Three Groups of Immigrants in Germany:

Analysing Health Inequalities

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Ich erkläre hiermit, dass ich die vorliegende Arbeit ohne unzulässige Hilfe Dritter und ohne Benutzung anderer als der angegebenen Hilfsmittel angefertigt habe; die aus fremden Quellen direkt oder indirekt übernommenen Gedanken sind als solche kenntlich gemacht.

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Zusammenfassung

Deutschland ist seit den 1960er Jahren ein Einwanderungsland, das durch verschiedene Einwanderungsperioden und Einwanderergruppen geprägt ist. Folglich haben heute fast 27% der Bevölkerung in Deutschland, und somit fast 21 Millionen Menschen, einen Migrationshintergrund. Der Migrationsprozess selbst sowie die Bedingungen vor und nach der Migration tragen zu gesundheitlichen Unterschieden innerhalb der Migrantenpopulation und im Vergleich zur Bevölkerung ohne Migrationshintergrund bei, wobei bisherige Befunde auf einen schlechteren allgemeine Gesundheitszustand von Immigranten hindeuten. Dieser variiert jedoch nach Rechtsstatus, Herkunft sowie demografischen und sozioökonomischen Merkmalen. Somit ist der Migrationshintergrund eine wichtige Dimension gesundheitlicher Ungleichheit, die sowohl die (Gesundheits-)Versorgung vor Herausforderungen stellt als auch die individuelle Lebensqualität und Möglichkeiten zur Teilhabe an der Gesellschaft und am Arbeitsmarkt beeinflusst.

Bisherige empirische Befunde und theoretische Ansätze verdeutlichen ein komplexes Zusammenspiel in der Genese von Gesundheit bei Immigranten. Bedingungen im Herkunftsland und in frühen Lebensjahren, kulturelle Merkmale (auch in Bezug auf den Lebensstil), positive und negative Migrationserfahrungen sowie die Bedingungen im Zielland (wie politische Rahmenbedingungen oder soziale Prinzipien) beeinflussen signifikant die gesundheitliche Situation. Dabei bedingen sich die bestimmenden Faktoren zeitlich und kausal: beispielsweise begünstigt ein niedriger sozioökonomischer Status im Herkunftsland eine niedrige Positionierung im Zielland, und kulturelle Merkmale prägen, ob und wie sich Herkunftsbedingungen auswirken. Darüber hinaus determiniert die Herkunft die Bedingungen nach der Einwanderung, beispielsweise in Bezug auf die rechtliche Situation oder die soziale Wahrnehmung. Noch fehlen jedoch eindeutige Erkenntnissen zur gesundheitlichen Situation von Immigranten in Deutschland.

Ziel dieser Arbeit ist, die gesundheitliche Situation von Immigranten in Deutschland zu beschreiben und Gesundheitsdeterminanten verschiedener Immigrantengruppen vergleichend zu analysieren. Besonderer Schwerpunkt liegt dabei auf der Bedeutung sozialer und sozioökonomischer Merkmale. Diese wurden bereits als wesentliche Ursache für gesundheitliche Unterschiede in der Allgemeinbevölkerung identifiziert, aber noch nicht in Interaktion mit dem Migrationshintergrund betrachtet. Unter Anwendung des theoretischen Rahmens der "social

determinants of health" werden auf verschiedenen Ebenen wirkende Gesundheitsfaktoren inkludiert. Die zentralen Forschungsfragen lauten: Welchen Einfluss haben soziale und sozioökonomische Merkmale auf die Gesundheit von Immigranten? Ob und wie unterscheiden sich die Mechanismen der Pathogenese zwischen Migrantengruppen und im Vergleich zu Nicht-Migranten? Ziel dieser Arbeit ist es also, sowohl allgemeine als auch (migranten-)gruppenspezifische Gesundheitsdeterminanten herauszuarbeiten.

Der Heterogenität der Immigrantenpopulation in Deutschland wird Rechnung getragen, indem die drei aktuell größten Immigrantengruppen differenziert analysiert werden: (Spät-)Aussiedler (Ethnic German Immigrants, EGI), türkische Immigranten sowie Geflüchtete und Asylbewerber. Diese drei Gruppen unterscheiden sich hinsichtlich Einwanderungszeitraum und -erfahrungen, Herkunft, rechtlichem Status, soziokultureller Normen, demographischer Verhaltensweisen und sozialer Eigenschaften. Unter Berücksichtigung etablierter Theorien zu gesundheitlicher Ungleichheit, sozialer Exklusion und Intersektionalität wird die Hypothese aufgestellt, dass diese sozialen, strukturellen und individuellen Unterschiede mit gesundheitlichen Unterschieden verbunden sind. Dabei wird angenommen, dass benachteiligende soziale Strukturen einen größeren negativen Einfluss auf Immigranten haben, wobei diese Nachteile zusätzlich zu jenen durch den Migrantenstatus verursachten bestehen. Es wird jedoch davon ausgegangen, dass sich diese Benachteiligungen nicht gleichermaßen auf alle Immigrantengruppen auswirken.

Studie I untersucht den Zusammenhang zwischen Migrationshintergrund, Haushaltsmerkmalen und Geschlecht sowie deren Wechselwirkungen im Hinblick auf die Gesundheit von Deutschen ohne Migrationshintergrund (Non-migrant Germans, NMG), EGI und türkischen Immigranten. Die geschätzten Regressionsmodelle zeigen, dass 1) türkische Immigranten einen schlechteren Gesundheitszustand haben als NMG, während die Unterschiede zwischen EGI und NMG gering sind, 2) weibliche EGI ein geringeres Risiko schlechter Gesundheit haben und weniger anfällig für nachteilige Haushaltseffekte sind (wie das Leben in Ein-Generationen-Haushalten oder ohne Partner), 3) Haushaltsmerkmale ansonsten weitgehend unabhängig vom Migrationshintergrund wirken und 4) sozioökonomische Merkmale gesundheitliche Nachteile türkischer Immigranten erklären, während sie jene von EGI überlagern. Diese Ergebnisse deuten darauf hin, dass Haushaltsmerkmale weitestgehend identisch für Immigranten und NMG wirken und es nur partiell eine Interaktion von Migrationshintergrund und Haushaltsmerkmalen in Bezug auf die Gesundheit gibt. Darüber hinaus verdeutlichen die Ergebnisse die interne gesundheitliche Varianz innerhalb

der Immigrantenpopulation, die signifikant von sozialen und sozioökonomischen Merkmalen charakterisiert wird. Die Gesundheit von (weiblichen) EGI ist insgesamt besser, und diese Gruppe ist weniger anfällig für negative Einflüsse als die türkische Vergleichsgruppe.

Studie II erweitert die Haushaltsperspektive und analysiert die Auswirkungen informeller Pflege (innerhalb oder außerhalb des Haushalts) auf Veränderungen der körperlichen Gesundheit der Pflegeleistenden vergleichend für EGI und NMG. Die Ergebnisse deuten auf einen negativen Zusammenhang zwischen (aktueller und früherer) Pflege und körperlicher Gesundheit hin. Die gesundheitliche Nachteile von EGI gegenüber NMG werden durch die Pflege noch verstärkt. Kontrolliert auf sozioökonomische Merkmale konvergieren Gesundheitsveränderungen von EGI und NMG, während die Interaktion zwischen Migrationshintergrund und Pflege erst dann nachgewiesen werden kann. Diese Ergebnisse veranschaulichen die Interdependenz der Gesundheitsdeterminanten und zeigen, dass Immigranten nicht per se gesundheitliche Nachteile haben, sondern diese oft durch strukturelle und soziale Unterschiede und in der Intersektion von Nachteilsdimensionen entstehen. Die Berücksichtigung von EGI, die rechtlich, kulturell, demografisch und sozioökonomisch den NMG ähnlich sind, liefert zudem wichtige Erkenntnisse über die Auswirkungen des Migrations- und Integrationsprozesses selbst auf die Gesundheitsentwicklung. Allerdings werden in den Analysen weder allgemeine noch versorgungsbezogene Unterschiede zwischen EGI und NMG vollständig erklärt. Es müssen also weitere unbeobachtete Zusammenhänge für gesundheitliche Unterschiede vermutet werden.

Studie III bezieht zusätzlich die Makroperspektive ein, indem sie den Einfluss politischer Rahmenbedingungen hinsichtlich des Zugangs zum Gesundheitssystem auf die Gesundheit irakischer, afghanischer und syrischer Geflüchteter analysiert. Während Geflüchtete in Österreich mit ihrer Ankunft uneingeschränkten Zugang zum Gesundheitssystem haben, ist dieser in Deutschland während des Asylverfahrens für bis zu 15 Monate auf die Grund- und Akutversorgung beschränkt. Es wird die Hypothese aufgestellt, dass daraus ein schlechterer Gesundheitszustand von Geflüchteten in Deutschland resultiert. Die Analysen zeigen eine durchschnittlich schlechtere Gesundheitsbeurteilung von Geflüchtete in Deutschland, was diese Hypothese bestätigt und auf einen Effekt der politischen Rahmenbedingungen hinweisen könnte. Darüber hinaus variiert die Gesundheit innerhalb der Geflüchtetenpopulation, wobei afghanische Geflüchtete in beiden Zielländern einen signifikant schlechteren Gesundheitszustand aufweisen. Sozioökonomische Merkmale und strukturelle Unterschiede (z.B hinsichtlich des Bildungsniveaus)

sind für die Unterschiede zwischen den Herkunftsländern und zwischen den Aufnahmeländern von geringer Bedeutung. Diese Ergebnisse liefern wichtige Erkenntnisse über die Gesundheit der (noch) wenig erforschten Gruppe der Geflüchteten. Während soziale und sozioökonomische Merkmale nur schwach zu gesundheitlichen Ungleichheiten in dieser Bevölkerungsgruppe und zwischen den Ländern beitragen, bestimmen makrostrukturelle und rechtliche Bedingungen diesen Zusammenhang maßgeblich. Darüber hinaus unterstreichen die Ergebnisse, dass selbst innerhalb einer vermeintlich homogenen Submigrantenpopulation gesundheitliche Unterschiede bestehen. Dies verdeutlicht die Bedeutung von Merkmalen vor der Migration für Gesundheitsunterschiede.

