable in epidemiological research

The unique approach of the papers included in this thesis lies in their exploration of migrant status as an epidemiological determinant of health outcomes and access to health care. In most papers (I, II, IV-VIII) migrant status is used as an exposure group, and in one paper (III) only as a covariate. This subchapter elaborates on and frames migrant status as an epidemiological variable in research on migrants' health.

The literature does not operate with a clear definition of migrant status as a variable in epidemiological research on migrants. Consequently, papers referring to migrant status in epidemiological studies use different measures, and only a few theoretical papers attempt a more systematic definition of the concept and suggest operationalisations of it (31,61). Perhaps this lack of consensus is related to the fact that different measures of migrant status exist and that measures of migrant status are rough proxies for complex underlying mechanisms. The latter is not, however, so different from many other epidemiological variables, including ethnicity and socio-economic status, that attempt to indicate underlying phenomena of interest that are difficult or impossible to measure directly. Table 2 provides examples of selected measures of migrant status as used in the literature (62-70). These measures form a heterogeneous group, which generally define migrant status according to the following: 1) geographical origin, 2) time, 3) language skills, and 4) legal grounds. Migrant status defined by geographical origin becomes a potential indicator of newness (newcomer/1st generation versus descendant), which is again related to integration and intergenerational differences. Additionally, geographical origin may be seen as a proxy for the emigration country context (i.e. low versus high income country). Migrant status based on time relates to degree of integration where long duration of residence suggests higher degree of integration although this is not necessarily the case. Likewise, migrant status based on language skills also relates to degree of integration implying that integration is higher the more fluently the language of the immigration country is spoken. In contrast, definitions based on legal/juridical grounds concern a number of other factors. Thus, nature of residence status, concerns legal rights related to citizenship or lack thereof, and reason for obtaining residence permit concerns migration processes (see below). Nationality is defined on legal grounds but most often used as an indicator of country of birth rather than citizenship. This is also the case in this thesis. Consequently nationality concerns similar aspects as country of birth. Which migrant status measure to use depends, of course, on the scientific problem and the availability of data. Moreover, measures may be used alone or in combination.

Table 2. Selected measures of migrant status in the literature and their characteristics

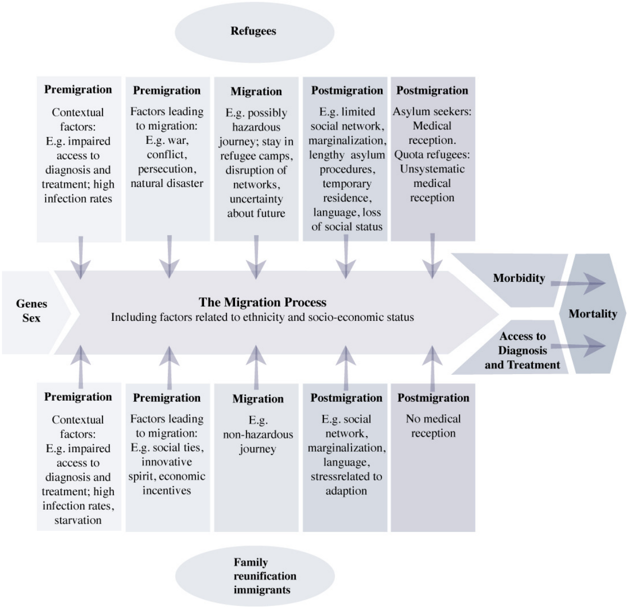


Measure	Basis of Definition	Interpretation of Indicator
Country of Birth	Geographical origin	'Newness'; i.e. first generation immigrant Integration Intergenerational differences Emigration country context: i.e. low versus high income country
Mothers Country of Birth	Geographical origin	Integration Intergeneration differences
Fathers Country of Birth	Geographical origin	Integration Intergeneration differences
Years Since Immigration	Time	Integration
Host Language Skills	Language	Integration
Nationality	Legal grounds	'Newness'; i.e. first generation immigrant Integration Intergenerational differences Emigration country context: i.e. low versus high income country
Nature of Residence Status - Citizenship - Permanent residence - Temporary residence - Undocumented	Legal grounds	Legal rights including right to health care in immigration country
Reason for Obtaining Residence Permission - Refugees - Family reunification - Skilled workers - Student visa	Legal grounds	Premigration exposures : i.e.forced versus voluntary, trauma, starvation etc. Migration exposures: i.e. possible hazardous journey, no access to food, water, health care and medicine Postmigration exposures: i.e. health reception in immigration country, social ties in immigration country Integration

In this thesis, I use the legal grounds for obtaining a residence permit as a proxy for migrant status. This definition is grounded on whether individuals received residence permit in Denmark on the basis of a refugee status or through family reunification. This definition of migrant status may express past exposures during the pre-migration stage as well as on the nature of the migration stage and post-migration risk factors related to the immigration countries. Both refugees and family reunification immigrants are characterised by being born abroad and are thus first generation migrants. This implies that they are faced with similar challenges of being a newcomer in the immigration country including language barriers, discrimination etc. However, refugees and family reunification immigrants differ from one another for the following reasons. Firstly, refugees are forced migrants whereas family reunification immigrants are in principle voluntary migrants emigrating due to social ties or other opportunities. Consequently, refugees may have been exposed to war, trauma, and hazardous life circumstances, and the migration itself may have been unsafe. In contrast, family reunification immigrants have not usually been personally persecuted and have not usually had a hazardous journey. Having said this, family reunification immigrants form a diverse group, and family members reunified with refugees may also have experienced trauma. Secondly, more family reunification immigrants come from Western countries implying high or middle income countries compared to refugees which implies more advanced health care services and better access to health care than many low income countries. Moreover, they are less likely to have been exposed to factors such as infections and malnutrition. Thus, in the AdultMigCohort 18% of family reunification immigrants come from Western countries whereas this is only the case of 0.1% of refugees. Thirdly, refugees differ from family reunification immigrants in relation to their health reception in Denmark. Most refugees are offered a medical examination upon arrival in Denmark: Asylum seekers receive a systematic screening offer upon arrival at the Sandholm Lejren reception centre, and some quota refugees are offered medical examination in the respective municipalities in which they are located (71). In contrast, no such systematic screening is offered to family reunification immigrants. Figure 2 represents a modification of Figure 1 and attempts to pinpoint life course exposures more specifically related to being either a refugee or family reunification immigrant.

The methodological area of the thesis lies within social epidemiology. Social epidemiologists work to explain the health consequences of systems of social stratification and structure. Migrant status as well as ethnicity may be considered new variables in this context. Senior & Bhopal (72) have proposed three attributes of a sound epidemiological variable: 1) It should differentiate populations according to underlying characteristics relevant to health. 2) The observed differences in patterns of disease should generate testable aetiological hypotheses or be applicable to the planning and delivery of health care. 3) It should be accurately measurable. I argue that migrant status, defined by one's legal grounds for obtaining a residence permit, fulfils these criteria. Migrant status differentiates people according to past and present exposures that are relevant to health, and it allows for the generation of aetiological hypotheses or interventions applicable to the planning and delivery of health care. Moreover, residence permits are based on a standard definition provided by the Danish Immigration Service in accordance with international conventions; albeit changing national immigration policies to some degree may influence the administration of residence permits.

Figure 2. An analytical model of migration related health exposures in relation to refugees and family reunification immigrants. The model serves to explain exposures related to migrant status defined on legal grounds. The model is based on Figure 1.



1.7. Framing the new field of research in a European context

This subchapter aims to portray the societal and academic context as well as the current status of the field of research in which the thesis is set.

1.7.1. The societal and academic context

From a societal perspective, there are strong pragmatic and moral reasons for immigration countries to address the health of migrants and ethnic minorities. The pragmatic argument entails that immigration countries have an interest in sustaining migrants' health because integration facilitates health, and by the same token, health is a prerequisite for integration. Additionally, migrants contribute via direct and indirect taxes and often take on jobs that non-migrants are unwilling to carry out. The moral argument builds on equity in health and implies that the highest attainable health is a fundamental human right and that immigration countries are therefore obliged to promote migrants' health and provide access to care (73). However, the historical attention devoted by politicians to migrant and ethnic minority health in different European countries vary uniquely in accordance with the immigration history of each country. Ex-colonial countries like the UK have focused for decades on ethnic diversity in health and health care, in contrast to 'new' immigration countries like Denmark.

Within the academic world, social sciences such as sociology and anthropology considered the impact of ethnic background and migration processes early on. In contrast, medical researchers often excluded and still often exclude migrants and ethnic minority groups from clinical trials and surveys (74). This is in part due to a lack of interest in the topic and in part due to migrants and ethnic minorities probably being considered too problematic to include as a result of excess costs and methodological difficulties, including language barriers and cultural and biological diversity. Moreover, register-based studies have not accounted for migrants and ethnic minorities due to lack of information on ethnic background and migrant status in national registers. In the USA, this practice discouraged with the passing of a law in 1993 that required medical researchers to include ethnic minorities in order to qualify for funding from the National Institute of Health (75). No equivalent requirements exist in Europe. Because of the USA's long multi-ethnic history and the 1993 law, the contrast between the research records of the USA and Europe is stark. Nevertheless, over the past 20 years, research on migrant and ethnic minority health has emerged as a discipline in its own right in a European context.

1.7.2. A dynamic new field of research within Public Health

The emerging field of research has mainly been pioneered within public health institutions around Europe. Public health has been defined as "the efforts organised by society to protect, promote and restore people's health" (76). Among the highest priorities of public health research, policy, and practice is the reduction of inequalities by improving the health of worse-off groups so they converge with that of the best-off (75). It is thus not unnatural that the guiding academic agenda for the field of research has its roots in public health because factors related to migration processes and ethnicity may lead to inequalities. Equity in health is defined here in accordance with Whitehead, implying that "ideally everyone should have a fair opportunity to attain their full health potential and, more pragmatically, that no one should be disadvantaged" (77). Apart from the theoretical framework of equity, migrant and ethnic minority health is increasingly studied within a human rights framework, arguing that the right to health (care) is universal and that the lack of social and civic rights may promote ill health. The right to the highest attainable standard of health is reflected in the World Health Organisation Constitution of 1946 (78) and other fundamental WHO declarations (79,80) as well as in several international human rights documents, including the Universal Declaration of Human Rights (81,82). This framework has received increasing attention in relation to access to care for vulnerable migrant groups such as undocumented migrants, asylum seekers, and unaccompanied minors. In this light, the overall agenda of the thesis is to reduce potential inequities in health between migrants and non-migrants.

Beyond these overarching theoretical frameworks, the field considers a large number of research themes, the common denominator of which is the target group in question, heterogeneous though this group may be. This makes the field's scope very broad as it concerns many areas of health and access to care yet also very narrow as it only concerns a minority of the total population. This may explain why no clear definition of the field exists. Three areas are of overall concern: a) health outcomes and their determinants; b) access to and quality of health care; and c) health policies. The field is referred to by several names, including migrant health, migration and health, ethnicity and health, and even migrant and ethnic minority health. Use of terminology overall depends on whether emphasis is on migration processes or ethnicity, which again reflects the accent of the unique research problem and the individual research environment. Initially, focus was on ethnicity in particular, whereas the impact of migration processes receives increasing attention today. Notwithstanding this thesis' emphasis on the importance of migration processes, I apply the comprehensive heading migrant and ethnic minority health as it simultaneously recognises the importance of migration processes and ethnic background.

1.7.3. The state of progress of the field of research

The field of research is interdisciplinary, integrating medicine, social sciences, and humanities and drawing on both quantitative and qualitative research methods. So far, epidemiological studies have established associations and documented inequalities in morbidity and mortality patterns as well as differences in health care utilisation across Europe for migrants and ethnic minorities compared with majority populations. Simultaneously, surveys and qualitative research have been added to understand the causes and mechanisms of these inequalities. However, a variety of challenges remain to be addressed (75,83). Firstly, research suffers from a lack of standardised categorisations of ethnicity and migrant status, hampering comparisons within and across countries. Secondly, data is often derived from local studies and thus does not provide a national or pan-European perspective. Thirdly, certain study designs are rare in practice, for example intervention studies and quality of care studies. Fourthly, studies of gene-environment interactions are needed as they may illuminate the complex aetiological processes behind the increase in chronic diseases such as diabetes among migrants and ethnic minorities. Finally, studies based on a truly global perspective including data from the emigration country are needed.

The field's evolution in a European context has resulted in an increasing number of available publications over the past ten years. These include peer-reviewed publications as well as a number of books addressing a wide range of problems related to migration and ethnicity using both quantitative and qualitative methods (84-89). In addition, four conferences on Migrant and Ethnic Minority Health in Europe have been held under the leadership of the European Public Health Association's Migrant Section. Finally, the EU has funded several high-profile programs to promote meetings and cooperation among researchers within migration and ethnic minority health in Europe, further consolidating the field.

2. PURPOSE OF THE THESIS

The intention of this thesis is to explore migrant status alone and in interplay with ethnicity as a determinant in register-based studies on migrant health. The thesis is based on eight studies investigating the following three overall study questions, based on a cohort of migrants and a native Danish comparison group:

1. What is the importance of migrant status alone and in interplay with ethnicity for morbidity among migrants compared with native Danes? (Papers I-III)

2. Does migrant status alone and in interplay with ethnicity affect clinical indicators of access among migrants compared with native Danes? (Papers IV-V)

3. What is the importance of migrant status alone and in interplay with ethnicity for mortality among migrants compared with native Danes? (Papers VI-VIII).

3. POPULATION AND METHODS

3.1 Study design

I designed a historically prospective cohort study to investigate differences in health outcomes and health care response among migrants compared with non-migrants. The cohort design involved following a group of individuals: in this case, refugees and family reunification immigrants matched on the basis of age and sex with a native Danish comparison group. The cohort is historically prospective in the sense that it was established back in time and then followed prospectively for new information available at each follow up in 2005 and 2009 respectively (90).

3.2. Study population

This subchapter describes how the AdultMigCohort, which forms the population of all the papers, was established.