Diese Arbeit liefert Einblicke in die Gesundheitsdeterminanten von Immigranten in Deutschland und unterstreicht den engen Zusammenhang zwischen Migrationshintergrund, sozialen und sozioökonomischen Merkmalen und Gesundheit. Sie ist eine der wenigen Arbeiten innerhalb der Demographie, die die Gesundheit von Immigranten in multivariater und vergleichender Perspektive betrachtet und somit den Nachweis von konfundierenden, mediierenden und moderierenden Gesundheitsfaktoren ermöglicht. Diese Arbeit zeigt auf, dass Immigranten in Deutschland eine gesundheitsvulnerable Gruppe darstellen, die jedoch durch interne Varianz gekennzeichnet ist. Die Ergebnisse verdeutlichen, dass Immigranten im Vergleich zu NMG teilweise anderen und höheren Gesundheitsrisiken ausgesetzt sind und dass diese Unterschiede zumeist durch sozioökonomische und soziale Benachteiligungen getrieben sind. Insbesondere rechtlich, sozial und sozioökonomisch weniger integrierte Gruppen (z. B. türkische Immigranten, afghanische und weibliche Geflüchtete) sind höheren Risiken ausgesetzt, während EGI und NMG weitgehend vergleichbar sind. Soziale Determinanten erklären teilweise den Gesundheitsgradienten in Abhängigkeit vom Migrationshintergrund. Es wird jedoch auch deutlich, dass die meisten analysierten sozialen Determinanten unabhängig vom Migrationshintergrund wirken und als allgemeine Gesundheitsdeterminanten verstanden werden können. Haushaltsmerkmale gelten (mit wenigen Ausnahmen) weitgehend in gleicher Weise für EGI, türkische Immigranten und NMG, während Merkmale außerhalb des Haushalts zu einer größeren Varianz zwischen den Migrationshintergründen beitragen. Bei Immigranten sind sowohl individuelle Bedingungen als auch übergeordnete Strukturen mit individuellen und gruppenspezifischen Belastungen und Chancen verbunden, die wiederum die gesundheitliche Entwicklung maßgeblich beeinflussen. Das Beispiel der Geflüchteten verdeutlicht zudem die hohe Bedeutung prädisponierender

(Herkunfts-)Merkmale und gesellschaftlicher und politischer Gegebenheiten, die (zumindest) in der Phase kurz nach der Immigration jene individueller sozialer Merkmale überlagert.

Interventionen zur Förderung der gesundheitlichen Chancengleichheit in der Bevölkerung Deutschlands und zur Verringerung von Gesundheitsrisiken von Immigranten umfassen somit zum einen allgemeine Interventionen, wie beispielsweise die Gesundheitsförderung von Personen mit geringer sozialer Integration, niedrigem sozioökonomischem Status, ungünstigen Lebensbedingungen und im Prozess des Alterns. Zum anderen sollten diese vor dem Hintergrund des Migrationshintergrundes kultursensibel und gruppenadäquat sein, indem beispielsweise die Gesundheit von türkischen Männern mit vielen Kindern, pflegenden EGI, afghanischen Geflüchteten und Migrantinnen gefördert wird. Wie in dieser Arbeit gezeigt wird, sind die sozialen und politischen Rahmenbedingungen aufgrund ihres inklusiven und exklusiven Charakters von besonderer Bedeutung.

Summary

Germany has been a country of immigration since the 1960s and has been characterised by different immigration periods and immigrant groups. As a result, almost 27% of the population in Germany today has a migration background (i.e. almost 21 million people). The process of migration itself, as well as conditions prior to and after migration, contributes to internal health differences amongst immigrants and in comparison to the non-migrant population. Findings suggest that the general health status of immigrants in Germany is worse than the non-migrant population and varies across legal status groups, origins, and demographic and socioeconomic characteristics. Thus, the migration background is an important dimension of health inequalities, which is associated with challenges for (health) care systems and affects individual quality of life and opportunities to participate in society and the labour market.

Empirical findings and theoretical approaches provide evidence of a complex interplay in the genesis of health amongst immigrants. Conditions in the country of origin and in early life, cultural characteristics (e.g. with regard to lifestyle), positive and negative migration experiences, and conditions in the country of destination (e.g. in relation to political frameworks or social principles) significantly affect health outcomes. Usually, determining factors interfere in temporal and causal perspective; for instance, a poor socioeconomic situation in the country of origin favours a poor situation in the country of destination, and cultural characteristics shape how and if conditions in the country of origin affect persons or groups. Moreover, origin determines which conditions apply after immigration with regard to, for example, legal situation or social perception. However, there is a lack of distinct findings on the health situation of immigrants in Germany.

The objective of this thesis is to describe the health status of immigrants in Germany and to analyse determinants of health amongst different immigrant groups in the country in a comparative perspective. The focus is on the importance of social and socioeconomic characteristics, which have already been identified to manifest health differences in the general population but have not yet been analysed in terms of interaction with the migration background. Applying the social determinants of health framework, the multidimensionality of health determinants is considered by integrating factors acting at different levels. The main research questions are: What is the impact of social and socioeconomic characteristics on health outcomes amongst immigrants? To what

extent are the mechanisms different or similar amongst immigrant groups and compared to non-migrants? Thus, this thesis aims to elaborate both general and group-specific health determinants.

The heterogeneity of the immigrant population in Germany is taken into account by analysing distinct immigrant groups, namely the three largest groups currently: Ethnic German Immigrants (EGI), Turkish immigrants, and refugees and asylum seekers. These three groups differ significantly from each other in terms of their migration-specific, demographic, and general characteristics, such as immigration period and experiences, origin, legal status, socio-cultural norms, and social characteristics. Considering established theories on health inequality, social exclusion, and intersectionality, it is hypothesised that these social, structural, and individual differences are associated and interfere with health differences. Further, it is hypothesised that disadvantageous social structures have a greater negative impact on immigrants and that these disadvantages apply in addition to those caused by the migrant status. However, it is assumed that these do not affect health equally across the migration background.

Study I analyses the association of migration background, household characteristics, and gender and their interactions with regard to health amongst Ethnic German Immigrants (EGI) and Turkish immigrants. Estimating (gender-stratified single-level and multilevel) regression models, it is found that 1) Turkish immigrants have worse health compared to non-migrant Germans (NMG), whereas EGI and NMG differ less, 2) female EGI have lower risks of poor health and are less prone to adverse household effects (e.g. when they are living in one-generation households or without a partner), 3) household characteristics otherwise largely act independently of the migration background, and 4) socioeconomic characteristics explain health disadvantages of Turkish immigrants, whilst they veil those of EGI. These findings indicate a partial interaction of migration background and household characteristics in terms of health. However, immigrants and NMG are largely equally affected by these characteristics. Furthermore, the results illustrate the internal health variance within the immigrant population, which is significantly driven by social and socioeconomic characteristics. Health outcomes are better amongst (female) EGI, and this groups is less susceptible to negative influences than Turkish immigrants.

Study II extends the household context and determines the impact of informal care (within or beyond households) on physical health changes in a comparative perspective of EGI and NMG. The results of generalised estimating equations indicate a clear negative association of caregiving

and physical health, with both current and past caregiving decreasing physical health. EGI have small health disadvantages over NMG, and these are amplified by providing care. Once adjusting for socioeconomic characteristics, health developments of EGI converge towards those of NMG, whilst the interacting effect of migration background and caregiving emerges. These findings illustrate the interdependence of health determinants and show that immigrants do not have health disadvantages per se but often only when adjusting for structural and social differences and in the intersection of disadvantageous features. Accounting for EGI, who are both legally equal and culturally, demographically, and socioeconomically close to NMG, also provides important insights into the impact of the process of migration and integration itself on health developments. However, neither general nor care-related differences between EGI and NMG are fully explained within the analyses. Thus, additional unobserved mechanisms for health differences might be assumed.

Study III additionally includes the macro perspective by analysing the impact of political frameworks with regard to access to the healthcare system on health outcomes of Iraqi, Afghan, and Syrian refugees. In Germany, the access is restricted to basic and acute treatment during the asylum process for up to 15 months, whereas refugees in Austria have full access upon arrival. It is hypothesised that the health of refugees in Germany is comparatively poor due to the access restrictions. The analyses indicate a lower health assessment of refugees in Germany, which verifies this hypothesis and might point to an effect of policy frameworks. Moreover, there is evidence of health variance across the refugee population, with Afghan refugees having significantly worse health in both countries of destination. Socioeconomic characteristics are of minor relevance on the differences according to country of origin, and adjusting for structural differences (e.g. educational level) only slightly reduces the distinction between the health status of refugees in Germany and Austria. These results provide important insights into the health of the (as yet) little researched group of refugees. Whilst social and socioeconomic characteristics only weakly contribute to health inequalities in this population and across countries, macro-structural and legal conditions significantly frame this association. In addition, the findings underline that health differences prevail even within a supposedly homogeneous sub-migrant population. This highlights the importance of pre-migration characteristics for health differentials.