3.2.1. The Danish Immigration Service

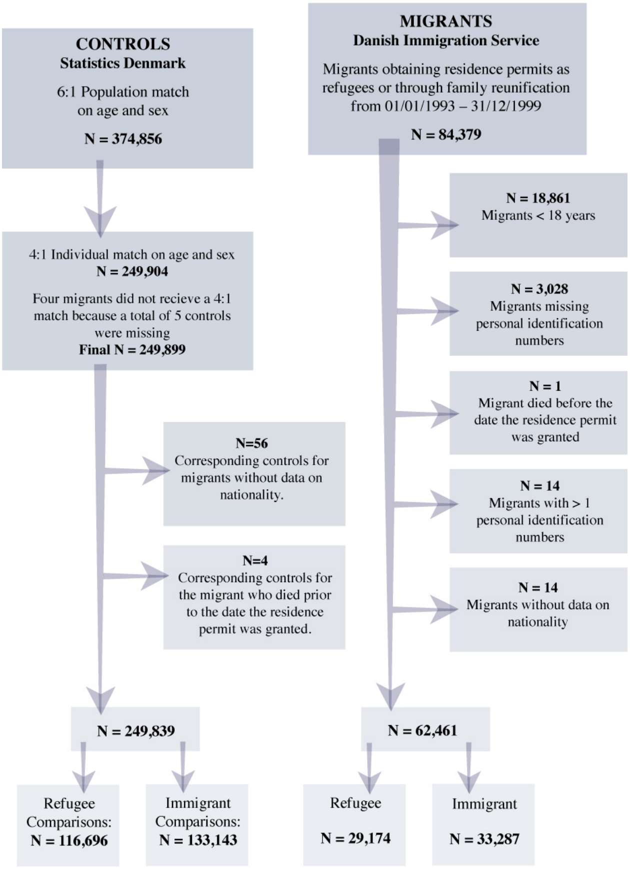
The migrant cohort was obtained through the Aliens Register at the Statistical Department of the Danish Immigration Service. This was an alternative approach as Statistics Denmark is the most frequently used source for population data in Denmark. Statistics Denmark registers data on country of birth and nationality (which is updated continuously); however, I wished to study migrant status as a determinant of migrants' health outcomes using the legal grounds on which migrants obtained residence permits as a proxy for migrant status. I therefore contacted the Danish Immigration Service, which is the authority in Denmark that grants residence permits. This approach enabled me to identify individuals who obtained residence permits as refugees or through family reunification. The Statistical Department at the Danish Immigration Service began systematically registering residence permits on 1 January 1993. Data registered before this date is not considered valid.

Our population data set from the Danish Immigration Service contained eight variables: nationality (citizenship upon arrival), sex, birth year, foreigner identification number, personal identification number, date of entry, date of residence permit, and legal grounds for residence permit. A few of these variables deserve further explanation. The foreigner identification number is an identification number granted to all migrants whose cases are being processed by the Danish Immigration Service. The personal identification number replaces the foreigner identification number when a residence permit is granted, but the migrant must actively go to the local municipality where he/she resides in order to receive a personal identification number. A total of eight subgroups of residence permits existed. Refugees obtained residence permits on the following legal grounds: 1) convention status; 2) de facto status, including B-status ; 3) quota refugees; 4) applicants from abroad/embassy refugees; 5) asylum on other grounds, including humanitarian grounds such as severe illness. Family reunification was obtained on the following grounds: 1) family reunification with refugee; 2) family reunification with immigrant; 3) family reunification with a Danish or Nordic citizen. In general, for quota refugees, embassy refugees, and family reunification immigrants, the entry date to Denmark is after the date of residence permit because these groups apply and obtain residence permits from their countries of emigration. In contrast, all other refugees (convention status; de facto, including B-status; and other grounds) have a date of entry that is prior to the date of residence permit because they apply and obtain residence permits while staying in Denmark.

3.2.2. Establishing the migrant cohort

The cohort is composed of migrants who obtained residence permits in Denmark as refugees or through family reunification from 1 January 1993 to 31 December 1999. Migrants were included consecutively during this period. The entry date into the cohort was defined as the date when the residence permit was granted. Regarding entry dates for refugees, a peak was observed in 1995 due to the Balkan wars of the 1990s. In contrast, family reunifications were more evenly distributed throughout the inclusion period. The date of study end (31 December 1999) was somewhat arbitrarily chosen as it was considered that a sufficient number of individuals had been enrolled for statistical analysis by that point. In the studies individuals in the cohort were followed from entry date until one of the following exit date events: 1) date of study end; 2) date of death; or 3) date of first emigration. Follow-up time was calculated from the entry date/date of residence permit until one of the exit date events took place. The first data linkage in 2005 included data from 1 January 1993 to 31 December 2003, and the second data linkage in 2009 naturally allowed for a longer follow up as it included data from 1 January 1993 to 31 December 2007 and 31 December 2008.

Figure 3. Selection of the study cohort and matching procedure



In total, 84,379 migrants obtained residence permits during the inclusion period. Figure 3 shows the selection of the cohort, including the matching procedure. Individuals who were <18 years of age (n=18,861) on the date of obtaining a residence permit were excluded. In addition, 3,028 migrants were excluded due to missing personal identification numbers. One migrant had died before the date on which the residence permit was granted. Another 14 were excluded because their personal identification numbers appeared more than once. Reasons for missing and 'double' personal identification numbers were explained by the Danish Immigration Service as follows: Firstly, as mentioned above, individuals who obtained family reunification received permits while living in the country of emigration. The permits contained a foreigner identification number and allowed for one year's entry to Denmark. If they never emigrated within this year, then they never converted their foreigner identification numbers to personal identification numbers, resulting in 'missing' personal identification numbers. Furthermore, technical and procedural problems in transferring and matching civil registration data from the civil register with the residence data from the Aliens Register also resulted in either missing or double civil registration numbers in the Aliens Register. The final migrant population thus totalled 62,461 individuals, of whom 29,174 were refugees and 33,287 were family reunifications. In some the papers included in the thesis this original cohort has been modified by excluding certain nationalities due to small sample size or the nature of the problem in question.

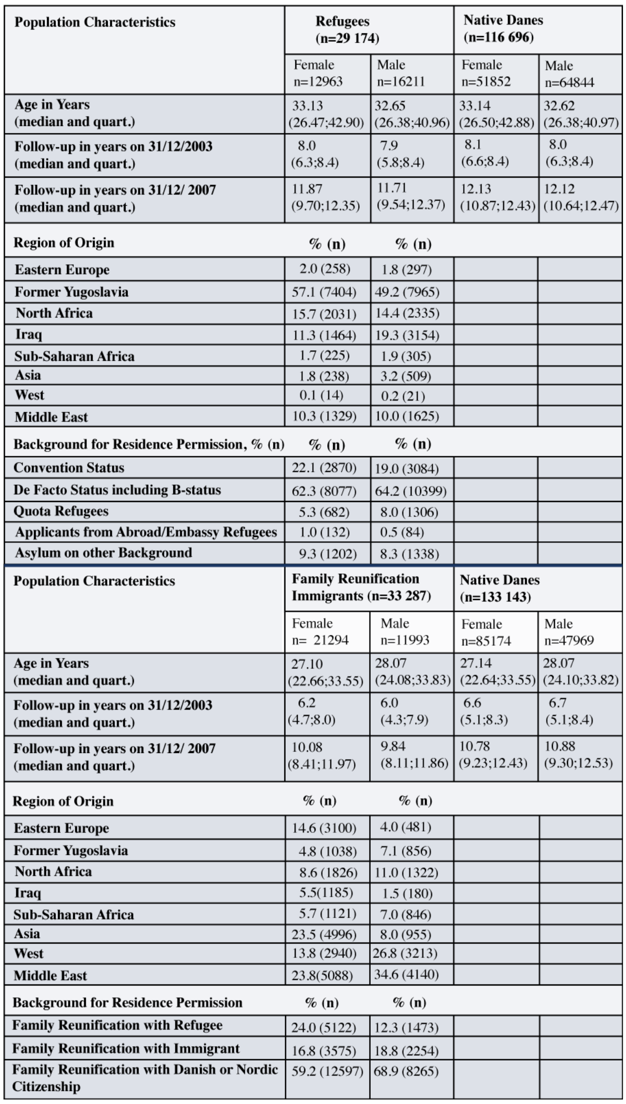
3.2.3. The matching procedure

A native Danish comparison group was identified through Statistics Denmark. The matching was performed as a two-stage hierarchical procedure because Statistics Denmark was only able to perform the crude population match. Consequently, we undertook the individual matching as an additional step on the basis of the first population-matched study cohort. The population matching was carried out to ensure sufficient controls were available for a later matching on an individual basis for all cases. Statistics Denmark performed a 6:1 matching at population level on sex and age on the first day of the year in which the residence permit was granted, i.e. if a female migrant received a residence permit during 1995 and was 32 years old on 1 January 1995, then six native Danish females who were also 32 years old on 1 January 1995 were drawn from the national population data set. Native Danes were excluded from the national 'population pool' of individuals for comparison on the following grounds:

1. Individuals in the comparison group had to be native Danes with native Danish parents to avoid including descendants.
2. Individuals in the comparison group were excluded from later participation when they had been used once.
3. Individuals in the comparison group were excluded if they had died in the year of inclusion.
4. Individuals in the comparison group were excluded if they emigrated during the year of inclusion.

Next, the individual 4:1 matching on age and sex was performed. This sampling was chosen to optimise the group comparisons in the initial descriptive analyses, i.e. refugees versus native Danes and family reunification immigrants versus native Danes. The matched sampling resulted in an age distribution among native Danes identical to that among refugees and family reunification immigrants, consequently allowing for direct comparisons of unadjusted results between refugees and family reunification immigrants and their comparisons. A random sampling procedure was used for the matching procedure. We were able to make a 4:1 match for all refugees, resulting in 145,870 individuals: 29,174 refugees and 116,696 native Danes. Four family reunifications were missing a total of five native Danish comparisons due to difficulties with age matching because of outlying ages; accordingly, there were 33,287 family reunification immigrants and 133,143 ethnic Dane comparisons. In total 166,430 individuals. Table 3 shows the baseline characteristics of the AdultMigCohort.

Table 3. Baseline characteristics of the Adult Mig Cohort (n=312.300)



Population Characteristics	Refugees (n=29 174)		Native Danes (n=116 696)	
	Female n=12963	Male n=16211	Female n=51852	Male n=64844
Age in Years (median and quart.)	33.13 (26.47;42.90)	32.65 (26.38;40.96)	33.14 (26.50;42.88)	32.62 (26.38;40.97)
Follow-up in years on 31/12/2003 (median and quart.)	8.0 (6.3;8.4)	7.9 (5.8;8.4)	8.1 (6.6;8.4)	8.0 (6.3;8.4)
Follow-up in years on 31/12/ 2007 (median and quart.)	11.87 (9.70;12.35)	11.71 (9.54;12.37)	12.13 (10.87;12.43)	12.12 (10.64;12.47)
Region of Origin	**% (n)**	**% (n)**		
Eastern Europe	2.0 (258)	1.8 (297)		
Former Yugoslavia	57.1 (7404)	49.2 (7965)		
North Africa	15.7 (2031)	14.4 (2335)		
Iraq	11.3 (1464)	19.3 (3154)		
Sub-Saharan Africa	1.7 (225)	1.9 (305)		
Asia	1.8 (238)	3.2 (509)		
West	0.1 (14)	0.2 (21)		
Middle East	10.3 (1329)	10.0 (1625)		
Background for Residence Permission, % (n)	**% (n)**	**% (n)**		
Convention Status	22.1 (2870)	19.0 (3084)		
De Facto Status including B-status	62.3 (8077)	64.2 (10399)		
Quota Refugees	5.3 (682)	8.0 (1306)		
Applicants from Abroad/Embassy Refugees	1.0 (132)	0.5 (84)		
Asylum on other Background	9.3 (1202)	8.3 (1338)		

Population Characteristics	Family Reunification Immigrants (n=33 287)		Native Danes (n=133 143)	
	Female n= 21294	Male n=11993	Female n=85174	Male n=47969
Age in Years (median and quart.)	27.10 (22.66;33.55)	28.07 (24.08;33.83)	27.14 (22.64;33.55)	28.07 (24.10;33.82)
Follow-up in years on 31/12/2003 (median and quart.)	6.2 (4.7;8.0)	6.0 (4.3;7.9)	6.6 (5.1;8.3)	6.7 (5.1;8.4)
Follow-up in years on 31/12/ 2007 (median and quart.)	10.08 (8.41;11.97)	9.84 (8.11;11.86)	10.78 (9.23;12.43)	10.88 (9.30;12.53)
Region of Origin	**% (n)**	**% (n)**		
Eastern Europe	14.6 (3100)	4.0 (481)		
Former Yugoslavia	4.8 (1038)	7.1 (856)		
North Africa	8.6 (1826)	11.0 (1322)		
Iraq	5.5(1185)	1.5 (180)		
Sub-Saharan Africa	5.7 (1121)	7.0 (846)		
Asia	23.5 (4996)	8.0 (955)		
West	13.8 (2940)	26.8 (3213)		
Middle East	23.8(5088)	34.6 (4140)		
Background for Residence Permission	**% (n)**	**% (n)**		
Family Reunification with Refugee	24.0 (5122)	12.3 (1473)		
Family Reunification with Immigrant	16.8 (3575)	18.8 (2254)		
Family Reunification with Danish or Nordic Citizenship	59.2 (12597)	68.9 (8265)		

3.3. Data collection

This subchapter describes the different health registers involved in the studies of the thesis as well as data handling and ethics of register-based studies in Denmark.

3.3.1. The personal identification number and the Danish Civil Registration System

Danish population-based registers offer unique opportunities for epidemiological studies (91). The linking key is the personal identification number (CPR number), which makes it possible to link information from all national registers at the individual level. The Danish Civil Registration System was established in 1968 for administrative purposes, especially the collecting of tax from Danish residents (92). For this purpose all persons alive and living in Denmark were given a personal identification number. Since then, within a few hours of birth, all individuals born in Denmark are assigned a ten-digit personal identification number that then follows the person forever. The first six digits indicate the date of birth; the next three digits indicate a serial number to distinguish between people born on the same day. Digit 7 indicates century of birth and digits 8 and 9 form a sequence number. The last digit is a control digit introduced to minimise recoding errors and also indicates the person's sex. The Danish Civil Registration System is updated daily on data of emigration, immigration, birth and death reported by local municipalities and authorities. Information on death is available only if death occurred in Denmark or if the Danish Authorities were informed of the death.