This thesis provides insights into the health determinants of immigrants in Germany and emphasises the close link of migration background, social and socioeconomic characteristics, and health. It is one of the few studies within demography which considers health outcomes of

immigrants in a multivariate and comparative perspective and thus enables the demonstration of confounding, mediating, and moderating health determinants. This thesis makes the important contribution to prove that immigrants in Germany represent a health-vulnerable group, which is, however, characterised by internal variance. The results illustrate that immigrants in Germany are partially exposed to other and increased health risks compared to NMG and that these differences are strongly driven by socioeconomic and social disadvantages. Especially legally, socially, and socioeconomically less integrated groups (i.e. Turkish immigrants, Afghan refugees, female refugees) face higher risks, whilst EGI and NMG are largely comparable. Social determinants partly explain the health gradient by migration background. However, it also becomes clear that most analysed social determinants emerge regardless of the migration background and may be categorised as general health determinants. Household characteristics (with few exceptions) apply largely similarly for EGI, Turkish immigrants, and NMG, whilst characteristics beyond the household justify greater variance across different migration backgrounds. Thus, amongst immigrants, both individual conditions and higher-level structures are associated with individual and group-specific burdens and opportunities which, in turn, significantly affect health developments. Moreover, the example of refugees illustrates the importance of predisposing (origin-related) characteristics as well as societal and political circumstances, which (at least) in the period shortly after immigration superimposes those of individual social characteristics.

Interventions to promote health equality within the population of Germany and to reduce health hazards amongst immigrants include, on the one hand, general interventions (e.g. health promotion of persons with low levels of social inclusion, low socioeconomic status, unfavourable living conditions, and in the course of ageing). On the other hand, in the context of the migration background, these should be culturally sensitive and group-adapted by, for example, promoting the health of Turkish men with many children, caregiving EGI, Afghans, and female immigrants. As shown in this thesis, social and political frameworks are of particular importance due to their inclusive and exclusive character.

List of Abbreviations

ADL	activities of daily living
AME	average marginal effect
ATE	average treatment effect
BL	baseline
BMI	body mass index
e.g.	*exempli gratia*, for example
EGI	Ethnic German Immigrants
FIMAS	*Integrationsmaßnahmen und Arbeitsmarkterfolg von Flüchtlingen und sibsidiär Schutzberechtigten in Österreich,* Integration measures and labour market success of refugees and beneficiaries of subsidiary protection in Austria
GEE	generalised estimating equations
GSOEP	German Socio-Economic Panel
HALE	healthy life expectancy
IADL	instrumental activities of daily living
i.e.	*id est,* that is
IOM	International Organization for Migration
LE	life expectancy
NMG	non-migrant Germans
OR	odds ratio
PCS	physical component summary
PP	percentage points
PSM	propensity score matching
ReHIS	Refugee Health and Integration Survey
SD	standard deviation
SDH	social determinants of health
SF-12	Short-Form 12
SF-36	Short-Form 36
SRH	self-rated health
vgSRH	(very) good self-rated health
WHO	World Health Organization
1G-HH	one-generation households
2G-HH	two-generation households
3+G-HH	three- or more generation households
95%CI	95% confidence interval

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List of Original Publications

Study I:

Georges, D.; Kreft, D.; Doblhammer, G. (2018): The Contextual and Household Contribution to Individual Health Status in Germany: What is the Role of Gender and Migration Background? In: Gumá, J.; Doblhammer, G. (Ed.) (2018): Family and Health from a Gender Perspective in Europe. Springer Brief.

Study II:

Georges, D. (2022): The effect of informal caregiving on physical health among non-migrants and Ethnic German Immigrants in Germany: a cohort analysis based on the GSOEP 2000–2018. *BMC Public Health* 22**,** 121 (2022). https://doi.org/10.1186/s12889-022-12550-0

Study III:

Georges D.; Buber-Ennser I.; Rengs B.; Kohlenberger J.; Doblhammer G. (2021): Health determinants among refugees in Austria and Germany: A propensity-matched comparative study for Syrian, Afghan, and Iraqi refugees. PLOS ONE 16(4): e0250821. https://doi.org/10.1371/journal.pone.0250821

1. Introduction

Low fertility rates, associated with population ageing and population decline, are currently the main demographic challenges for Europe and many developed countries as they are linked to social and economic consequences and affect the labour market, care systems, and health systems [1]. Migration is often seen as a solution to counteract both ageing and declining populations, whereby, in particular, the immigration of young people appears favourable to decrease the old-age ratio and to compensate for the birth gap [2, 3].

In 2020, the number of international migrants worldwide was estimated at 280 million; migration movements were usually towards developed industrialised countries, and Europe was the main region of destination [4]. In Europe, immigration accounted for 70%, and thus was the main driver, of the population growth between 2005 and 2010 [5]. Consequently, most European countries have become multi-ethnic and culturally diverse over the past decades [6].

These developments and challenges can specifically be observed in Germany. Due to the recruitment of guest workers, the nation's history, and the progressed level of development, Germany has de facto been an immigration country since the 1960s [7, 8]. From a demographic perspective, immigration in Germany certainly rejuvenated the population, stabilised the labour market, compensated for low birth rates, and contributed to population growth. Today, almost 21 million people with a migration background originating from various contexts of origin live in Germany, accounting for roughly 27% of the entire population [9]. However, since German policy denied being a country of immigration for a long time, no policies towards immigrants (e.g. with regard to their rights and obligations in terms of integration) were developed, and immigrants have been socially marginalised. This also applies to the health system and healthcare policies, which is problematic in that such systems must adapt to increasing diversity to remain effective and ensure universal health coverage [10].

Whilst traditional voluntary migration is, in and of itself, not a risk to health [11], the migration process of refugees and asylum seekers represents a particularly critical time point for health (e.g. due to the risky mode of transport and dangerous routes or in case of human trafficking) [12, 13].

Moreover, migration is associated with both societal changes and health challenges because immigration brings together people with diverging health profiles [10, 14] and affects individual life courses [15]. Thus, migrants are a particularly health-vulnerable group within societies due to the migration experience and their special situation. This also applies to immigrants in Germany, whereby the migration background represents a central dimension of health inequalities [16–18], which contradicts the World Health Organisation's (WHO) principle of 'the highest attainable standard of health […] of every human being without distinction of race' [19] (p. 1). This is also associated with disadvantages for social systems, public health, and individual health as poor health hinders integration into societies and the labour market, lessens individual quality of life, and increases health expenditures [20–23]. Thus, the association of migration and health represents a 'global public health research priority' [24]. Nonetheless, research on the health situation of immigrants in Germany and underlying determinants is (yet) quite limited in the area of demography. This might be driven by the fact that migration research has been considered outside the scope of demographic research [25], mainly focussing on the causes of migration [26]. Theories of migration have predominantly been derived from economics [27], and migration and its consequences lie at the interface of demography and related research areas such as sociology, psychology, epidemiology, and economics.

1.1 Thesis Objective

The aim of this thesis is to analyse the health situation of immigrants in Germany, with an emphasis on the distinct consideration of different migrant backgrounds and their similarities and differences in terms of health. Germany provides a case study for one developed country with a long history of migration and a huge share of the population with an immigrant background. Analysing three partially diverging immigrant groups (Ethnic German Immigrants, Turkish immigrants, and refugees), determinants of health differences with special consideration of the influence of social and socioeconomic characteristics are identified. Derived from established theoretical frameworks, such as the social determinants of health approach, the focus (in addition to socioeconomic status) is on family characteristics, namely household composition and exchanges within the family (Study I and Study II). Additionally, health is embedded into a broader set of determinants via a cross-country comparison (Study III). Based on this, the following research questions are answered: What

is the impact of social and socioeconomic characteristics on health outcomes amongst immigrants? To what extent are the mechanisms different or similar amongst immigrant groups and compared to non-migrants?

Moreover, it is hypothesised that social, structural, and individual differences within the immigrant population contribute to and interfere with distinctions in health and do not apply equally across the groups. Further, it is hypothesised that immigrants' health is more prone to disadvantageous social structures and that there is an interaction of the adverse effects of disadvantages and having a migration background.

1.2 Thesis Structure

This thesis is divided into nine chapters. This introduction is followed by an approximation of the concepts of migration (chapter 2) and health (chapter 3), each of which is not based on generally accepted definitions. After a global embedding, reference is made in each chapter to Germany, namely with regard to the history of immigration and immigrants and the composition of the immigrant population, with respect to the epidemiological situation in Germany. In chapter 4, central theories on the association of health and immigration are presented. A discussion of the research literature and empirical results on this association, including both international results and specific findings for Germany, is provided in chapter 5.

This thesis is a cumulative work consisting of one book chapter (Study I) and two peer-reviewed articles (Studies II and III). In chapters 6, 7, and 8, these are presented and discussed with regard to their data; analytical strategies and methods; substantial, theoretical, and scientific background; and their main results. Finally, in chapter 9, the lines of argument are concluded and the results synthesised. This includes a discussion of the strengths and shortcomings of the studies, an examination of the theoretical frameworks, an elaboration of the implications, and an overall conclusion.