3.3.2. Registration of ethnicity, migration and migrant status in Danish registers

Registers on diseases and health care use in Denmark do not routinely contain data on migration and ethnicity. It is therefore necessary to link these registers to the Danish Civil Registration System using the personal identification number (60). Statistics Denmark is the usual source for population data in Denmark, and its Civil Registration System includes data on country of birth and nationality (continuously updated), parents' country of birth, and immigration and emigration dates as well as emigration destination country. In addition, the Danish Immigration Service registers length of asylum procedure and data on migrant status based on a legal grounds for residence permit, which can be used, for example, to identify refugees versus family reunification immigrants, as I do in this thesis. Nationality (citizenship upon arrival) is recorded as well. Data from the Danish Immigration Service is not, however, routinely available for register-based research.

3.3.3. Registers used in the study

The thesis builds on data from several health-related registers. The described data linkage was carried out twice during follow ups in 2005 and 2009 respectively. Papers I-V are based on the 2005 data linkage and Papers VI-VIII are based on the 2009 data linkage. In 2005, the following registers were included in data linkage: The Danish Cancer Registry, the Psychiatric Central Research Register, the Registry of Coercive Measures in Psychiatric Treatment, and the Danish National Health Registry. This linkage retrieved data from 1 January 1993 to 31 December 2003. The 2009 data pull relevant to the papers of the thesis included data from the Danish National Health Registry as well as the Register of Causes of Death and the Danish Civil Registration System. This linkage retrieved data from 1 January 1993 to 31 December 2007. At the time the studies were conducted, the National Board of Health handled most health-related registers in Denmark whereas population and social registers were handled exclusively by Statistics Denmark, which also possessed copies of important health registers. The included registers are briefly described below (apart from the Danish Civil Registration System, which was described above).

The Danish Cancer Registry was established in 1942 (93). It is a population-based registry containing data on all new cancer cases in Denmark. Reporting is mandatory. Apart from the special electronic notification scheme, which clinicians fill out, the registry is constructed from multiple notifications from different data sources, including the Pathology Registry and the Danish Register of Causes of Death. This increases validity and coverage alongside other mechanisms of quality control. The Danish Cancer Registry contains personal characteristics such as age and sex and tumor characteristics including s well as cancer type, stage, morphology and topography.

The Danish National Patient Register was established in 1977 and represents a key Danish health register (94). Originally intended for monitoring hospital activities, it now also serves as a source register for more specific registers such as the Danish Cancer Registry and as the basis for the payment of public hospitals via the Diagnostic Related Group (DRG) system. The National Patient Register initially covered only inpatient hospitalisations, but from 1995, data was added on outpatient visits and emergency room activities as well as psychiatric contacts. Moreover, from 1994, a change took place, with ICD-10 replacing ICD-8 (ICD-9 was never implemented in Denmark). The Danish National Patient Register includes data on date of contact, diagnoses, examinations, and treatment, including operations. The Danish National Patient Register is a complicated register and the validity and coverage have been discussed in the literature (95,96).

Since 1875, it has been mandatory to complete death certificates with a registration of cause of death in any case of death occurring in Denmark. The electronic version of The Danish Register of Causes of Death as we use it today began in 1970 (97).The cause of death is coded in accordance with WHO's ICD-10. Until 2007, medical officers at the National Board of Health centrally coded causes of death based on information from death certificates. Since 2007, all death certificates have been submitted electronically, and the individual physician does the coding independently. Problems of validity and coverage related to the Danish Register of Causes of Death has been discussed by Helweg-Larsen (97).

The Danish Psychiatric Central Research Register, established in 1969, is a nationwide electronic database on psychiatric hospital contacts (98). However, systematic nationwide collection of clinical data on psychiatric inpatients in Denmark had begun already in 1938 when eight mental hospitals comprised the entirety of the country's treatment facilities. In 1995, the registry was integrated into the Danish National Patient Register, and data was concurrently added on outpatient treatment and emergency room contacts. As for The National Danish Patient Registry, the coding was changed in 1994 from ICD-8 to ICD-10. Nationwide coverage of hospital contacts for severe mental disorders is considered complete as no private psychiatric hospitals exist. But, mild to moderate psychiatric disorders are not treated at hospital facilities, but rather by general practitioners and therefore not included in the register. Validation of the clinical diagnoses in the register is limited. The Registry of Coercive Measures in Psychiatric Treatment is rather new, starting in 1999. It includes information on use of coercive measures upon admission and during inpatient hospitalisation, including medication and restraint by coercion. No documentation exists on coverage and validity.

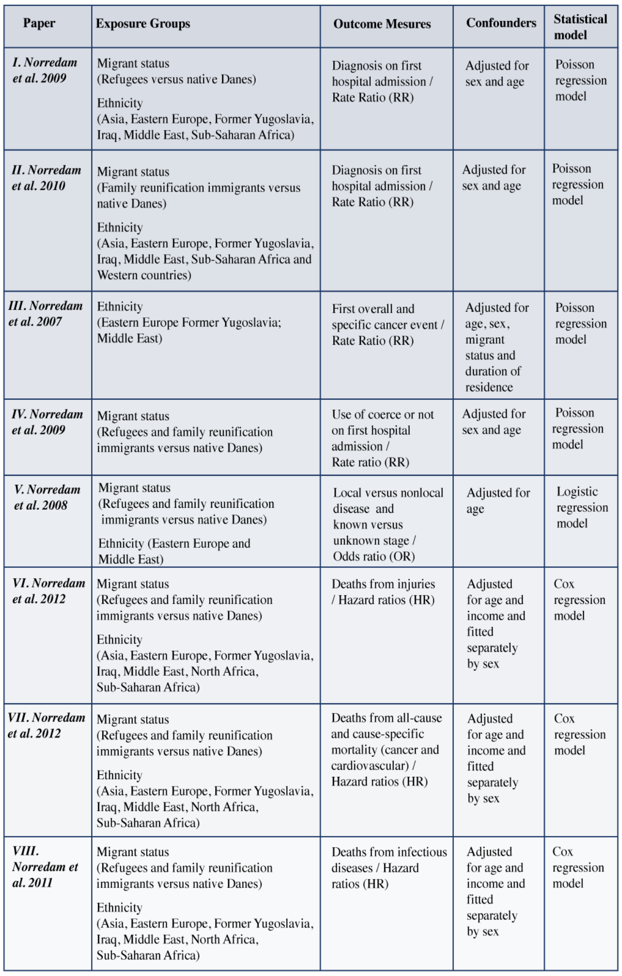
3.3.4. Data handling and ethics of register-based studies in Denmark

The studies in the thesis are based on individual level register data as opposed to aggregated data. The Act on the Processing of Personal Data sets out the legal conditions for accessing and processing individual data (91). According to the Act, all data subjects must be guaranteed confidentiality and anonymity. Therefore, individual level data is not delivered to external institutions. Instead, datasets and linkages between datasets are constructed at Statistics Denmark. Researchers may then access the data remotely online. For security reasons, only researchers employed at authorised research institutions can gain access to data at Statistics Denmark. The Act on the Processing of Personal Data allows for the processing of data on ethnic origin, including nationality, country of birth, and migrant status as long as the data is processed as described. In accordance with the Act, I obtained authorisation to process data from the Danish Data Protection Agency prior to each data linkage. Register-based studies do not require approval from ethics committees in Denmark if they do not include human biological material. But, it should be noted that researchers using register-based data are not allowed to contact the registered individuals to obtain additional information such as survey data.

3.4. Variables

This section describes the main variables included in the studies. They are derived from both of the data linkages described above. Table 4 summarises the main variables and statistical models.

Table 4. Variables and statistical models included in the analyses of the papers



Paper	Exposure Groups	Outcome Mesures	Confounders	Statistical model
I. Norredam et al. 2009	Migrant status (Refugees versus native Danes) Ethnicity (Asia, Eastern Europe, Former Yugoslavia, Iraq, Middle East, Sub-Saharan Africa)	Diagnosis on first hospital admission / Rate Ratio (RR)	Adjusted for sex and age	Poisson regression model
II. Norredam et al. 2010	Migrant status (Family reunification immigrants versus native Danes) Ethnicity (Asia, Eastern Europe, Former Yugoslavia, Iraq, Middle East, Sub-Saharan Africa and Western countries)	Diagnosis on first hospital admission / Rate Ratio (RR)	Adjusted for sex and age	Poisson regression model
III. Norredam et al. 2007	Ethnicity (Eastern Europe Former Yugoslavia; Middle East)	First overall and specific cancer event / Rate Ratio (RR)	Adjusted for age, sex, migrant status and duration of residence	Poisson regression model
IV. Norredam et al. 2009	Migrant status (Refugees and family reunification immigrants versus native Danes)	Use of coerce or not on first hospital admission / Rate ratio (RR)	Adjusted for sex and age	Poisson regression model
V. Norredam et al. 2008	Migrant status (Refugees and family reunification immigrants versus native Danes) Ethnicity (Eastern Europe and Middle East)	Local versus nonlocal disease and known versus unknown stage / Odds ratio (OR)	Adjusted for age	Logistic regression model
VI. Norredam et al. 2012	Migrant status (Refugees and family reunification immigrants versus native Danes) Ethnicity (Asia, Eastern Europe, Former Yugoslavia, Iraq, Middle East, North Africa, Sub-Saharan Africa)	Deaths from injuries / Hazard ratios (HR)	Adjusted for age and income and fitted separately by sex	Cox regression model
VII. Norredam et al. 2012	Migrant status (Refugees and family reunification immigrants versus native Danes) Ethnicity (Asia, Eastern Europe, Former Yugoslavia, Iraq, Middle East, North Africa, Sub-Saharan Africa)	Deaths from all-cause and cause-specific mortality (cancer and cardiovascular) / Hazard ratios (HR)	Adjusted for age and income and fitted separately by sex	Cox regression model
VIII. Norredam et al. 2011	Migrant status (Refugees and family reunification immigrants versus native Danes) Ethnicity (Asia, Eastern Europe, Former Yugoslavia, Iraq, Middle East, North Africa, Sub-Saharan Africa)	Deaths from infectious diseases / Hazard ratios (HR)	Adjusted for age and income and fitted separately by sex	Cox regression model

3.4.1. Migrant status

Migrant status was based on the legal grounds for obtaining a residence permit. I grouped the eight grounds for obtaining a residence permit into two overall groups: refugees and family reunification immigrants. I decided on this combination because the overall aim of the papers was to investigate differences between these groups in relation to native Danes and not within the groups themselves. Moreover, the small sample size did not allow for further stratification of the variable, especially not when ethnicity was also included. One study (Paper I) is based only on refugees, another (Paper II) only on family reunification immigrants, and five studies (Papers IV – VIII) include both refugees and family reunification immigrants as exposure groups. Paper III only adjusts for migrant status.

3.4.2. Ethnicity

As a proxy for ethnicity, we used nationality as recorded by the Danish Immigration Service, which did not record country of birth. However, nationality generally implies country of birth, and I took the liberty of renaming the variable accordingly throughout the papers even if this represents something of an approximation. On the basis of WHO criteria, I divided nationalities into the following seven regions of origin: Asia, Eastern Europe, the former Yugoslavia, Iraq, Middle East, Sub-Saharan Africa, and Western countries (99). Iraq was singled out as a country of its own due to the large number of Iraqis included in the study. We similarly excluded the former Yugoslavia/Balkans from Eastern Europe because individuals coming from the Balkans in the 1990s mainly came due to war, rendering them a special group. Based on these categories, the ethnicity variable, however, varies between the studies due to pragmatic and theoretical decisions. Western migrants were included in Paper II but not in Paper I as most refugees come from non-Western countries. Paper IV does not include ethnicity at all. In Papers III and V, only the two largest regions of origin – namely Eastern Europe, including the former Yugoslavia, and the Middle East, including Iraq and North Africa – were included due to small sample sizes for the other ethnic groups. For Papers VI-VIII, I decided that only non-Western migrants were of interest as they constituted the largest groups of migrants to Denmark and presumably also those who differed most from native Danes.

3.4.3 Other sociodemographic variables

We matched our population on age and sex. This allowed for direct comparison of unadjusted results. The interpretation of Rate Ratio (RR), say,being the RR of family reunification immigrants versus native Danes where the native Danes have the exact same age distribution as the family reunification immigrant age distribution. Further analyses were adjusted for age in spite of the matching because the association measures had an interpretation which was independent of the age distribution, i.e. an effect for a given age instead of the unadjusted which is the effect for a given age distribution.

Age is included as a categorical variable in paper I and IV: 18-49;50-59;60-69 and ≥ 70 years. In paper II age is again included as a categorical variable: 18-29;30-34;35-39;40-44;45-49;50-54;55-59;60-64;65-69 and ≥ 70 years. Paper III also includes age as a categorical variable with five years intervals. Paper V includes age as less than 50 and ≥ 50 years in the analysis of specific cancers and for ‘all sites’ into five age categories: 40;40-49:50-59;60-69 and ≥ 70 years. In the cox regression analyses, which papers VI-VIII are based on age is included as a continuous variable in the analyses.

We also matched our population on sex. In spite of the matching further analyses were adjusted for sex in some of the analyses because again the association measures had an interpretation which was independent of the sex distribution, i.e. an effect for a given sex instead of the unadjusted which is the effect for a given distribution. Alternatively, sex was stratified by in other analyses. By making sex specific analyses it was possible to look for similarities as well as differences between them. The analyses of paper I and II are not stratified by sex as no significant differences were found in the initial analyses except for nervous disorders were an interaction between sex and region of origin occured. In papers III, IV and VI-VIII all analyses are stratified by sex. Paper V only includes women.

Using data from The Income Statistics Register we adjusted for personal income in papers VI-VIII. This was important as the migrant groups under study generally belong to more economically disadvantaged groups. Income was divided into the following categories: low (<13,500 euro/year), middle (<13,500 – 40,500 euro/year) and high (>40,500 euro/year). Individuals with missing income were excluded. Fortunately this only amounted to a small number.

3.4.4. Morbidity outcome measures

Prevalence of mental disorders (Papers I and II) in the population was measured using diagnosis of first psychiatric hospital contact in the study period from 1 January 1994 - 31 December 2003. Discharge diagnosis based on ICD-10 was used. All psychiatric inpatient and outpatient contacts recorded in the Danish Psychiatric Central Register were included. Incidence of overall and specific cancers (Paper III) was based on cancer diagnosis reported to the Danish Cancer Registry between 1 January 1994 - 31 December 2003. Only the first diagnosis of cancer in the registry was included. Non-melanoma skin cancer was excluded.

3.4.5. Clinical indicators of access

Use of coercion upon admission and during admission (Paper IV) was applied as an indicator of access to health care until time of diagnosis and during admission. Data on compulsory admissions was derived from the Danish Psychiatric Central Register during the period from 1 January 1994 to 31 December 2003. Data on coercive measures during admission – such as compulsory detention, use of physical force, and/or acute medication – was derived from the Registry of Coercive Measures in Psychiatric Treatment during the period from 1 January 1999 to 31 December 2003. Cancer disease stage (Paper V) was used as a clinical indicator of access to health care prior to diagnosis. Information on cancer disease stage was obtained from the Danish Cancer Registry for the study period of 1 January 1994 to 31 December 2003. The registry classified disease stage into four categories: 1) local, 2) regional spread, 3) metastatic, or 4) unknown. We analysed the following two binary outcomes: (i) local versus nonlocal (regional spread or metastatic) and (ii) unknown versus known (local or nonlocal). We included the later outcome because initial analysis showed a high number of cases of unknown disease stage among migrants.

3.4.6. Mortality outcome measures

In Papers VI-VIII, mortality was viewed as an ultimate proxy for morbidity and health care response. Two outcome measures were under study: all-cause mortality and cause-specific mortality. Papers VI, VII, and VIII studied cause-specific mortality. The study cohort was cross linked to data from The Danish Register on Causes of Death, which was updated on 31 December 2007. This allowed for a follow-up period from 1 January 1994 to 31 December 2007. All causes of death from infectious diseases, cancer, cardiovascular disease as well as injuries were identified respectively. Death causes were coded according to ICD-10. Paper VIII additionally measured all-cause mortality by identifying all deaths (not cause specific) in the cohort through cross-linkage to data from the Danish Civil Registration System. The system was updated until 31 December 2008 and consequently allowed for a longer follow-up period from 1 January 1994 to 31 December 2008.

3.5. Data analyses

The studies use slightly different approaches, which are consequently commented on. Initially, Poisson models (Papers I-IV) and logistic regression (Paper V) were used because analyses did not include such time-dependent variables as income and also the Cox model is a very computer intensive model and consequently impractical when analysing large numbers of individuals. However, in the later analysis (Papers VI-VIII) we decided to use Cox regression analysis as it is considered more precise because it allows for a 'linear' inclusion of time in contrast to Poisson model in which the time is split into small intervals in which rates can be estimated. However, for small intervals and a large number of individuals the Poisson model and Cox model will result in identical events. All analyses were done in SAS.

3.5.1 Papers I and II

Paper I and II investigated the incidence of mental disorders using Poisson regression analysis. The outcome measures were in the form of rate ratios and 95% confidence intervals, sometimes, also refereed to as relative risk because of the close correspondence between the Poisson analysis and the Cox analysis. As done previously diagnosis on first admission was used as a measure of the incidence (100,101). Incidence of diagnosis on first admission was estimated as cases per 10,000 person years. The Poisson model included sex, age, and ethnicity. Relative risks were calculated for psychotic, affective, and nervous disorders as well as for all disorders combined. The analyses of both papers included a model showing an interaction between nervous disorders and sex and region of origin. The analyses were consequently stratified by sex for this disease category.

3.5.2.Paper III

Paper III investigated the incidence of a first cancer event, likewise using Poisson regression analysis. The outcome measure was in the form of rate ratios (RR) and 95% confidence intervals. Incidence was calculated as the incidence of a first cancer event estimated as cases per 10,000 person years at risk. The analyses of 'all site' cancer were sex-specific and adjusted for age, duration of residence in one-year intervals, and migrant status. However, in the analysis of specific cancers, we were unable to adjust for all of these variables due to low cell counts.

3.5.3. Paper IV

Paper IV analysed the frequency of use of coercion related to first-time hospital admissions, likewise using Poisson regression analysis. The outcome measure was in the form of rate ratios and 95% confidence intervals, which represented the factor by which refugees and family reunification immigrants experienced coercive measures compared with native Danes. First admissions were dichotomised into: i) compulsory admissions and ii) voluntary admissions. Analyses were done separately for refugees and family reunification immigrants compared with their native Danish counterparts. The Poisson model adjusted for sex and age. Rate ratios were calculated for psychotic, affective, and nervous disorders as well as all disorders combined. Calculations were based on first-time admission as our initial analysis showed that 90% of the admission type (voluntarily versus compulsory) of first admissions held for the remainder of contacts. The use of coercive measures during hospital admission was based on a subset of the total population as the registry was not established until 1 January 1999. Consequently, small sample size allowed only for calculations of percentage distributions.

3.5.3 Paper V

Paper V studied cancer stage at diagnosis among women analysed by ethnic subgroups and collectively in the overall analysis. Logistic regression analysis was used. The outcome measure was in the form of odds ratios (OR) and 95% confidence intervals. Odds of local versus nonlocal stages and known versus unknown were estimated. The basic confounder was age.

3.5.4. Papers VI-VIII

Papers VI-VIII studied mortality using Cox regression analysis, which was fitted separately for men and women. Hazard ratios (HR) and 95% confidence intervals were estimated for mortality by injuries, cancer, cardiovascular disease, infectious diseases and all-causes among refugees and family reunification immigrants compared with native Danes. The HR was analysed by both migrant status and ethnicity and adjusted for income. The Cox regression analysis implied a continuous adjustment for age in the model. The HRs of the Cox regression analyses of refugees and immigrants respectively in Papers VI-VIII are also directly comparable with one another. This because of the age-adjustment, which implies that the estimated risks of refugees and immigrants are relative to native Danes with an identical age. For example refugee women (aged 50, say), in Paper VIII have a 4.15 times higher mortality compared with native Danish women (ages 50), and family reunification women (aged 50) have a 1.23 times higher mortality compared with their native Danish comparisons aged 50. Consequently results also imply that the HR of refugees is higher (4.15/1.23) than for family reunification immigrants. The statistical significance cannot be assessed directly.

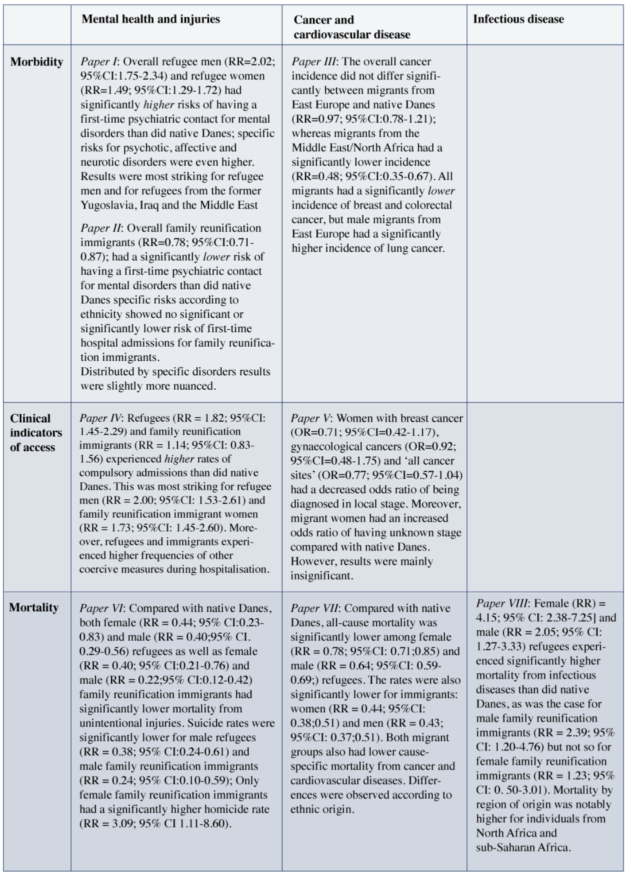
4. RESULTS

The findings are described in detail in the separate papers. This chapter summarises the main results, followed by a short discussion in the context of the European literature. The updated literature search for the thesis research was overall conducted from February to April 2012. The chapter is divided in accordance with the three themes that the thesis investigates: 1) morbidity; 2) clinical indicators of access; and 3) mortality. Table 5 shows abstracts of the results divided thematically according to health-related outcomes and disease categories. The discussions emphasise the role of migrant status alone and in interplay with ethnicity. Where possible, I will argue the thesis' papers against one another. Chapter 5 contains discussion of the study's population and methods while Chapter 8 contains discussion of its clinical implications.

4.1. Morbidity

Results on morbidity patterns include papers on mental disorders and cancer. This subchapter thus summarises and discusses the results of Papers I-III. Papers I and II on mental disorders are presented and discussed together. From a life course perspective, the examined outcome measures may be associated with both pre- and post-migration risk factors; however not least premigration factors are likely of particular importance for morbidity outcomes in these rather newly arrived groups of migrants.

Table 5. General overview of the results of the study according to helath-related outcomes and disease categories



	Mental health and injuries	Cancer and cardiovascular disease	Infectious disease
Morbidity	*Paper I*: Overall refugee men (RR=2.02; 95%CI:1.75-2.34) and refugee women (RR=1.49; 95%CI:1.29-1.72) had significantly *higher* risks of having a first-time psychiatric contact for mental disorders than did native Danes; specific risks for psychotic, affective and neurotic disorders were even higher. Results were most striking for refugee men and for refugees from the former Yugoslavia, Iraq and the Middle East *Paper II*: Overall family reunification immigrants (RR=0.78; 95%CI:0.71-0.87); had a significantly *lower* risk of having a first-time psychiatric contact for mental disorders than did native Danes specific risks according to ethnicity showed no significant or significantly lower risk of first-time hospital admissions for family reunification immigrants. Distributed by specific disorders results were slightly more nuanced.	*Paper III*: The overall cancer incidence did not differ significantly between migrants from East Europe and native Danes (RR=0.97; 95%CI:0.78-1.21); whereas migrants from the Middle East/North Africa had a significantly lower incidence (RR=0.48; 95%CI:0.35-0.67). All migrants had a significantly *lower* incidence of breast and colorectal cancer, but male migrants from East Europe had a significantly higher incidence of lung cancer.	
Clinical indicators of access	*Paper IV*: Refugees (RR = 1.82; 95%CI: 1.45-2.29) and family reunification immigrants (RR = 1.14; 95%CI: 0.83-1.56) experienced *higher* rates of compulsory admissions than did native Danes. This was most striking for refugee men (RR = 2.00; 95%CI: 1.53-2.61) and family reunification immigrant women (RR = 1.73; 95%CI: 1.45-2.60). Moreover, refugees and immigrants experienced higher frequencies of other coercive measures during hospitalisation.	*Paper V*: Women with breast cancer (OR=0.71; 95%CI=0.42-1.17), gynaecological cancers (OR=0.92; 95%CI=0.48-1.75) and 'all cancer sites' (OR=0.77; 95%CI=0.57-1.04) had a decreased odds ratio of being diagnosed in local stage. Moreover, migrant women had an increased odds ratio of having unknown stage compared with native Danes. However, results were mainly insignificant.	
Mortality	*Paper VI*: Compared with native Danes, both female (RR = 0.44; 95% CI:0.23-0.83) and male (RR = 0.40;95% CI. 0.29-0.56) refugees as well as female (RR = 0.40; 95% CI:0.21-0.76) and male (RR = 0.22;95% CI:0.12-0.42) family reunification immigrants had significantly lower mortality from unintentional injuries. Suicide rates were significantly lower for male refugees (RR = 0.38; 95% CI:0.24-0.61) and male family reunification immigrants (RR = 0.24; 95% CI:0.10-0.59); Only female family reunification immigrants had a significantly higher homicide rate (RR = 3.09; 95% CI 1.11-8.60).	*Paper VII*: Compared with native Danes, all-cause mortality was significantly lower among female (RR = 0.78; 95%CI: 0.71;0.85) and male (RR = 0.64; 95%CI: 0.59-0.69;) refugees. The rates were also significantly lower for immigrants: women (RR = 0.44; 95%CI: 0.38;0.51) and men (RR = 0.43; 95%CI: 0.37;0.51). Both migrant groups also had lower cause-specific mortality from cancer and cardiovascular diseases. Differences were observed according to ethnic origin.	*Paper VIII*: Female (RR) = 4.15; 95% CI: 2.38-7.25] and male (RR = 2.05; 95% CI: 1.27-3.33) refugees experienced significantly higher mortality from infectious diseases than did native Danes, as was the case for male family reunification immigrants (RR = 2.39; 95% CI: 1.20-4.76) but not so for female family reunification immigrants (RR = 1.23; 95% CI: 0. 50-3.01). Mortality by region of origin was notably higher for individuals from North Africa and sub-Saharan Africa.

4.1.1. Mental disorders

Paper I on the relative risk of mental disorders among refugees compared with native Danes, adjusted for age, found that refugee women (RR=1.49;95%CI:1.29-1.72) and men (RR=2.02;95%CI:1.75-2.34) had a higher risk of having a first-time psychiatric hospital contact for all mental disorders combined. Specific risks of psychotic disorders were also significantly higher in total for both sexes (RR=2.03; 95%CI:1.72-2.40). For affective disorders, the risk for refugees of both sexes was also elevated (RR=1.96; 95%CI:1.70-2.25). For nervous disorders, specific risks were calculated separately for men and for women because this diagnostic category showed a statistically significant interaction between sex and ethnicity. Both sexes were at higher risk of nervous disorders, but this was more pronounced among men (RR=4.39; 95%CI:3.56-5.40) than among women (RR=2.09; 95%CI:1.70-2.57). Differences were evident by ethnic group for the combined and specific disorders. Overall, these differences support the summarised results.