2. Theoretical Framework: Migration

The first essential element within this work is the migration background. Below, this term is defined and classified in the international and German contexts.

2.1 Definitions: Migration and Migrants

The term 'migration' is derived from the Latin words *migratio* and *migrare*, which mean 'to move from one place to another' and thus describe geographic movements of individuals, groups, and populations, usually away from their place of residence [28]. However, a general and universally accepted definition of the term 'migrant' does not yet exist, as the International Organization for Migration reflects:

Migrant: An umbrella term, not defined under international law, reflecting the common lay understanding of a person who moves away from his or her place of usual residence, whether within a country or across an international border, temporarily or permanently, and for a variety of reasons. The term includes a number of well-defined legal categories of people, such as migrant workers; persons whose particular types of movements are legally-defined, such as smuggled migrants; as well as those whose status or means of movement are not specifically defined under international law, such as international students. [28] (p. 132)

On the one hand, this broad and vague definition depicts the internal heterogeneity of migrants in terms of origin and destination, legal status, the (in)voluntary causes of the movement, and the length of stay. On the other hand, it illustrates that the term 'migrant' is subject to diverse conceptions of time, law, and culture. Consequently, the underlying concepts to measure, record, and identify migrants vary considerably across countries and through time [29] and are often based on different criteria. Traditional concepts such as the country of birth, (former or current) citizenship or nationality, and comparison of usual residence at different points in time partly map various groups of persons, contribute to an undercoverage of individuals with a migration history, and neglect important migrant characteristics (e.g. the migrant generation or return migrants) [9, 30–32]. Thus, the heterogeneity within the migrant population in terms of migration biography contributes to challenges to accurately and comprehensively grasp and define this group. Especially in a cross-country perspective and time comparison, these difficulties and differences might

contribute to biased results (e.g. when analysing migration flows or the situation of migrants). However, considering these diverse characteristics of migrants and migration, there is largely a consensus on defining several subgroups of migrants:[1]

- Country perspective and nature of movement: emigrants (from the perspective of the country of origin) versus immigrants (from the perspective of the receiving country)
- Geographical classification: national/internal migrants (migration within a state) versus international/external migrants (migration across borders)
- Causal classification: (e.g.) economic migrants versus labour migrants versus health migrants versus educational migrants versus environmental/climate migrants versus family-based migrants
- Freedom of choice: involuntary (forced) migrants versus reluctant migrants (relocation) versus voluntary migrants
- Migrant generation: first- versus 1.5- versus second- versus third-generation migrants
- (Intended) Duration of stay: tourists versus transmigrants versus permanent migrants
- Legal status: illegal/irregular migrants versus legal migrants versus asylum migrants
- International law: nationally defined migrant groups versus internationally defined groups (e.g. refugees as defined in the 1951 Geneva Refugee Convention)

Within this dissertation, several concepts and criteria are integrated to determine and distinguish immigrant groups (e.g. [own and parental] nationality, country of origin, legal status, and country of birth) [see chapter 6]. Non-migrant status is usually defined when none of these criteria indicates an immigrant background. The analyses involve international, forced and voluntary, legal, and permanent immigrants in Germany from 2000 to 2018 (see chapter 6). This restriction enables the minimisation of temporal and regional changes in the definition of immigrants. A differentiation regarding the causes of migration and the migrant generation was not applied during the selection of immigrant groups. However, some if these migrant-specific characteristics (e.g. duration of stay and legal status) have been considered to differentiate the immigrant groups and have been integrated into the statistical analyses.

[1] There are manifold concepts for the classification of migrants and migration; this list is not intended to be exhaustive, and the categories are not disjunct. For a comprehensive overview, I refer to [28].

2.2 Brief Overview of Global Migration Processes

Migration has always occurred as the result of various motives and reasons such as employment, education, family reunification, environmental disasters, wars, or political conflicts [5], and the rationale to migrate usually was (and is) driven by the expectation to realise net gains in well-being [33, 34]. Prior to 1750, migration processes were largely restricted to local movements. Beginning in the late 18th century, there were increasing migration movements, particularly in America and in terms of employment migration and refugee migration during the growth of empire. During the 19th century, progressive industrialisation and urbanisation were main drivers of increasing migratory flows, where emigration streams led largely to the industrialising colonies in the New World and in traditional immigration countries (e.g. Australia and the United States) [2, 33, 35, 36]. In Europe, which has been an emigration territory for a long time, the transition from agrarian to industrial societies similarly contributed to labour mass migration in the 19th and early 20th centuries. In addition, new motives for migration arose; for example, the number of flights for political reasons increased in this period [27, 37].

In the 20th century, 'immigration […] emerged as a major force throughout the world' [27] (p. 431). In this context, the 1960s marked a sharp break in terms of migration patterns as the volume of migrants had grown, and the composition of migration had changed. Many traditionally migrant-sending countries transformed into immigrant-receiving countries (e.g. Southern European countries) and vice versa (e.g. the former colonial countries), and the receiving developed countries were faced with increasing diversity and multiethnicity due to immigration from developing countries [27].

By the end of the 20th century, most developed nations in Central and Northern Europe, North America, Australia and Oceania, and Asia had become countries of immigration, immigration became truly global, and international migration got a new face: the variety of receiving countries grew, the spectrum of emigration countries shifted, the causes and reasons for migration changed, irregular migration increased, and migration involved increasing numbers of people [33, 35, 36]. In 2020, the number of international migrants was estimated at nearly 272 million globally, and international migration was characterised by major migration and displacement events. Thus,

migration is currently—more than ever—related to acute or persisting global political, social, environmental, demographic, economic, and technological transformations [38]. However, migration movements are still distributed non-uniformly across the world in terms of scale and pace and are becoming increasingly diverse with regard to underlying causes and associated effects on individuals, sending countries, and receiving countries [38, 39]. The increasing extent, complexity, and diversity of migration patterns are a global challenge as they are associated with advantages and disadvantages in the development perspective [34, 40]. Social and political concerns cover multiculturalism and assimilation, labour force, integration, demographic changes (e.g. in terms of marriage patterns and population growth), policies, and the maintenance of social systems [2, 41, 42]. In addition, for scientific research, which has mainly focussed on the causes of migration [26], the sweeping changes are accompanied by new needs such as insights into the health situation of migrants, which has evolved to be a 'global public health research priority' *[24]*.

2.3 Immigration and Immigrants in Germany

As in other developed countries, the history of migration in Germany began in the middle of the 18th century, when migration was characterised by emigration. The continental emigration of approximately 500,000 to 700,000 individuals to Eastern Europe, East Central Europe, and South-eastern Europe between 1750 and the 1830s was followed by transatlantic mass emigration of approximately 5.5 million people up to the late 19th century. The subsequent change in the directions of migration or new forms of migration due to economic and employment advancements led to a high volume of mobility. Migration in Germany included large flows of internal migration (e.g. rural-urban migration) and international immigration. Almost half of the 62 million inhabitants of the German Reich in 1907 did not live in their place of birth, which justified the need for the first (inclusive and exclusive) migration policies in the late 19th century [43]. Whilst the time of the world wars was characterised by forced emigration, mass expulsions, and displacement, the post-war period marked the beginning of a new migration regime: Germany opened to immigration, especially by foreign workers, and became one of the most important immigration countries in the world. The migratory movements in the following decades fluctuated, but the net migration was positive in most periods. Thus, immigration made a significant contribution to the national population growth [8, 43–45].

The international immigration and emigration numbers in Germany for 1964 to 2018 are shown in Figure 1. The immigrant movements can essentially be subsumed into five categories (adapted from [7, 46, 47]):

1) Continental European immigration with a large influx of approximately 14 million guest workers in the 1960s and 1970 due to labour recruitment agreements (1955 with Italy, 1960 with Spain and Greece, 1961 with Turkey, 1964 with Portugal, 1968 with Yugoslavia[2]), followed by Eastern European immigrants due to the collapse of the Soviet Union in the 1990s
2) Ethnic German immigrants (EGI) from Europe and Asia between 1985 and 2005, particularly due to the collapse of the Soviet Union and the legal right to re-naturalisation
3) (European-origin) Refugees and asylum immigrants in the 1980s, 1990s, and 2000s due to political instability in European countries (e.g. the 1980 military putsch in Turkey or the civils wars in and breakup of Yugoslavia)
4) Jewish immigration from the former USSR in the 1990s and 2000s
5) International refugee and asylum migration since 2005, especially since 2015 due to the Arab Spring