Paper II on the relative risk of mental disorders, adjusted for age, among family reunification immigrants compared with native Danes showed an overall significantly lower risk for family reunification immigrants of having a first-time psychiatric contact compared with native Danes (RR=0.78; 95%CI:0.71-0.87). For psychotic disorders, no significant differences were observed compared with native Danes (RR=1.02;95%CI:0.85;1.22), but there was a borderline-significant tendency for family reunification immigrants (RR=0.81; 95%CI:0.65-1.00) to have fewer contacts for affective disorders compared with native Danes. For nervous disorders, an interaction between sex and migrant status was found and included in the analysis. Female family reunification immigrants did not differ significantly from native Danish women (RR=0.99; 95%CI:0.82-1.19), but male family reunification immigrants had a significantly higher ratio compared with native Danish men (RR=1.59; 95%CI:1.17-2.17). Again variations were observed by ethnic origin for the combined and specific disorders, which, overall, supported the summarised results.

The literature on mental disorders among refugees supports the findings of Paper I. Consequently, high rates of neurotic disorders (especially PTSD) and, to a lesser extent, affective disorders are documented among refugee populations residing in Europe (101-108). Hollander et al.(62) compared refugees with non-refugee immigrants (family members to individuals granted asylum) and found that female refugees were an at risk group of elevated psychotropic drug purchased used as a proxy for mental health problems. The findings of Paper 1 are therefore unsurprising, but the consistently high rates of psychotic disorders among refugees from all ethnic backgrounds appear novel.

The analytical model in Figure 1 is helpful for understanding the psychopathological mechanisms behind refugees' elevated risks of affective and nervous disorders. Refugees may have been exposed to pre-migration risk factors for mental disorders, including trauma, loss, torture, and lack of access to health care, which may affect health outcomes (108,109). The nature and accumulated burden of these risk factors is associated with disease severity and psychosocial functioning. In addition, the travel process itself may involve risk factors associated with adverse mental health outcomes, including stress, fear, and trauma. Finally, post-migration risk factors comprise a broad range of events related to re-establishing life in a new country, some of which – such as prolonged asylum procedures – are especially pertinent to refugees (37, 110-114). Pre-migration and post-migration factors may act synergistically so that pre-migration events have latent effects that are triggered at later stages in life, leading to vulnerability when exposed to adverse circumstances following migration (115).

Regarding the higher risk of psychotic disorders, the results are in accordance with Paper IV showing a higher use of coercion in psychiatry among refugees compared with native Danes, which indicates a possible higher burden of psychotic disorders. Several studies (116-118) document higher rates of psychotic disorders among ethnic minorities and migrants; none, however, focus specifically on refugees. It is hypothesised that the process of migration, independent of ethnicity and socio-economic status, is a risk factor for psychoses. This may be even more true for refugees, who are likely to have had a difficult migration process, involving the aforementioned pre-migration trauma. An explanation for the higher rate of psychotic disorders specifically among refugees may lie in the increasing documentation of the relationship between severe PTSD and various manifestations of psychotic illness. PTSD and psychosis are hypothesised to be part of a spectrum of responses to trauma in which psychotic symptoms become more manifest as the PTSD condition develops into a chronic state (119-121). This association has mainly been studied among veteran populations in the USA but most likely also applies to traumatised refugees (122).

To our knowledge, no previous study has specifically addressed family reunification immigrants' mental health. However, among mixed groups of migrants from non-Western countries, the most dominant finding is higher incidences of psychotic disorders (101, 116-118, 123-128) and, to a lesser extent, affective (129-131) and neurotic disorders compared with among non-migrants. Studies on elevated risk of psychosis among migrants have occupied researchers since Ødegaard's pioneering study in 1932 of Norwegian emigrants to the USA (132). Explanatory factors have been related to socio-economic status (118,125,133-134); the migration process itself (123), including environmental factors (126); diagnostic misclassification (135); and people predisposed to schizophrenia being more likely to emigrate (136). In contrast to these studies, Paper II shows no overall increase in the rate of psychotic disorders – or indeed any other disorders – among family reunification immigrants apart from an elevated risk of nervous disorders among men. Several explanations may be involved: (i) The difference between Paper II and the majority of the literature may be explained by the fact that family reunification immigrants are not singled out in these studies, meaning that the results are dominated by other groups of migrants, including refugees. (ii) Consequently the results of Paper II may reflect true morbidity patterns as family reunification immigrants have not been exposed to the same risk factors for mental disorders as refugees. In addition, family reunification immigrants voluntarily choose to leave their country and already have social ties upon arrival. (iii) Alternatively, the follow-up time in Paper II was shorter than some other national population-based studies, implying that family reunification immigrants did not have time to develop manifest psychosis or other disorders. (iv) Moreover, results may be caused by underestimation due to a lack of adequate diagnosis because of obstacles to migrants' help-seeking processes. The latter argument is supported by studies showing lower utilisation of mental health care services among migrants compared with non-migrants (137) and more complex pathways to specialist care. Barriers may include stigmatisation within migrant communities and communication problems with health care professionals. That said, equality in uptake of services for mental disorders have also been shown (138). (v) Finally, results may be due to a 'healthy family reunification effect' where only the most mentally stabile will choose to emigrate.

The opposing findings of Papers I and II highlight migrant status as an important determinant of mental health outcomes in epidemiological studies. If the cohort had not been divided according to migrant status, the results and their subsequent interpretation would have been less valid. Individuals with family reunification would have appeared more vulnerable and refugees less vulnerable to mental disorders than the papers documented. Unfortunately, existing studies tend to focus either on subgroups of refugees (including asylum seekers) (139) or a mix of refugees and other family reunification immigrants (family reunification and work) (140,141), which obscures interpretation of the results. It is important to stress that the results of Papers I and II only concerned hospital treated prevalence in that our analyses are based on hospital contacts alone. This does not allow one to conclude the population prevalence of mental disorders among refugees and family reunifications in Denmark. That would require data from primary care and specialised rehabilitation centres for traumatised refugees, which are not, unfortunately, recorded.

The significant and novel contribution to the literature made by Papers I and II lies in its accentuation of the importance of migrant status as a variable in epidemiological research on mental health among migrants. Paper I supports literature documenting that refugees are an at-risk group for all mental disorders - also including psychotic disorders. Finally, if Paper II reflects true morbidity patterns, it breaks with the notion that all migrant groups have vulnerable mental health compared with non-migrants.

4.1.2. Cancer

Paper III investigated both the overall and selected site-specific incidences of cancer among migrants compared with native Danes. Rate ratios of cancer by region of origin were adjusted for age, migrant type, and duration of residence. The overall cancer incidence among migrant women (RR=0.97; 95%CI:0.78-1.21) and men (RR=1.15; 95%CI:0.99-1.34) from Eastern Europe (including the former Yugoslavia) did not differ significantly from native Danes. For individuals from the Middle East (including North Africa), however, significantly lower incidences were seen for both migrant women (RR=0.48; 95%CI:0.35-0.67) and men (RR=0.74; 95%CI:0.59-0.94) compared with for native Danes. For site-specific cancers, all migrants had significantly lower incidences of breast and colorectal cancer, but male migrants from Eastern Europe (including the former Yugoslavia) had a significantly higher incidence of lung cancer; whereas females did not differ significantly. Additionally, we analysed the impact of duration of residence on cancer incidence. There was a significant annual reduction in the cancer incidence of 5% among migrant women over time. The analyses of migrant men did not show any significant change over time.

The results correspond with previous findings among non-Western migrants living in Europe. A review of 37 European studies found that migrants from non-Western countries showed more favourable all-cancer morbidity outcomes than non-migrants (142). Simultaneously, a considerable site-specific diversity was found. As such, the literature documents that cancers related to Western health behaviour like breast cancer (143) and colorectal cancer (144,145) are less frequent among non-Western migrants (146) whereas cancers related to infectious diseases such as stomach cancer (144,147), primary liver cancer (148,149), cervical cancer (46,149-150), mouth and pharyngeal cancer (149, 151-152), and bladder cancer (153) are more prevalent among non-migrants. These results are in line with the life course approach. We studied cancers related to Western risk factors, and results may therefore be attributed to a low incidence of these cancers in the regions of origin in this relatively newly arrived cohort. This may be somewhat reflected in the gradient we observed where Eastern Europeans (including the former Yugoslavia) were more likely to develop the cancers in question compared with migrants from the Middle East (including North Africa). Unfortunately, some cancer incidence patterns appear to change over time and with new generations resulting in less favourable outcomes for migrants in relation to cancers related to health behavior (142, 154-157)

The study also explored the importance of diagnosis in relation to time after arrival, which is of interest to early diagnosis and treatment. This aspect is rarely investigated. Our results indicate that migrant women may have undetected disease upon arrival, perhaps due to lack of diagnosis in the country of origin.

Due to small numbers, the study had to focus on either migrant status or ethnicity as the exposure group. Ethnicity was chosen as it was considered more relevant than migrant status, hypothesising that cancer incidence depends largely on region of origin and less on factors associated with migration processes. Although only the 'all sites' analysis was adjusted for migrant status to detect a possible effect, no significant effect was detected, and migrant status was therefore excluded from the final analysis model.

Paper III contributes to the literature in that it demonstrates the low incidence of cancers related to Western health behaviour, especially among migrants from the Middle East (including North Africa) whereas migrants from East Europe (including former Yugoslavia) showed opposing tendencies. Moreover, the study explored the impact of duration of residence and indicated a diagnostic bulk shortly upon arrival among women, which may signify lack of access to diagnostic services in the emigration country.

4.2. Clinical indicators of access

This subchapter includes papers concerning clinical outcome measures related to diagnosis and treatment. In a life course model, the examined indicators of health care response are mainly associated with conditions in the immigration country (post-migration stage). Paper IV concerns the use of coercion in psychiatry, which may be viewed as indirect measure of health care response expressing factors related to both diagnosis and treatment. Paper V concerns cancer stage at diagnosis used as a clinical indicator of access to health care prior to diagnosis.

4.2.1. Use of coercion in psychiatry

For all psychiatric disorders combined, refugees were significantly more likely than native Danes to have had a compulsory admission (RR = 1.82; 95%CI: 1.45-2.29). For all psychiatric disorders combined, refugee men were twice as likely to have had a compulsory admission compared with their native Danish counterparts (RR = 2.00; 95%CI: 1.53-2.61). Elevated risk of compulsory admission was also seen for psychotic and neurotic disorders but was not the case for affective disorders. Refugee women had a non-significant tendency compared with their native Danish counterparts of ever having had a compulsory admission in any of the diagnostic categories (RR = 1.27; 95%CI: 0.8-2.01). In total, family reunification immigrants did not show any significant tendency towards more compulsory admissions than did native Danes (RR = 1.14; 95%CI: 0.83-1.56). Also, male family reunification immigrants did not differ significantly in any of the diagnostic categories (RR =0.73; 95%CI: 0.44-1.19) compared with their native Danish counterparts; whereas female family reunification immigrants experienced a significantly higher use of coerce on admission (RR = 1.73; 95%CI: 1.45-2.60) compared with their native Danish counterparts. Due to small numbers, only frequency analysis was performed on three different forms of inpatient coercion in all hospital admissions during the study period. Some kind of coercive measure had been used in 55.8% of all admissions among refugees compared with 23.9% among their native Danish counterparts. This striking difference was also true for admissions among family reunification immigrants inasmuch as some kind of coercive measure had been used in 47.9% of all admissions among family reunification immigrants compared with 30.3% among their native Danish counterparts.

The results are supported by the literature, which likewise finds higher rates of

compulsory admission among migrants divided by ethnicity and compared with non-migrants (158-164); none, however, divide specifically according to migrant status. The findings may be explained by factors operating at or prior to admission, which may increase the risk of compulsory admission. Explanations are either patient-related or service-related. As far as patients are concerned (i) it has been proposed that more compulsory admissions are related to higher rates of psychosis among migrants than among non-migrants(117,126). Paper I supports this by identifying twice as high an incidence of inpatient contacts for psychotic disorders among refugees compared with native Danes. (ii) The findings may also be explained by UK studies of ethnicity and psychosis, which stress the importance of a supportive family structure in ensuring access to health care among migrants. Indeed, many refugees come to Denmark alone or with few relatives, leaving them with little or no familial support, which may result in a vulnerable network that is unable to help ill individuals gain access to mental health services(163,165-166). However, we also found more compulsory admission among family reunification immigrant women who may have a familiar network upon arrival but potentially lack a broader social and community-based network. (iii) Stigma of having a mental disorder may be more pronounced among migrant populations, leading to social isolation and consequential delay in seeking help. (iv) Language and communication barriers may additionally complicate access to mental health care, which is why health professionals of all ethnic backgrounds should be encouraged to develop cultural skills (167). Finally, ‘newness to the Danish health care system’ may delay care seeking. Patient and service-related factors are likely to interact and constitute barriers to migrants’ access to relevant and effective mental health services, possibly resulting in delayed help seeking and increased disease severity and thus to higher rates of compulsory admission. As far as the health care system is concerned: (i) Language also constitutes a problem, including a lack of interpreters and multilingual staff. Denmark is traditionally an ethnically homogenous society, and rising diversity is not yet reflected among different groups of health professionals in the health care system. (ii) Additionally, results may be explained by poor engagement with services prior to admission (168), resulting in lack of diagnosis and referral and thus more severe disease (169). Studies have shown that general practitioners tend not ask their foreign-born patients about trauma (170).

Paper IV also showed that refugees and family reunification immigrants experienced more compulsory detention, coerced treatment, and use of physical force and ⁄ or acute medication. There is little data available to put these results into perspective (160,171-172). The high rates of use of coercion may be related to some of the previously discussed explanations regarding use of coercion upon admission. Understanding factors that operate after admission is crucial for explaining the findings. Communication problems – both verbal and non-verbal – may be of great importance. Psychotic patients may become more agitated if they feel misunderstood, and staff may misinterpret migrant patients’ agitation as psychotic and dangerous. Hence, when working with refugees and family reunification immigrants who are inpatients, cultural skills are crucial in preventing the use of coercive measures.