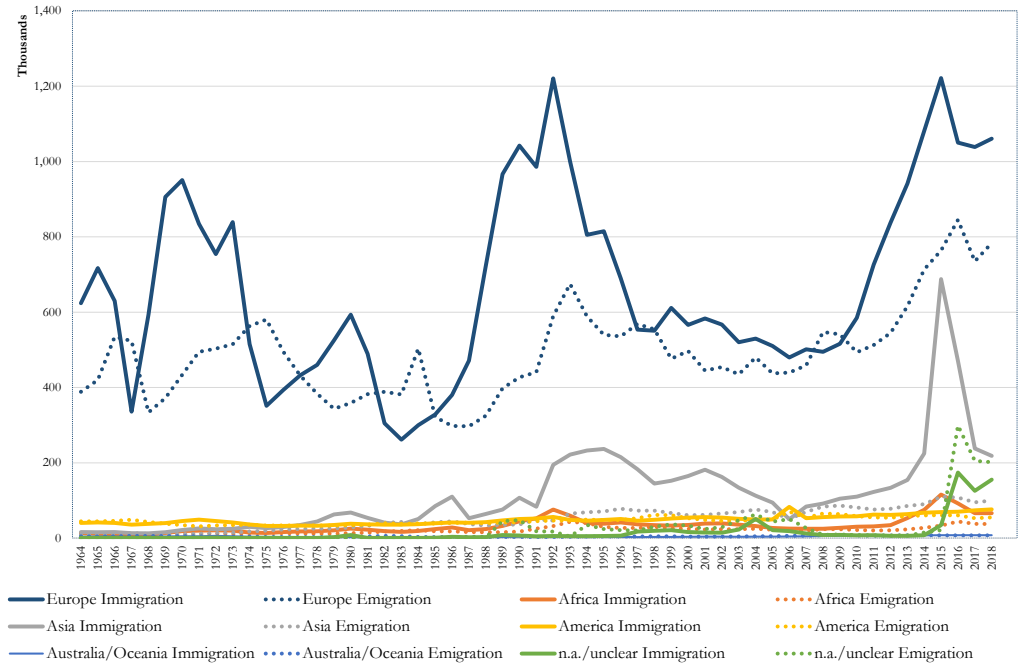

Figure 1: Immigration and emigration in Germany, 1964–2018, by continents

Source: [43], own compilation

[2] Besides these labour recruitment agreements with European countries, there have also been agreements with Morocco (1963), South Korea (1963), and Tunesia (1965). For the former German Democratic Republic, there have been contract worker agreements with Poland (1965), Hungary (1967), Mozambique (1979), and Vietnam (1980).

Persons with a migration background in Germany

Despite the long history of immigration and the essential contribution of immigration to the economic and demographic growth, the Federal Republic of Germany did not declare being a country of immigration until 2004, which manifested in the lack of general policies towards immigration and immigrants. The Immigration Law was implemented in 2005, and for the first time, it regulated the entry, residence, employment, integration rights, and integration duties of foreigners and immigrants. Moreover, in 2005, the concept of the 'migration background' was established and integrated into official statistics. This concept is a central category still used to describe ethnic diversity in Germany and provides a specifically German variant to define immigrants [48–50]. 'Individuals with a migration background' are defined as those who immigrated to the territory of the Federal Republic of Germany, foreigners born in Germany, and all individuals born in Germany with at least one immigrant or foreign parent born in Germany[3] [51]. This broad definition enables the differentiation of people with and without their own migration experience (i.e. first- and second-generation immigrants), foreigners and naturalised persons, and those with a one-sided or two-sided migration background. Considering different criteria implemented into the official statistics (e.g. own and parental citizenship, legal status at time of immigration, country of birth, and country of origin), the composition of persons with a migrant background can be depicted in more detail.

In 2018, every fourth person in Germany had a migration background (20.8 million people). Of these, 65% had their own migration experience, and 35% did not migrate themselves; respectively, 52% had German citizenship, whilst 48% were foreign nationals [52]. The composition of individuals with a migration background in terms of origin reflects the migration phases and groups described above. Those of Turkish origin (2.8 million) and EGI (2.6 million) each accounted for 13% of the population with a migration background. Moreover, 9% were asylum immigrants (1.8 million), and a considerable share of immigrants in Germany originated from

[3] In 2018, this definition was simplified: 'A person has a migration background if he/she or at least one parent does not have German citizenship by birth' (9). However, the change in definition has no effect on the analyses and results presented in this thesis.

several of the (other) countries with labour recruitment agreements: 4% were of Italian origin (0.8 million) and 2% of Greek origin (0.45 million) [52].

People with a migration background differ from Non-migrant Germans (NMG) in terms of demographic characteristics: on average, they are younger (e.g. share of people younger than 45: 67.1% immigrants versus 42.5% NMG), and the share of men is slightly higher (51.3% versus 48.9%)[4] [52]. In addition, there are different cultural profiles amongst people with a migration background (and compared to NMG), which is briefly presented below. In Table 1, selected indicators of the socioeconomic status of the main immigrant groups are shown. These groups are analysed in the further course of this work.

Table 1: Selected indicators of socioeconomic status for immigrant groups

Immigrant group	NMG	Turkish	EGI	Refugees/asylum immigrants		
Indicator (share [%])				**Syrian**	**Afghan**	**Iraqi**
Without school graduation	1.4	19.5	5.3	18.5	25.3	25.5
Abitur	21.7	11.7	18.5	23.1	15.5	14.5
Professional qualification	71.8	29.9	74.3	17.4	15.8	16.1
of which: academic degree	16.7	6.0	14.0	9.7	7.1	8.4
Working population	52.9	46.1	63.6	22.7	32.0	27.4
Employment rate of women	49.3	37.3	58.5	7.8	16.9	14.9
Individual net income (on average, in €)	2,225	1,785	1,915	1,456	1,591	1,442
Risk of poverty[a]	11.7	31.1	18.3	74.5	63.8	66.5
Predominantly spoken language in the household = German	99.6	50.7	n.a. (Russian Fed.: 63.0)	22.4	33.6	31.4

Source: [9], own calculations and compilation
Note: [a] Equivalent income lower than 60% of the median equivalent income (of private households)

Turkish immigrants: Fifty-five per cent of the Turkish immigrants in Germany are recruited guest workers of the period from 1950 to 1980, including subsequent family migration (i.e. first-generation immigrants), and 45% are their descendants (i.e. second-generation Turkish immigrants). Thirty-six per cent of the entire group has German citizenship. Along these two dimensions (immigrant generation and citizenship), significant structural differences persist. Essentially, the

[4] However, the sex ratio varies considerably by origin (e.g. the share of men was 41.1% amongst people with a Ukrainian migration background and 60.5% amongst Syrian immigrants).

group of first-generation Turkish immigrants is older, lives in more traditional family and household settings, is more often of strict Muslim faith, has lower levels of gender equality (e.g. a significantly lower employment participation of women), possesses lower levels of education, and has a lower socioeconomic status [9, 53–56]. Moreover, Turkish immigrants have a comparably disadvantageous educational profile (i.e. they yield the lowest proportion of individuals with abitur or academic qualifications), but their income and German-language utilisation are located between that of NMG/EGI and the refugee groups (see Table 1). However, the acquisition of German citizenship and the generation transition tend to (partly) contribute to assimilation, where the second generation of Turkish immigrants is strikingly younger (32.3 years) and is located between the first-generation of Turkish immigrants and non-migrant Germans in terms of their values and socioeconomic situation [56–58].

EGI: EGI[5] are persons or descendants of Germans who emigrated from Germany to mainly Eastern European countries prior to the 20th century or people (and their descendants) of German origin who did not return from (designated) former German regions after World War II. Based on the Federal Refugees Act, EGI can remigrate to Germany and acquire German citizenship in simplified procedures [52, 59]. Since 1950, about 4.5 million EGI underwent the admission process, mainly coming from the Russian Federation, Poland, Romania, the Soviet Union, Kazakhstan, Kyrgyzstan, the Ukraine, and Belarus [52]. Due to their special legal position, their language abilities, and their cultural proximity, EGI are most similar to the NMG population. However, in many traits, EGI range between those of the sending regions, the other immigrant groups in Germany, and NMG. Compared to other immigrant groups, for example, EGI have a favourable socioeconomic profile [55, 59, 60]. Whilst the employment rates of EGI are even higher than those of NMG (which is also, however, due to the age structure), they are otherwise behind NMG but ahead of Turkish immigrants and the refugee groups in almost all socioeconomic aspects (see Table 1).

[5] Synonymously used terms: in-migrating ethnic Germans, (Spät-)Aussiedler, (ethnic) repatriates.

Refugees and asylum immigrants:[6] Asylum is a humanitarian right protected by the German Constitution. It applies to people who were or would be threatened by serious dangers in their country of origin and includes politically persecuted foreigners, beneficiaries of international protection, refugees, and persons in need of subsidiary protection. Whilst asylum immigrants have only basic rights within the ongoing asylum process (e.g. restricted access to healthcare or the labour market), the formal recognition includes a (limited) residence permit, the possibility to apply for a permanent settlement permit, and unrestricted access to the labour market [52, 61]. The highest annual numbers of asylum immigration were filed between 2015 and 2020. During this extensive wave of immigration, 1.44 million first applications for asylum had been filed. Of them, about 593,000 were from Syrian, about 204,000 from Afghan, and about 187,000 from Iraqi immigrants. Recent asylum immigrants are the youngest immigrant group in Germany and reflect a surplus of men. On average, they have a low socioeconomic status but with a polarised profile of education and employment rates. Whilst the educational profile is best amongst Syrian asylum immigrants (e.g. in terms of a comparably high proportion of individuals with abitur), they have the lowest levels of employment when compared to NMG, EGI, Turkish immigrants, and other asylum immigrant groups. On the contrary, the employment situation and German-language utilisation of Afghan immigrants are highest within the asylum immigrant comparison. Apart from the rate of academic degrees, the socioeconomic profile of Iraqi asylum immigrants is the most disadvantageous (see Table 1).