Paper IV contributes to the literature in that it takes a unique perspective on investigating access to mental health care and, in addition to use of coercion on admission, includes use of coercion following admission. It identifies male refugees and female family reunification immigrants as special at-risk groups for use of coercion upon admission. The first finding being supported by Papers I of the thesis.

4.2.2. Cancer stage at diagnosis

Paper V aimed at comparing differences in cancer stage at diagnosis between migrant women and native Danish women. Analyses showed an overall tendency of all migrant women with breast cancer (OR=0.71; 95%CI=0.42-1.17), gynaecological cancers (OR=0.92; 95%CI=0.48-1.75) and ‘all cancer sites’ (OR=0.77; 95%CI=0.57-1.04) of having a decreased odds ratio of being diagnosed in local stage. However, all results were non-significant. Moreover, migrant women with breast cancer (OR=1.80; 95%CI=0.83-3.91), gynaecological cancers (OR=1.27; 95%CI=0.45-3.57) and ‘all cancer sites’ (OR=1.59; 95%CI=1.07-2.36) had tendencies towards more unknown stage at diagnosis compared with native Danes. However, results were mainly insignificant. Also, analyses stratified by migrant status and ethnicity did not show any significant differences regarding local vs. nonlocal stage and unknown vs. known stage for migrant women compared with native Danish women apart from family reunification immigrants from the Middle East, who had a significantly decreased odds ratio of being diagnosed in local stage (OR=0.38; 95%CI=0.16-0.90).

The literature on cancer stage shows that migrants and ethnic minorities are sometimes diagnosed with more advanced cancer (173-175). Paper V views cancer stage as a health care response outcome or an indicator of access to services prior to diagnosis. Severe disease at diagnosis is therefore interpreted as a result of a delay in access to care or as a result of access to inappropriate care. Other studies have likewise used clinical indicators as proxies for measures of barriers to accessing services among migrants, including late presentation of HIV diagnosis (176) and use of coercion upon admission as seen in Paper IV of this thesis.

If the results of Paper V are truly insignificant they may indicate equity in access to care until cancer diagnosis between migrant women and native Danish women; however if they are due to small sample size and the observed tendencies are real several factors may explain this: (i) Differences in tumour histology between migrants and native Danes could explain these results. For example, cancer may behave more aggressively among persons from some ethnic groups (177,178). (ii) Late stage diagnosis among migrants could be caused by barriers to access to health care. The Danish health care system is a free-access system. Nevertheless, the literature documents that migrants' access may be affected by language barriers and different cultural notions and practices regarding health and 'newness', both related to migrants and to health care professionals (1, 179). (iii) Underuse of screening services has been shown for screening for colorectal cancer (180), breast cancer (181-183), and cervical cancer (184) among ethnic minorities and migrants – also in Denmark (185) - which may result in more advanced disease at diagnosis. Studies have identified reasons for lower screening uptake among migrants, including ethnic differences in cancer awareness (186-188); service provision issues (189). Moreover, inability to read the letter of invitation; resettlement rather than health promotion activities being a priority upon arrival; and lower incidences of cancer in ethnic countries may cause migrant women not to see themselves as susceptible to breast cancer.

The results of Paper V also showed some non-significant tendencies towards more unknown stage cancers among refugees and family reunification women than among native Danish women. The results finds support in the literature (175). If the results reflect reality the following explanations are relevant: Unknown stage is a combination of truly unknown stage cancers and staged cancers that are not reported to the Danish Cancer Registry. It is likely that migrants have more truly unknown stages because there is no reason to believe that missing reports on stage vary between migrants and non-migrants. Three different explanations are relevant for why truly unknown stages may be more prevalent among migrants: (i) Some late stage cancer patients may be so ill upon diagnosis at an internal medical or surgical ward that they die before receiving a proper work up at a specialised oncology ward. This interpretation implies that access to primary care has been suboptimal. (ii) The higher number of unknown stages among migrants may be due to a quality of care problem in the clinical encounter between migrant patients and physicians, resulting in a decreased work up for migrant patients. This may again be due to linguistic and socio-cultural barriers on both sides. (iii) Migrants may choose to return to their country of origin when receiving a diagnosis of cancer and therefore do not receive a full work up. The first and second explanations imply that migrants have had suboptimal access to health services prior to diagnosis.

The results of paper V should be interpreted with great precaution as they overall are non-significant. Some consistent tendencies are, however, observed in that both refugees and family reunification immigrants overall tend to experience more non-local stage diagnosis and more unknown stage cancers. These results warrant further investigations with increased sample size and follow up time. The paper contributes to the literature in that it uses an innovative approach (tumor stage at diagnosis) as a measure of health care response.

4.3. Mortality

Mortality may be interpreted as a final health outcome measure resulting from both morbidity and health care response, i.e. access to diagnosis and treatment. From a life course perspective, the examined outcome measures may therefore be associated with a combination of risk factors along all phases of the migration processes. The resultant discussion is thus related to the findings of the two previous subchapters. Results on mortality patterns include all-cause and cause-specific mortality. All results have been adjusted for personal income. Paper VII concerned all-cause mortality and Papers VI, VII, and VIII concerned cause-specific mortality. They are presented and discussed accordingly, meaning that the results of Paper VII are split up.

4.3.1. All-cause mortality

Paper VII investigated differences in all-cause mortality among refugees and family reunification immigrants compared with native Danes. Hazard ratios for sex-specific all-cause mortality were estimated by migrant status and ethnicity and adjusted for age and income. All-cause mortality was lower among female refugees (RR=0.78;95%CI:0.71;0.85) and male refugees (RR=0.64;95%CI:0.59;0.69) compared with native Danes. Similarly, rates were lower for family reunification immigrant women (RR=0.44;95%CI:0.38;0.51) and family reunification immigrant men (RR=0.43;95%CI:0.37;0.51). Differences according to ethnicity were observed in that all ethnic subgroups showed similar or significantly lower mortality estimates compared with native Danes apart from refugees from Sub-Saharan Africa who had a significantly higher mortality.

In conclusion, migrants overall had a lower all-cause mortality compared with native Danes. To my knowledge, only one other European study exists on all-cause mortality according to migrant status; however, the reference group is comprised of 'non-refugees', who are defined somewhat differently than family reunification immigrants in our study, and ethnic Swedes were not included (190). The study documented an insignificantly elevated risk for all-cause mortality among refugees compared with 'non-refugee' immigrants; which is in line with the results of paper VII. The literature on all-cause mortality among migrants and ethnic minorities as such analysed according to ethnic background is more abundant (64,191-194). These studies likewise document a reduced all-cause mortality risk among many groups of non-Western migrants compared with non-migrants despite migrants' lower average socio-economic status. Lower all-cause mortality among migrants has been explained by several factors: (i) The 'healthy migrant effect' involves the selection of healthy individuals into migration, implying that it is mainly particularly fit and healthy individuals who chose to emigrate resulting in low mortality and morbidity among migrants in immigration countries (195). (ii) The 'remigration bias' or 'salmon bias' implies that chronic and critically ill migrants return to their country of origin to live with close family and perhaps to access health care services there. As a consequence, their possible deaths are most often not reported to the authorities of the immigration country, which may unjustly skew mortality estimates in favour of migrants compared with native Danes. (iii) Differences in genetic susceptibility alone or in interplay with beneficial health-related behaviours from countries of origin may affect morbidity and mortality. All of these factors are likely to interact, and the extent to which they explain our results is unknown.

Paper VI contributes to the literature in that it investigates all-cause mortality by migrant status. Results demonstrated that migrants overall had a lower all-cause mortality compared to native Danes. This was also the case for most migrant subgroups when stratifying by ethnicity. The results appeared least favourable for refugees and individuals from Sub-Saharan Africa compared to native Danes and family reunification immigrants.

4.3.2. Cause-specific mortality: injuries

Paper VI concerned unintentional and intentional injury mortality. Compared with native Danes, both female (RR=0.44; 95%CI: 0.23-0.83) and male (RR=0.40; 95%CI: 0.29-0.56) refugees as well as female (RR=0.40; 95%CI: 0.21-0.76) and male (RR=0.22; 95%CI: 0.12-0.42) family reunification immigrants had significantly lower mortality from unintentional injuries. Suicide rates were significantly lower for male refugees (RR=0.38; 95%CI: 0.24-0.61) and male family reunification immigrants (RR=0.24; 95%CI: 0.10-0.59) whereas their female counterparts showed no significant differences. Female family reunification immigrants but not men had a significantly higher homicide rate (RR=3.09; 95%CI: 1.11-8.60) compared with native Danes. Refugees did not differ significantly.

The results thus suggested a lower suicide mortality among migrants although this was only significant in the case of men. The literature on suicide by migrant status and ethnicity in Europe is rather scarce. A Dutch study found that asylum seeking men had a higher suicide rate compared with the Dutch population as a whole, but no differences were found for women(196). The remaining literature shows contrasting results depending on ethnic background and type of disorder, but tends to find lower suicide rates among non-western immigrants (197-199). The results are puzzling for refugees because Paper I, in line with the literature, documents a high rate of mental disorders in this group (139). One would accordingly anticipate more suicides. Plausible explanations may lie in suicide being less acceptable in some cultures or due to certain cultural and religious norms (200,201).

Paper VI showed a non-significant tendency towards a higher mortality from homicide among immigrant women. This finding is based on very small numbers, which warrants cautious interpretation. However, other studies have likewise identified a higher homicide rate among certain migrant groups (202,203). Conceivable explanations include the psychosocial stress of establishing life in a new country, lower socio-economic status, and greater involvement in criminal affairs among migrants.

Finally, Paper VI showed consistently lower rates of unintentional injury mortality among all groups of migrants compared with non-migrants. Descriptive analysis showed few significant differences in causes of death; however, male refugees died more often from traffic injuries and native Danes more often from poisoning. The possible 'protective effect' of being a migrant with regards to unintentional injury mortality cannot be straightforwardly explained; however, the literature from Denmark and other European countries shows less alcohol and drug abuse among migrants compared with majority populations (204,205).

Paper VI contributes to the literature in that it uniquely examined unintentional and intentional injury mortality among migrants. Results were overall in favour of migrants apart from outcomes on homicide mortality among family reunified women. Surprisingly, refugee men had significantly lower suicide mortality.

4.3.3. Cause-specific mortality: cancer

Paper VII studied differences in cancer mortality among refugees and family reunification immigrants compared with native Danes. Hazard ratios for sex-specific mortality from cancer was estimated by migrant status and region of birth and adjusted for age and income. Compared with native Danes, cancer mortality was lower both among female (RR=0.75;95%CI:0.63-0.88) and male refugees (RR=0.86;95%CI:0.73-1.00) but only significantly so among female refugees. Overall, family reunification immigrant women (RR=0.36;95%CI:0.26-0.48) and family reunification immigrant men (RR=0.55;95%CI-0.39-0.78) had significantly lower mortality compared with native Danes. Mortality by region of origin generally supported these results.

The literature supports the finding of low cancer mortality among non-Western migrants although no European studies have subdivided by migrant status, using ethnicity instead (48,155,194). Moreover, studies show that mortality varies with cancer type, which Paper VII did not attempt to investigate due to small numbers (48,147,206). Also, Stirbu et al. (155) documented that mortality rates of migrants converge with 'new' migrant generations and duration of residence towards that of the ethnic Dutch population. This supports the hypothesis that migrants are exposed to an ongoing health transition as cancer becomes an increasingly important cause of death. The low cancer mortality among newly arrived migrants is most likely explained by the low incidence of cancer types related to Western health behaviour in the emigration countries and the fact that migrants have not yet adopted Western health behaviours associated with the most prevalent cancer types in European countries.

Paper VII supports the literature on cancer mortality. It adds migrant status as a new dimension, showing that both refugees and family reunification immigrants have lower cancer mortality, though less so for refugees compared to native Danes.

4.3.4. Cause-specific mortality: cardiovascular disease

Paper VII investigated differences in mortality from cardiovascular disease (CVD) among refugees and family reunification immigrants compared with native Danes. Hazard ratios for sex-specific mortality from CVD were estimated by migrant status and region of birth and adjusted for age and income. CVD mortality was significantly lower among male refugees (RR=0.68; 95%CI:0.55-0.84) compared with native Danes; whereas refugee women did not differ significantly from native Danish women. Mortality by region of origin showed no significant differences compared with native Danes, apart from refugee men from the former Yugoslavia and the Middle East, whose mortality was significantly lower. Likewise, family reunification immigrant women (RR=0.39; 95%CI:0.25-0.61) and family reunification immigrant men (RR=0.57; 95%CI:0.38-0.84) overall had lower CVD mortality compared with native Danes. Mortality by region of origin showed no significant differences compared with native Danes, apart from Asian-born men, who had a significantly lower risk.

The literature on CVD mortality among migrants in Europe have shown that mortality rates from CVD vary substantially between migrants from different countries of origin and between migrants and the native populations of their host countries (207). Consequently, higher mortality rates have been shown among some migrant groups whereas other studies find migrants to have similar or even lower mortality rates from CVD (192,208-210). The results of paper VII are supported by recent findings by Statistics Denmark Data (211), but Bhopal et al. (212) in contrast suggests mortality rates from ischemic heart disease to be generally higher among persons born outside Denmark relative to native Danes. In addition, a recent study on CVD mortality according to migrant status showed high CVD mortality among refugee men compared to non-refugee immigrants (190).Our findings of low CVD mortality may be attributed to a lower incidence or a better survival after diagnosis. But, paradoxical studies on CVD incidence in Denmark have shown elevated CVD incidence at least among some non-Western migrants compared with native Danes (213,214). Perhaps observation over time will show that increasingly migrants will also die from CVD. Alternatively, migrants' access to treatment or health behaviour is more optimal compared to native Danes. Few studies exist to shed light on this, but Hempler et al. (215) showed that migrants do not receive adequate medical treatment with beta-blockers after a first acute myocardial infarct compared with native Danes. Consequently, our findings are not easily explained.

Paper VII found a lower mortality from CVD among migrants and thus adds to the heterogeneous findings of the literature. Migrant status is incorporated as a new dimension showing that results were in favour of both refugees and family reunification immigrants; again, however, this less the case among refugees than among family reunification immigrants.