The values of asylum immigrants in Germany tend to be more modern than amongst the non-migrants in the regions of origin; however, they reported rather more traditional attitudes towards gender equality than NMG. Moreover, language distance (see Table 1), cultural origin, and religious affiliation (85% of the asylum immigrants from Syria and Afghanistan are Muslim, and amongst the asylum immigrants from Iraq, 53% are Muslim, and 33% are Yezidish) distinguish the recent asylum immigrants from other immigrant groups and NMG [62–64].

[6] 'Refugees' only include the group as legally defined by the Geneva Convention, whereas 'asylum immigrants' include all immigrants who applied or apply for asylum. For the sake of simplicity, the term ‚refugees' is used for both groups below.

3. Theoretical Framework: Health

In the following sections, the term 'health' and essential findings concerning (inter-)national health developments are briefly introduced.

3.1 Definitions and Measurements

Defining health is, at best, problematic. ([65], p. 4)

A generally applicable health definition has still not emerged. Definitions of health and illness reflect the historical period and cultural beliefs, and they vary across cultural groups and perspectives [65, 66]. From a natural-scientific and biological perspective, illness might be defined as a deviation from a physiological equilibrium; from a social perspective, as a deviation from social norms; and from a biomedical-pathogenetic perspective, as the presence of diagnosable diseases [66, 67]. One of the first definitions to attempt a holistic and positive representation of health was published by WHO: 'Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' ([19], p. 1). Whilst this approach was one of the earliest which emphasised well-being and thus the subjective dimension of health, it has been criticised for neglecting the dynamic genesis of health and illness, for the tendency to cover happiness instead of health, and for the unattainable ideal of health [68, 69]. Subsequent health models and health definitions partly addressed these aspects. For example, bio-psycho-social models have described the interrelation of biological, psychological, and social aspects of health and illness [70]; disability models have represented the disablement process, usually as a path from health to limitations and disablement, which is embedded into social context and characterises health status [71, 72]; salutogenic models have considered the dynamic health/disease continuum, which is integrated into stress and coping resources [73]; and social models have understood health to be socially constructed and thus the result of social determinants[7] [76]. Consequently, health definitions have been relativised and differentiated in recent years, where various classification criteria and components of health have been identified:

[7] For a comprehensive discussion of health definitions and health models, I refer to [65, 67, 74, 75].

- Huber et al. (2011) have discussed three domains of health—physical, mental, and social —and distinguished between objective and subjective health [77].
- Verbrugge and Jette (1994) have differentiated illness according to the type and extent of health restrictions and disability: pathology, impairments, functional limitations, disability [71].
- Bergner (1985) has identified the genetic foundation of health; the biochemical, physiologic, or anatomic condition; the functional condition; the mental condition; and the health potential [78].
- Young (2005) has distinguished health status according to opportunities associated with illness and health, perceptions of health, functional status (in terms of social, psychological, and physical functioning), impairment, and duration of life [75].

The broad and vague definitions of health and the internal differentiation of health are associated with difficulties in measuring health directly [74]. Instead, numerous indicators of health to represent the abovementioned components have evolved (e.g. satisfaction with health as a valid and reliable indicator of health perceptions [75], mood indicating the mental condition [78], or difficulties preparing meals measuring limitations in the instrumental activities of daily living [71]). Thus, different objects of investigation require various health measurements [74].

Population-based surveys usually use standardised questions and include selected aspects of health status or an assessment of morbidity, such as the questionnaire on (Instrumental) Activities of Daily Living (IADL/ADL) and the Short-Form 36 (SF-36). Most of these instruments address general health, physical functioning, or mental health. Since survey questionnaires usually have little leeway left for detailed health questionnaires, some indicators to measure overall health have established. These include questions about illness within the past four weeks or the self-assessment of health (self-rated health, SRH). Such items are particularly suitable because they are generic and comparable health indicators [79, 80].

In this thesis, I adopted a fairly broad definition of health as I largely analysed self-assessed general health indicators (SRH, general long-standing illness) and physical health changes, derived from the SF-36 (see chapter 6). Given the purpose of this work, it appears effective to consider established measures which are generally understandable and easy to answer for all population groups and have a sufficient variance, even within small subgroups and subpopulations.

3.2 Epidemiological Transition and International Health Differences

Whilst at the beginning of the 19th century, no country had a life expectancy (LE) over 40 years, in some parts of the world, substantial health improvements and mortality declines have contributed to a steadily increasing LE since 1840 [81–83]. However, since particularly wealthy countries (in Oceania, Middle Europe, North America, parts of South America, and Japan) achieved LE gains, these regional improvements set the beginning of a global divide [81]. In 2020, the global LE at birth was estimated at 73.2 years but with a considerable range of 50.75 years (Lesotho) up to 84.26 years (Japan) [84]. Overall, there is a gap in LE at birth of 18.1 years between high-income and low-income countries [85].

Moreover, there has been a relative compression of unhealthy life time in the last few decades and a globally rising healthy life expectancy (HALE) [81]. However, HALE has developed unevenly in a similar way as LE; in 2020, HALE at birth was 74.09 years in Japan but only 44.24 years in Lesotho [86]. Again, country differences are largely shaped by national income differences [85].

The decrease in mortality could essentially be described in three phases over time: the phase of pestilence and famine was followed by a receding of pandemics and a subsequent phase of degenerative and humanmade disease [83]. This framework, known as the epidemiologic transition, has been updated and expanded by two phases, namely the transition from cardiovascular diseases to age-related diseases and the phase of increasing inequalities [87]. Considering the shift in the spectrum of diseases from infectious to non-communicable diseases in the development of countries, WHO (2009) have described this as a 'risk transition' [88] (p. 2). For low- and middle-income countries, these developments are associated with a double burden in terms of population health because they are confronted with a growing toll of non-communicable diseases in addition to infectious diseases [89]. Thus, unequal epidemiological improvements and unequal levels of welfare contribute to international heterogeneity in regard to population health, the prevalence of diseases, and the spectrum of diseases [85, 90].

An overview of selected health indicators in countries relevant for this work is given in Table 2. It reveals a huge variance in universal health coverage and health risks. Germany and Austria reported the highest absolute and relative health expenditures and the highest density of medical doctors. In

the Russian Federation (one of the main countries of origin of EGI), health expenditures were significantly lower, but there was nonetheless a comparably high density of doctors. Health expenditures in Turkey were at a similar level to the Russian Federation, but the density of doctors was much lower. Finally, the absolute health expenditures and the density of doctors were comparatively lowest in Syria, Afghanistan, and Iraq. However, there was a gradient within this country cluster, for example, in Afghanistan, the density of doctors was particularly low, and the relative health expenditures were rather high. These distributions were partly reflected in the LE, HALE, and health risks. LE and HALE were highest in Germany and Austria and lowest in Iraq, Syria, and Afghanistan. In contrast, the risk of death from non-communicable diseases at middle age and the incidence of the infectious disease tuberculosis were highest in Afghanistan and the Russian Federation and lowest in Germany and Austria. [85, 91].

Table 2: Selected world health indicators (2019), by country

	Germany	Austria	Turkey	Russia	Syria	Afghanistan	Iraq
Health expenditure per capita (US$)	4,714	5,002	469	469	69.83[a]	57	153
Health expenditure of GDP (%)	11.1	10.4	4.3	5.3	3.57[a]	10.2	3.3
LE at birth (men, years)	78.7	79.4	73.3	66.4	59.4	61.0	67.5
LE at birth (women, years)	83.3	84.2	79.4	77.2	68.9	64.5	72.2
HALE at birth (men, years)	70.2	70.9	64.4	59.1	52.5	52.1	57.4
HALE at birth (women, years)	73.0	73.9	67.6	67.5	59.5	54.1	60.6
Probability of dying from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases between 30 and 70 (both sexes, %)	12.1	11.4	16.1	25.4	21.8	29.8	21.3
Tuberculosis incidence (per 100,000, 2017)	7.5	7.4	17.0	60.0	19.0	189.0	42.0
Density of medical doctors (per 10,000; 2009–2018)	42.1	51.4	17.6	40.1	12.2	2.8	8.2

Source: [85]
Note: [a] Health expenditures for Syria for the most recent available year, 2012, based on [91]

Thus, the beginning of the 21st century might be characterised as a healthy era with a historically high LE and HALE. However, there is a huge amount of heterogeneity across countries, which reaches particular importance in the context of international migration. Usually, migration is accompanied by health selection, both in terms of who migrates (usually young and healthy individuals) and where these individuals migrate to (contemporarily, usually into more developed countries and health regimes; see chapter 2). Moreover, migration is a demographic consequence of, amongst other causes, uneven health risks and, in turn, has a significant impact on individual as

well as public health outcomes. However, the different contexts of origin and destination must be considered and differentiated.

3.3 Health Situation in Germany

Germany provides a high-level healthcare system as it has one of the most comprehensive health systems with a high coverage and comparably low cost-sharing [92]. Due to mandatory health insurance for all citizens and permanent residents, the health system is mainly publicly financed [93].