4.3.5. Cause-specific mortality: infectious diseases

Paper VIII studied differences in mortality from infectious disease among refugees and family reunification immigrants compared with native Danes. Hazard ratios for sex-specific mortality from infectious disease were estimated by migrant status and region of birth and adjusted for age and income. Infectious disease mortality was significantly higher among female refugees (RR=4.15;95%CI:2.38;7.25) and male refugees (RR=2.05;95%CI:1.27;3.33) compared with native Danes. This was also the case for male family reunification immigrants (RR=2.40;95%CI:1.21;4.79) but not significantly so for female family reunification immigrants (RR=1.23;95%CI:0.50;3.00). Mortality by region of origin was notably higher for individuals from North Africa and Sub-Saharan Africa for all migrant groups, albeit numbers were small.

The scant literature supports higher overall and specific mortality from infectious disease among non-Western migrants compared with host populations (193,203). However these studies divide by ethnicity; instead, and none define the exposure group by migrant status in the analysis. The results appear paradoxical as most non-Western migrants arrive to European countries with significantly improved access to diagnosis and treatment compared with the emigration country. Several factors may explain this: (i) Non-Western migrants in particular may come from countries with a high burden of endemic infectious diseases such as TB and HIV, resulting in increased morbidity and more advanced disease upon arrival. (ii) Stigma within migrant groups may prevent early diagnosis and treatment. (iii) Ineffective or non-existent screening programmes upon arrival to immigration countries may leave infections undetected. In Denmark, only asylum seekers are offered a nurse-directed systematic voluntary screening upon arrival. (iv). Language barriers and lack of knowledge concerning the Danish health care system may impede diagnosis and treatment. (v) Lack of specialised clinics for migrant medicine may result in referral delay among other things. These explanations may result in a higher frequency of late stage presentation among migrants.

Paper VII uniquely focuses on infectious disease mortality by migrant status and ethnicity. The results contribute to the literature in that they suggest that migrants generally are disadvantageous compared to native Danes regarding infectious disease mortality. This was not least the case for refugees and individuals from Sub-Saharan Africa.

5. DISCUSSION OF POPULATION AND METHODS

In this chapter, I discuss strengths and limitations of the population and methods. I only discuss themes that are of general relevance to all of the papers. The individual papers should be consulted for a more specific discussion of methodological issues.

5.1. Study design

The design is a historical prospective cohort design. Two register linkages were performed in 2005 and 2009, allowing for an inclusion period from 1 January 1993 to 31 December 2003 and from 1 January 1993 to 31 December 2007 respectively. This involved a median follow up of about seven years for the 2003 follow up and about 12 years for the 2007 follow up respectively. This is naturally a very short follow up from a life course perspective. The ideal epidemiological life course study design would be a prospective birth cohort that researchers could follow from birth in the emigration country and later during migration and onwards when residing in the immigration country. This would allow a comprehensive study of the timing and dynamics of exposures and health outcomes, including perspectives related to access to health care. Such a set up naturally poses enormous challenges and is difficult to implement with migrants because migrants must be identified before migration and even before they know that they will emigrate in the future. It would, moreover, be time consuming, expensive, and methodologically challenging. Given these obstacles, retrospective cohort studies or historically prospective cohort studies like the AdultMigCohort have thus far been the favoured design choice in epidemiological studies on migrant health. However, register-based retrospective studies are faced with the challenge that mainly data from the immigration country is available and only scarce data exists from low income emigration countries. The historical prospective cohort design enabled me to follow individuals prospectively from the date on which a residence permit was granted until the end of the study. As time passes and the cohort gradually 'grows older' this will result in an increasing number of health outcomes.

5.2. Population

The study cohort is unique in that it is based on an accurate identification of refugees and family reunification immigrants using specific information on the legal grounds on which they obtained residence permits from the Danish Immigration Service. In addition, the individual matching with a group of native Danes, based on clear inclusion and exclusion criteria, enabled direct comparisons with migrants in unadjusted analyses. In the more advanced analyses the matching variables were included as covariates. The process of establishing the population was lengthy, stretching over a period of about two years, but the result has been a large and robust cohort that can be analysed according to both migrant status and ethnicity. The study cohort also has several limitations, however, which will be discussed in the sections below.

5.2.2. Generalisability

The generalisability of the results to the general population of migrants in Denmark is limited in that the cohort reflects migrants who came to Denmark over a certain time period during the 1990s and therefore the composition of the cohort and the general migrant population will vary according to migrant status and ethnicity. Direct cross-national comparisons are also difficult for the same reasons, apart from comparisons with the exact same migrant groups arriving to other countries in the 1990s. This comparative aspect could be explored in future research.

5.2.3. Selection bias

A possible important selection bias that had to be considered was whether residence permits were granted more often to diseased individuals. Health outcomes would then be biased towards a higher morbidity and mortality among migrants compared with non-migrants if diseased individuals were specifically selected and obtained residence on these grounds. Regarding refugees, only the Kosovo Special Law provision in 1999 had regulations that prioritised elderly, diseased individuals and families with small children and families from the same cities (25,216). Unfortunately the distribution hereof is not publically available. Consequently, an unknown percentage of the 3,000 individuals who were evacuated from Macedonia were evacuated due to ill health. Secondly, during the study period, 2,540 refugees in the cohort were granted residence permits on 'other grounds' (see table 1). This category includes residence permits on 'humanitarian grounds', which is granted to four categories of applicants: 1) individuals suffering from very serious mental disorders (including schizophrenia or psychosis but not PTSD) or physical disorders (including advanced cancer or AIDS that cannot be treated in the country of origin); 2) individuals who are severely handicapped (who cannot be treated in country of origin); 3) individuals who have stayed a min. of five to six years in Denmark; 4) if you are a family with children under age and you come from a country of war or from regions with extremely difficult conditions of life such as famine or drought (217). During the period 1.1.1993 to 31.12.1999 1,002 refugees were granted asylum on humanitarian grounds according to The Danish Immigration Service (20). The percentage distribution on these different categories including medical reasons is not publically available. Thirdly, three types of quota refugees were granted asylum during the 1990s and today: 1) those originating from selected geographic regions; 2) those ill and in need of immediate treatment; and 3) those risking immediate expulsion to their country of origin or at risk in their country of residence, i.e. urgent cases (218). We do not know how many of the 500 annual quota refugees during the 1990s were granted refugee status due to illness. However, according to the Danish Immigration Service, the vast majority of quota refugees fall under the first category, and only a small number are chosen from the two other categories. It is impossible to rule out that these above mentioned selection biases have not affected our results regarding refugees' morbidity and mortality. However, they still pertain to a minority of the refugees included in the cohort. Selection bias towards more diseased individuals obtaining residence permit could also concern family reunification immigrants. Unfortunately, there is no way of estimating this, but it cannot be excluded that some family reunification immigrants were reunited with their families due to illness and a desire to receive better access to health care.

5.2.4. Choice of comparison group

Different comparison groups may be involved when conducting studies on migrants. In the papers of this thesis, the comparison group is: 1) the non-migrant population of the immigration country, i.e. native Danes with native Danish parents termed 'native Danes' throughout the thesis. Other possible comparison groups include: 2) descendants; 3) the population of the emigration country or 4) migrant populations from the same emigration country who migrated to different immigration countries. The choice of comparison group depends on the research question. As mentioned the papers of the thesis compare migrants with native Danes. This form of comparison rendered information on differences in health outcomes and clinical access indicators related to differences in exposures, behaviour and access to health care among migrants compared with non-migrants. Comparing migrants with descendants may render information on factors related to life in the immigration country including changes over time and place in exposures, health behaviour and access to care. Investigating migrants in the immigration country in comparison with the population in the country of emigration may render information on factors that are related to the migration process and the health situation and living conditions in the immigration country. Lastly, comparing migrants of the same origin in different immigration countries may provide information on the influence of factors specific to different immigration countries, for example, differences in the structure of the health care system, which might affect access to health care and consequently health outcomes. Ideally, a life course study on migrants' health would comprise all of the various comparison groups (45). The existing literature, however, mainly compares different groups of migrants with oneanother and migrants with non-migrants in the immigration country. Only more recently have studies begun to include comparisons with identical populations in the emigration country (219,220).

5.3. Register-based studies on migrants

5.3.1. Using register-based data

Researchers in Denmark using register data to investigate issues related to migration, ethnicity,

and health are privileged as national data on country of birth, nationality, parents' country of birth, and immigration and emigration dates are routinely available through Statistics Denmark and may be linked to all national health and health service registers via the personal identification number (60). Moreover, I obtained data on migrant status and nationality (citizenship upon arrival) from the Danish Immigration Service. However, it is important to note that register-based research in general has certain shortcomings. Firstly, the researcher depends on predefined data and is unable to define data collection him/herself. The latter approach may provide more comprehensive and specific information through questionnaires or individual interviews about reason for migration, self-perceived integration, and self-assessed ethnicity. In addition and on a related note, the validity of different measures (especially ethnicity) in registers has been debated (60) as objective measures like migrant status and country of birth will always be rough proxies for complex underlying mechanisms. In this context, the subjective criteria of self-assessment has the advantage of identifying ethnicity as a dynamic concept based on the individual's own choice of ethnic category. Self-assessment, as used for example in the English and Scottish health care system, is therefore generally regarded as the most valid means of measuring ethnicity; however, this is not used in Denmark. Self-assessed ethnicity has, however, limitations in that census data only operates with a certain number of categories due to practical reasons; and categories may therefore end up being very broad. Moreover categories may change hampering comparisons over time. One way of increasing the validity of measures of ethnicity and migrant status in register-based studies is to use several determinants in combination, including various measures of migrant status, ethnicity, and socio-economic status, as proposed by Stronks et al. (221).

5.3.2.Migrant status and ethnicity as exposure groups

Migrant status is based on information on the legal grounds for obtaining a residence permit. The original variable had eight subgroups of refugees and family reunification immigrants. In the papers, migrant status is operationalised into two overall subgroups because it was not possible to stratify further due to small numbers if we also stratified by nationality. The consequence is a potential loss of more detailed information about the different subgroups. The amalgamation of subgroups may be especially problematic for family reunification immigrants, who constitute the most heterogeneous group in the sense that family reunifications with refugees may themselves be refugees and so may differ substantially from family reunifications with other immigrants or Nordic citizens. Family reunifications with refugees comprised a minority (19%) of the total number of family reunifications. Future analyses of migrant status should aim to subdivide when possible.

As mentioned above, migrant status, like ethnicity, is an indicator of complex underlying mechanisms that are difficult to put into words. Migrant status as an epidemiological variable has received only scant methodological consideration to date. The literature employs a number of different measures of migration as outlined in table 2 and elaborated on by Schenk et al. (61). Moreover, Razum et al. (45) and Schenk (31) have embarked on the conceptual development behind using migrant status as a measure of migration processes in a life course perspective. The thesis contributes to these efforts by illuminating the importance of one aspect of migrant status as defined on legal grounds. Naturally, this focus leaves out other dimensions of migrant status such as those related to integration an acculturation.

Finally, nationality upon arrival was used to measure ethnicity. Country of birth is the most frequently used measure, but only nationally was recorded by the Danish Immigration Service. However, nationality generally implies country of birth, and I took the liberty of renaming the variable accordingly throughout the papers even if this represents something of an approximation. Apart from indicating cultural identity nationality also reflected whether migrants came from low, middle or high-income countries and the health hazards related to this context. Both ethnicity (nationality) and migrant status should be viewed as variables that – in spite of the associated challenges - may enrich the scope of social epidemiology.

5.3.3. Statistical power

Best practice in studies of migration, ethnicity, and health is to divide migrants into as many specific and meaningful categories as possible and, as a minimum, to adjust for the impact of socio-economic factors, age, and sex. However, a general problem for conducting epidemiological studies of migrants not least in countries like Denmark with relatively small migrant populations concerns statistical power. The limited number of migrants makes sub-classifications difficult. As a result, ethnically heterogeneous groups of migrants are often analysed together. Even in studies of widespread chronic diseases, numbers are often small when looking at cause-specific morbidity and mortality patterns. Again, this hinders more complex analysis using various confounding variables. In summary, although the papers are based on a relatively large cohort of migrants, absolute numbers become relatively small when specific diseases are investigated and when stratification is undertaken according to migrant status and nationality. This meant that further stratification by ethnicity or migrant status or more specific disease entities was sometimes impossible.

5.5 Additional methodological limitations

5.5.1. Death Statistics

The Register on Causes of Death did not receive death certificates for all of the annual deaths recorded in the Civil Registration System at Statistics Denmark during the follow up from 1 January 1993 to 31 December 2007. The percentages of missing death causes throughout these years differ between 0.3% and 2.7%. Data on these years are not publically available (222).

5.5.2. Remigration bias

Our results may have been affected by registered or unregistered remigration, which would have skewed the estimates. “Remigration bias” or “the salmon bias” refers to the hypothesis that migrants with severe chronic disease or those who expect to die shortly tend to remigrate to their country of origin due to social ties including family who may also be able to take care of them. Although “remigration bias” is generally seen as a potential underlying factor for the lower all-cause mortality among migrants the hypothesis has only been scarcely tested and mainly so in a US setting (223). Remigration of critically ill individuals who then die abroad will lead to an underestimation of our estimates of migrant mortality which may thus appear more favourable for migrants than they really are compared to native Danes. The problems are that if individuals with a Danish personal identification number die abroad they are reported to Danish authorities on an irregular basis; and even if death certificates are forwarded the Danish authorities and thereby the Register of Causes of Death they are not included due to validity problems. We have no means of taking unregistered remigration into account, as indicators hereof have no yet been developed. However, yet unpublished analyses of registered remigration patterns in an updated version of the AdultMigCohort suggests that severely ill migrants do not remigrate in comparison to migrants without disease. In fact, there is a gradient in that the higher the disease severity (accumulated number of comorbidities) the lower is the risk of remigration (224). Consequently, remigration bias apparently does not explain lower all-cause and cause-specific mortality patterns in the AdultMigCohort.