Both the LE and the HALE have risen steadily over the past decades in Germany (LE at birth, both sexes combined: 78.1 years in 2000 to 81.7 years in 2019; HALE at birth, both sexes combined: 68 years in 2000 to 71 years in 2019) [84, 86]. Thus, Germany is ranked in the EU's middle [94]. Subjective well-being and SRH have increased over time, and in 2013, 75% of the population in Germany rated their health as good or very good. Cardiovascular diseases (40%) and cancer (25%) were the main causes of death in 2013, but age-standardised mortality of these diseases has decreased over time. Whilst there were low and decreasing rates of alcohol consumption and smoking in Germany, there have been high and increasing rates of physical inactivity and associated symptoms such as obesity, high blood pressure, and diabetes over time [94, 95]. These developments towards longer lifespans as well as towards degenerative and manmade diseases illustrate that Germany has already finished the epidemiologic transition [96].

In addition to age and sex, social differences represent the main determinant of health inequities in Germany. Frequently, social status is approximated via socioeconomic status as it is closely linked to other social resources such as lifestyle and health behaviours, living and working conditions, and social capital [97]. Empirical findings have indicated a social gradient in Germany, whereby individuals with higher social or socioeconomic status have reported better health [94]. This gradient has been proven for different health indicators and age groups (e.g. for SRH, depression and functional limitations amongst individuals aged 60 years or older [98], for physical health, functional health, and subjective health amongst individuals aged 40+ years [99], for lung cancer [100], for obesity within the ages from 25 to 69 years [101], for the utilisation of health services and health-related lifestyles [102], and in terms of mortality [103, 104]).

Moreover, there is a significant health variance in Germany depending on the migration background [17, 105], driven by structural differences between the immigrant population and the autochthonous population (see section 2.3). However, previous findings did not draw a clear picture of the health situation of immigrants in Germany. By tendency, immigrants in Germany generally differed in their risk for certain diseases, but they did not suffer from different diseases [106]. More specifically, immigrants were more likely to have mental problems, reported lower levels of general health, had higher risks of infectious diseases, and were less likely to utilise healthcare services [94, 98, 107]. However, most of the studies emphasised the heterogeneity within the immigrant population and the need to apply internal differentiation (see section 5.3.2 for the description of the health status of immigrants in Germany). Socioeconomic disadvantages mediated migration-related health disadvantages and partly explained health differences both within the immigrant group and compared to NMG [18, 107, 108]. Furthermore, exposures in the pre-migration and post-migration contexts [106, 109] as well as the mere process of migration [110] contributed to social and socioeconomic differences, which in turn defined health (dis)advantages amongst immigrants [94, 107]. Thus, in the context of migration, an interaction of the migration background and (migration-specific and general) social characteristics determines health differentials.

4. Theoretical Approaches to Immigrant Health

Several theoretical approaches have emerged about the impact migration has on health. These are briefly presented in the subsequent section. With regard to the scope of this thesis, the focus is on demographic and sociological theories.

4.1 Health Transition

Considering the differences in epidemiological progress in Germany and the main countries of origin of immigrants in Germany (see section 2.3), the epidemiological transition, located at the macro level, has been transferred to the micro level. The health transition theory postulates that immigrants from less to more epidemiologically developed countries have lower mortality and morbidity than both the population of origin and destination at and shortly after immigration [111]. Thus, migration contributes to a 'rapid-health-transition' [112], which is caused by changing contextual effects in terms of hygienic conditions, medical care, and economic status on the individual [112–114]. Whilst individual imported risks from the countries of origin (e.g. infectious diseases and emergencies) can quickly be resolved by the well-developed 'therapeutic component' in the country of destination, the adapted 'risk factor component' due to the destination country's conditions (e.g. lifestyle-related health risks and cancer risks) takes effect in a time-delayed manner [111, 114]. Therefore, migration in itself is a health transition and associated with both a shift in the cause-of-death profile and an interaction of reduced short-term health risks and emerging long-term health risks, which contribute to temporary good health outcomes.

4.2 Stress Theories

Stress theories conceptualise the impact migration has on health due to its inherent stressful life changes in terms of the physical/geographical movement, cultural shock, goal-striving stress, social isolation, and social stress [115, 116]. Thus, the disruptive effects of migration [117] and the process of acculturation [118, 119] explain (particularly short-term) health inequities between migrants and non-migrants. The subsequent adaptation process, associated with a convergence in sociocultural characteristics and socioeconomic conditions, diversifies health differences in the medium-term perspective [120]. Therefore, both the phenomena directly associated with migration and the

immediate and time-lagged differences on social, economic, cultural, and behavioural levels cause health disparities [16, 121]. It must be assumed that shorter migration routes, cultural proximity, higher levels of social inclusion, a better socioeconomic position in the host country, and a small discrepancy between the socioeconomic positions before and after migration reduce the (perceived) levels of stress.

4.3 Disruption and Adaptation Hypotheses

The disruption and adaptation hypotheses originate in fertility research, but their basic assumptions can be transferred to the effect of migration on health outcomes. The disruption hypothesis assumes an initial drop in health outcomes due to migration-related disruption of the life course and social relationships [122, 123]. Migrants leave many of their social relationships with families and friends in their country of origin, which is associated with a loss of emotional bonding, social support, and sense of identification and belonging. Along with social, cultural, and linguistic barriers, this negatively affects health and (social) well-being [124–126]. According to the adaptation hypothesis, immigrants adapt to the conditions of the country of destination over time, which promotes social inclusion and relationships to peers, ethnic networks, and non-migrants. The recurring sense of bonding and social establishment favours an increase in well-being and health [127, 128].

4.4 Life Course Approach

Life course epidemiology aims to examine the temporal relationships and long-term effects of social or physical exposures across generations during gestation, childhood, adolescence, young adulthood, and adulthood on health outcomes in later life [129]. Within this conceptualisation, diseases are the outcome of different possible pathways of early life conditions [129]. In accordance with this approach, several concepts have been established which refer to time and duration (e.g. accumulation of risks, chain of risk or trajectory models), timing (referring to e.g. critical or sensitive periods, birth cohort effects, or latency periods), or mechanisms and temporal sequence (e.g. mediating and modifying effects, resilience, and vulnerability) [15, 130]. In the context of migration, all of these dimensions might be applied; migrants face additional exposures during the life course, the phase of migration represents a critical and sensitive period, (disadvantageous) exposures

usually accumulate over time, and mediating as well as modifying factors shape the association of exposures and health outcomes [15, 131].

4.5 Social Determinants of Health Model

Health differences and inequalities are largely affected by social determinants. According to WHO, social determinants are defined as 'the conditions in which people are born, grow, live, work and age. These conditions or circumstances are shaped by the distribution of money, power and resources at global, national and local levels' ([132], p. 1012). Thus, social determinants act at different levels across various domains of life [132], which results in systematic differences in terms of unequal positions in society [133].

One of the first and most effective illustrations of social health determinants was provided by Dahlgren and Whitehead within the social determinants of health (SDH) model. Social inequity in health is socially produced and characterised by avoidable, unfair, systematic, and non-random patterns of health differences [134]. Thus, social determinants operate through a range of social pathways (towards health inequalities), and health inequalities are determined by (threatening, promoting, and protecting) social factors acting at different levels. These have been conceptualised as rainbow-like layers, where inner layers are embodied into outer layers [134–136]:

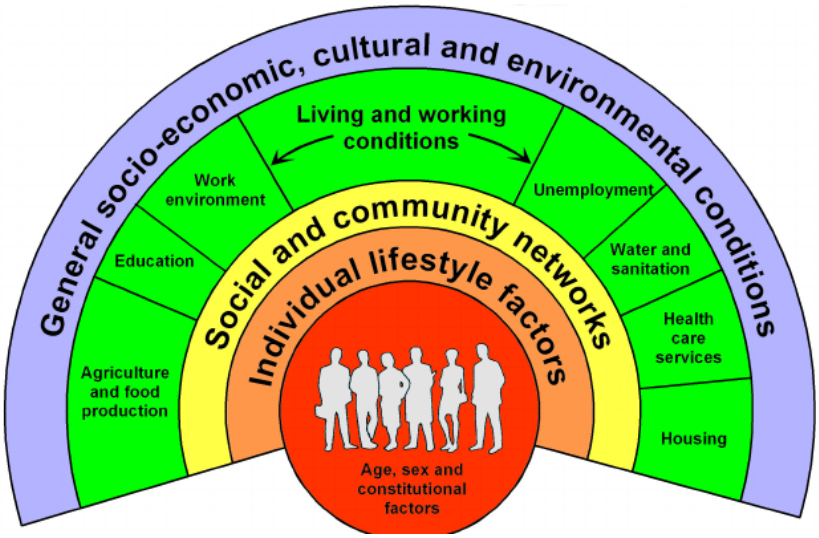

Figure 2: Conceptual framework: the Dahlgren-Whitehead rainbow

Source: [136]

The centre of the figure captures largely fixed characteristics which individuals possess (e.g. age, sex, and genetic disposition). These are surrounded by modifiable layers. The first layer represents personal lifestyle factors (e.g. physical activity and smoking habits), the second layer covers communities in which individuals interact (e.g. peer communities), and the third layer includes living and working conditions which shape individual abilities to maintain health (e.g. access to health services and the work environment). The fourth and outer layer represents general conditions and structural features (e.g. health policies, disposable income) which mediate individual and population health [135, 137]. Thus, health can be affected by individual, commercial, and policy decisions [135].