5.5.3. Using ICD-10

The register linkages in 2005 and 2009 respectively only included data on diagnosis from the Psychiatric Central Register, National Patient Register, and Register of Causes of Death from 1 January 1994 and onwards to 31 December 2003 and 31 December 2007 respectively even though the cohort was established from 1 January 1993. All registers had used the ICD-10 coding system from 1 January 1994, which was a change from the former ICD-8 coding system. As the validity of translations from ICD-8 to ICD-10 was questionable, I decided to use only ICD-10 diagnoses starting from 1 January 1994 on advice from the Psychiatric Central Research Register and the National Board of Health. This was especially true for data on mental disorders. By excluding data from 1993, we lost some data, but diagnostic validity was of the utmost importance. In Papers VI-VIII on mortality, ICD-10 based causes of death were also used. I could potentially have included causes of death data from 1993 because the studies analyse broad disease categories; however, the analyses were initially intended to include more refined neoplastic and cardiovascular diagnostic categories, hence the importance of specific diagnostic validity. Unfortunately, this was not possible due to small numbers.

5.5.4. Adjusting for income
Papers I-V were not controlled for socio-economic status because register data was regarded as inconsistent and invalid on income among migrants when we made the first data linkage in 2005. This is problematic because the incidence of some cancers (225,226) and mental disorders (227) differ with socio-economic status, and migrants in general have lower socio-economic status than non-migrants (228). Regarding the papers on clinical indicators of access, a previous Danish study on the association between cancer stage at diagnosis and socio-economic status did not identify any association (229). In addition, a study on variations in use of coercive measure across psychiatric hospital including patient related factors did not identify socio-economic status as an important determinant of use of coercion (230). In relation to the second data linkage in 2009, data on personal income was now considered more consistent and valid for migrants, additionally, as researchers; we had become more aware of the importance of socio-economic status in relation to studying migrants' health outcomes. As a result, personal income as an indicator of socio-economic status was adjusted for in Papers VI-VIII. Personal income has some shortcomings in that income of newly arrived migrants and family reunification individuals may be underestimated, i.e. newly arrived migrants may not yet have a job and family reunification immigrant women may be supported well by their spouses. Also, personal income may not reflect educational level as some migrants may have an academic background but work in unskilled employment in Denmark. Preferably, I would have used 'highest obtained education' because this is a good indicator of knowledge and resources relative to health and accessing health care. However, education is not systematically recorded among migrants arriving in Denmark, and recorded education from the country of origin is overruled by any new education obtained in Denmark. Thus, if a person has an engineering background from Uganda and obtains an upper-secondary school degree in Denmark, the latter is listed in the register as the highest obtained education, which invalidates the picture.

6. CONCLUSIONS

The thesis contributes new knowledge on migrant health in that it uniquely explored the effect of migrant status (in combination with ethnicity) on morbidity, clinical indicators of access, and mortality among migrants compared with native Danes. Several concrete conclusions as well as a number of general conclusions may be drawn from the eight papers:

1. Papers I-III document great variations in mental health morbidity among refugees and family reunification immigrants compared with native Danes. Refugees had remarkably higher rate of first-time admissions for all psychiatric disorders combined and also for specific disorders including psychotic disorders. In contrast, family reunification immigrants had an unexpected significantly lower or similar risk of mental disorders compared with native Danes. The cancer incidence study did not find an effect of migrant status but found, rather, that migrants from the Middle East (including North Africa) had a significantly lower cancer risk, and Eastern European (including the former Yugoslavia) migrants had a similar cancer risk compared with native Danes.

2. Papers IV and V focused on different clinical indicators of access, including use of coercion and cancer stage at diagnosis. Data showed that use of coercion was significantly higher among refugee men and immigrant women compared with native Danes. For cancer stage at diagnosis, migrants overall did not differ significantly from native Danes regarding diagnosis in non-locals versus local stage and more unknown versus known stage compared with native Danes apart from family reunified women from the Middle East.

3. Papers VI-VIII showed lower all-cause mortality, especially among family reunification immigrants but also among refugees compared with native Danes. Additionally, refugees and family reunification immigrants generally showed lower levels of cause-specific mortality compared with native Danes, apart from infectious disease mortality, which was higher for both refugees and family reunification immigrants (especially from sub-Saharan Africa).

4. The papers demonstrated how the unique Danish opportunities for performing register-based research with linkage via the personal identification number also applied to studies on migrants' health. This is welcome as there is a lack of cohort studies based on national data within the international field of research on migrant health.

5. Through the Danish immigration authorities, a large cohort of refugees and family reunification immigrants was identified based on specific information regarding migrant status. Information on nationality allowed for further division of refugees and family reunification immigrants into several ethnic subgroups based on nationality upon arrival.

6. Regarding clinical indicators of access results indicated that migrants potentially may experience problems in accessing primary and secondary health care before diagnosis resulting in excess use of coerce in psychiatry.

8. Finally, studies across all three themes showed that inequalities in health were more pronounced for the refugee group, which was consistently more at risk compared with native Danes - and compared with family reunification immigrants

7. PERSPECTIVES ON FUTURE RESEARCH

The results of this thesis suggest several perspectives for future register-based research on migrant health as such and specifically in relation to the AdultMigCohort.

7.1. General perspectives on register-based research on migrants and ethnic minorities

On an EU and national level, there is a need for collecting population data on ethnicity and migrant status. Naturally, the current lack of data leads to a lack of large cohort studies building on national data and international comparisons. In this context, it is not enough just to collect data; this must be done in a standardised way by authorities both among EU states and within each country. The ultimate aim would be to able to incorporate ethnicity and/or migrants' status into epidemiological studies with the same naturalness as socio-economic status has for decades been incorporated into studies on inequalities in health outcomes.

In relation to this point, an explicit ethical agenda has been called for concerning research in general on migrant and ethnic minority health given the various ethical and conceptual challenges that the field poses including register-based research. Consequently, Mir et al. (231) suggest ten guiding ethical principles for research on ethnicity and health, which may be expanded to migrant health as such. Among other things, the principles involve research being for the well-being and betterment of studied populations, with equity forming the guiding ethical principle.

Another agenda for register-based research is to move beyond descriptive studies into more analytical approaches in the future. One approach is to combine a number of variables on ethnicity, migrant status, and socio-economic status into analytical models based on sound theoretical arguments. This would allow more exposures and associations to be teased out and documented in a life course model, thereby permitting further development of the model in relation to migrant health. Variables should be as specific as possible to allow for valid interpretations.

Finally, there is a need for information on factors that are due to the migration process and living conditions in emigration countries. This requires methodologically challenging prospective study designs, which follow populations in the country of emigration as well as similar populations in countries of immigration (preferably involving several host countries). Ideally, such studies are based on a triangulation of collected clinical data, surveys, and register-based information. The EU-funded RODAM study on diabetes and obesity among Ghanaian natives in urban and rural Ghana and Ghanaian migrants to several European countires is an example of such pioneering new approaches, where different data sources from the emigration country and immigration countries are combined (232).

7.2. Future research based on the AdultMigCohort

In relation to the AdultMigCohort, the thesis gives rise to a number of exiting future research questions, several of which have already been embarked upon. Firstly, the cohort was enlarged in 2010 to include all refugees and family reunification immigrants who received residence permits from 1 January 1993 to 31 December 2010. The larger numbers will enable further subdivision according to migrant status. This is important because it may detect additional inequalities in health and health care use, for example among subgroups of refugees and family reunification immigrants. Quota refuges and asylum seekers in particular differ in their migration history and the ways in which they are received by Danish society. However, inequalities are also likely to occur depending on whether people are migrants reunified with families consisting of refugees, immigrants, or Danish/Nordic citizens.

Secondly, opportunities for conducting comparisons between the cohort and groups other than Native Danes should be explored. The cohort seems quite unique, so far, in Europe regarding migrant status, but comparisons according to ethnicity with migrants in other European countries are feasible and may, for example, provide information on the influence of factors specific to health care provision in different immigration countries.

Thirdly, to enhance understanding of migration processes relative to disease trajectories, it is necessary to explore temporal trends in disease development from arrival and onwards within the cohort. This is also in line with the life course approach outlined in the introduction. In Denmark, data on health outcomes for newly arrived migrants is only collected for asylum seekers, who are offered voluntary medical screening upon arrival. Unfortunately, this data is not available as register information. However, even without baseline data for the various migrant groups that arrive to Denmark, exploring disease trajectories may contribute to the understanding of aetiology and diagnostic strategies. Hopefully, the unique addition of Bio banks to the Danish registers will broaden this perspective and facilitate physio-pathological perspectives in the future.

Fourthly, the papers in the thesis indicate that migrants had more advanced disease at diagnosis. More register-based indicators of differences in treatment and disease severity at diagnosis are needed, particularly in relation to chronic diseases such as diabetes and cardiovascular disease, which are on the rise among migrants.

Finally, new forms of migration continue to arise, including the surge in circular migration and remigration. The mortality papers of this thesis showed a need for more knowledge on registered and unregistered remigration. The first study on the enlarged cohort thus concerned registered remigration among severely ill migrants compared with migrants who are not ill. The aim was to investigate whether there was evidence for the hypothesis of 'remigration bias'.

8. CLINICAL IMPLICATIONS

The results of this thesis point towards several clinical implications of importance to equity in health for migrants.

Firstly, the thesis documents that refugees can be singled out as an especially vulnerable group compared with native Danes and compared with family reunification immigrants. Several of the papers elucidated this pattern. As a result, a system should be put into place targeting the whole refugee group from arrival by: 1) offering a voluntary medical examination, including both mental and somatic health; 2) providing knowledge of health care systems; and 3) facilitating contact with health care services, including general practitioners. As part of this endeavour, the National Board of Health should develop medical guidelines for this approach, which may be used by health care professionals in charge of screening, including general practitioners. Moreover, existing screening practices of the Danish Red Cross for asylum seekers should be regularly subjected to critical revision and adapted to international state-of-the-art approaches. Although such initiatives appear most pertinent for refugees, family reunification immigrants could be offered the same diagnostic and preventive offers upon arrival.

Secondly, papers on clinical indicators of access potentially indicate inequalities in access to services, especially before diagnosis, and thus point to the necessity of adapting services to migrants' needs. Cultural skills, including language, should be further promoted both in primary and secondary care. Access to care may be further hampered by complex comorbidity, including severe psychosocial problems, especially for some vulnerable migrant groups. The existence of special services in addition to mainstream services thus appears essential. Special services like the Migrant Clinic at Odense University Hospital, the Ethnic Resource Team in Region Hovedstaden, and the Psychiatric Trauma Clinic for Refugees at Psychiatric Centre Ballerup are of the utmost importance for developing quality in care for migrants. Ideally, one can even envision an international subspecialist specialisation in immigrant medicine for doctors and other health care professionals as part of this effort.

Thirdly, the papers on mortality (apart from the paper on infectious disease mortality) indicate 'a protective effect' of being a migrant, which is encouraging for migrants' health. Two related points are important in addressing this issue. Firstly, furthering the understanding of migrants health from a life course perspective by disentangling the protective factors related to being a migrant may benefit non-migrants as well. Secondly, to prevent inequalities in mortality from becoming more disadvantageous to migrants in the future, public health authorities should discourage the further adoption of unhealthy risk behaviour in the immigration country and seek to eliminate the importance of past exposures. Consequently, one may envision future special screening programs, including for diabetes or cancer-related infectious agents, for at risk migrant groups.

9. SUMMARY

This thesis aims to explore migrant status as a determinant in register-based studies on migrant health. It is based on eight studies that investigate the following three main issues: 1) What is the importance of migrant status for morbidity patterns among migrants compared with Native Danes? 2) Do migrant status and ethnicity affect clinical indicators of access among migrants compared with Native Danes? 3) What is the importance of migrant status for mortality patterns among migrants compared with Native Danes?

The thesis builds on a register-based historical prospective cohort design. Through Statistics Denmark, all refugees (n = 29,174) and family reunification immigrants (n = 33,287) who received residence permits in Denmark from 1 January 1993 to 31 December 1999 were included and matched 4:1 on age and sex with Native Danes. Register linkage was obtained twice during follow ups in 2004 and 2008 respectively. Personal identification numbers were cross-linked to the Danish Psychiatric Central Register, the National Patient Registry, the Registry of Coercive Measures in Psychiatric Treatment, the Register of Causes of Death, and the Danish Cancer Registry. Migrant status defined by legal grounds for obtaining a residence permit was dichotomised into refugees and family reunification immigrants and used as the determinant in most studies. Analyses involved both Poisson and Cox regression analysis. Most analyses were stratified by ethnicity and adjusted for age and sex. Some were also stratified for individual income.

Three sub-themes were investigated: morbidity, clinical indicators of access, and mortality. The first sub-theme (Papers I-III) showed that refugees had a consistently higher morbidity from several mental health disorders in contrast to family reunification immigrants, whose morbidity from mental disorders was lower than or similar to Native Danes. The cancer incidence study did not find an effect of migrant status but found, rather, that migrants from the Middle East and North Africa had a lower cancer risk and that Eastern European migrants had a similar cancer risk compared with Native Danes. The second sub-theme (Papers IV-VI) focused on different proxy measures of clinical indicators of access. Use of coercion was generally higher among migrants –especially refugee men and immigrant women – compared with Native Danes. For cancer stage at diagnosis, migrants in general showed an unfavourable tendency towards more non-local versus local stages and more unknown versus known stages. No consistent patterns were found according to migrant status.The third sub-theme on mortality (Papers VI-VIII) found that refugees – especially family reunification immigrants – had lower all-cause mortality and lower mortality from cancer, cardiovascular disease, and injuries. In contrast, refugees in particular and migrants in general had a higher mortality from infectious disease.

The thesis demonstrates the unique opportunities for performing register-based research in Denmark, particularly in relation to migrants. It also demonstrates the role of migrant status as a useful variable in migrant studies in addition to ethnicity. Across all three sub-themes, inequalities in morbidity patterns were sometimes in favour of migrants and sometimes in favour of Native Danes. Finally, inequalities in health were more pronounced for the refugee group, which was consistently more at risk compared with Native Danes or which apparently benefited less from the protective factors of being a migrant compared with family reunification immigrants.

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