4.6 SDH Model within the Context of Migration

> *Analyses of systematic differences in health by ethnic background should, whenever possible, be related to socioeconomic background, as the magnitude and causes of the ethnic differences observed tend to differ by social position. Likewise, ethnic background needs to be included in analyses of social inequities in health in countries with marked ethnic discrimination.* ([134], p. 22)

The quote from Whitehead and Dahlgren highlights the essential role social and socioeconomic characteristics play in explaining health inequalities in the context of migration. Moreover, it illustrates the close nexus of social situation, socioeconomic background, migration background, and inequalities. Consequently, the migration background has also been integrated into social health models. Within this framework, the migration background represents a further dimension of health inequality, where the conditions surrounding migration are a catalyst for health inequalities, and the structural inequalities experienced by migrants have a significant impact on overall health and well-being [11, 138, 139] (see Figure 3).

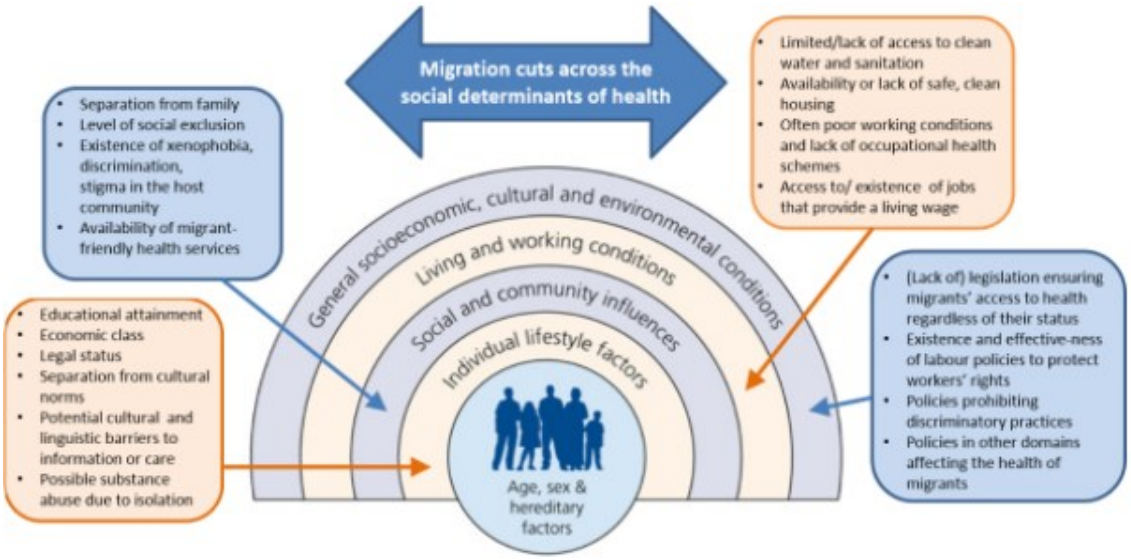

Figure 3: SDH model within the context of migration

Source: [139], p. 3 (adapted from [138])

At the individual level, migrant-specific characteristics comprise the unequal maintenance or adaption of lifestyle behaviours, language and cultural difficulties, loneliness and social stress, and access barriers. At the social and meso level (including social, community, living and working conditions), the separation from social networks such as the family, experiences of discrimination, exclusion, psychosocial stress, bad housing arrangements, and greater occupation risks constitute migrant-specific health risks At the macro level covering structural determinants, a lack of adapted policies and conditions might contribute to health disadvantages [11, 139].

For this thesis, the Dahlgren-Whitehead model has been adopted to provide a broad explanation of social health inequalities. The different layers of the Dahlgren-Whitehead rainbow have been considered, and in all of the three studies, the individual core characteristics (age, sex) and a selection of the characteristics of the layers are included (see Figure 4).[8]

[8] Not all characteristics can be clearly assigned to one layer. For example, education and household characteristics act on several layers. Migration background/immigrant group cuts through all layers and was considered as a core characteristic due to its predisposing and causal nature.

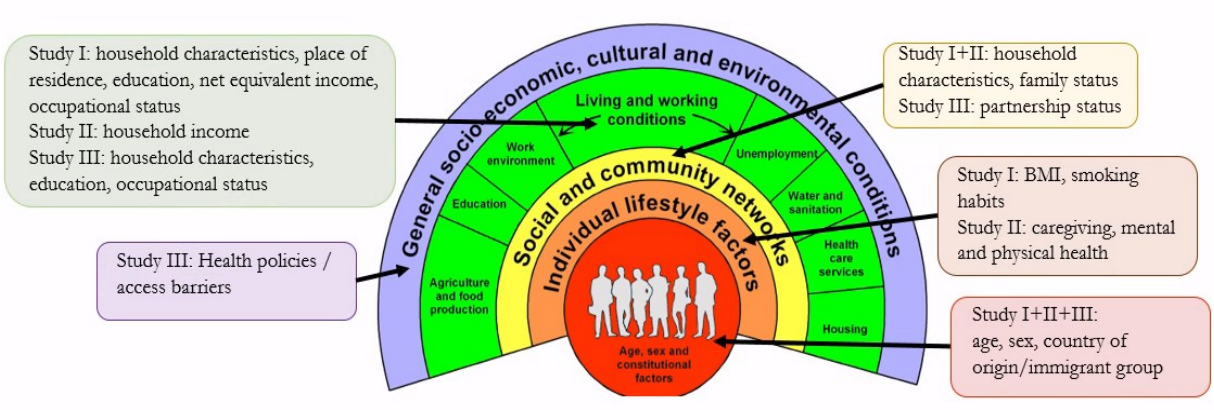

Figure 4: Adaption and application of the Dahlgren-Whitehead rainbow in this thesis

Source: Adapted from [136]

4.7 Social Exclusion Theory

The notion and consideration of social exclusion is a rather new concept and originally referred to individuals who were not covered by the social security system [140]. The scope of this idea has been continuously expanded, and in contemporary understanding, social exclusion is a multidimensional phenomenon which refers to unequal access to resources, unequal participation, and/or denial of opportunities and is driven by institutional and cultural discrimination. Thus, social exclusion is associated with a disruption of the relationship between society and individuals and reduces cohesion within societies [141]. Exclusion criteria are usually based on age, sex, disability, race, ethnicity, religion, migration status, socioeconomic status, place of residence, sexual orientation, or gender identity [141–143]. Thus, immigrants pool attributes which might contribute to social exclusion in terms of the deprivation of resources (e.g. healthy foods, medical products), denial of social rights (e.g. medical treatment, right to work), or prevention from social participation and cultural integration (e.g. intra- and interethnic networks, social recognition). Perceived structural discrimination is associated with poorer health outcomes [144–146]. The reciprocity of causes and effects of disadvantages due to exclusion can lead to a downward spiral. Therefore, social exclusion theories might explain level differences in the health of and across immigrants and the variety of health pathways over time.

4.8 Intersectionality Framework

The framework of intersectionality is based on the intersection of race and sex as well as the triple oppression theory on race, class, and gender from the 1980s [147–149] and partly expands the abovementioned demographic health theories. Intersectionality describes the interfering, mutually constituting, and (non-additive) reinforcing nature of multiple dimensions of inequalities such as race, social class, disability, religion, or sex/gender. Thus, health represents one dimension of inequalities, and health risks as well as individual experiences of ill health are affected by intersecting disadvantages caused by marginalisation, stigmatisation, oppression, and discrimination [150–154].

Analogous to the SDH model, the causes of inequality are located at the macro, meso, and micro levels and include discriminatory policies and norms, negative stereotypes and interpersonal discrimination, and intrapersonal identifies and inequalities [153]. Within the context of migration, 'being a migrant' is associated with numerous inequalities (e.g. based on life course, religion, race/skin colour, social class, and socioeconomic status), each of which is both associated with health inequalities and likely to intersect [155]. Consequently, individual or group-specific inequalities of their own emerge, and these are closely related to different procedures and experiences of discrimination. These are important to explain health variance related to immigrant groups or countries of origin. With regard to immigrants in Germany, therefore, it might by assumed that EGI are subject to fewer levels of discrimination than Turkish immigrants or refugees due to their linguistic, cultural, phenotypical, religious, and social proximity. These differences might also contribute to differences in the genesis and perception of health and illness across individuals and immigrant groups.

5. Empirical Findings: Migration and Health

This chapter introduces empirical findings on health differences between migrant groups (immigrants and non-migrants) and an overview of the health situation of people with a migration background in Germany.

5.1 Measuring the Health of Immigrants—Selection and Methodological Problems

Studies on the morbidity and mortality of migrants are confronted with methodological problems as their results are located in the area of tension amongst selection effects, recording problems, and true migration effects[9] [156, 157].

The 'healthy migrant effect' (also healthy immigrant paradox) conceptualises the importance of positive health selection into migration decisions. This selection counteracts the inverse effects of the socioeconomic profile of immigrants and the stressors to which they were exposed during the migration and within the integration process and contributes to the better health outcomes recent immigrants have compared to established immigrants and non-migrants [158–161]. However, due to a suppression by (disadvantageous) socioeconomic factors, the healthy migrant effect works only in the short term, and usually health outcomes of immigrants deteriorate shortly after immigration [160, 162]. Moreover, the selection into migration is more pronounced with increasing geographical and economic distance between the countries of origin and destination [163]. Thus, the time perspective and the extent of selection must be taken into account to avoid biased results and an overestimation of (particularly newly arrived) immigrant health.

An approach similar to the healthy migrant effect was postulated with the 'Hispanic health paradox', which tried to disentangle the mortality advantages and better (physical) health Hispanic immigrants in the United States had despite their low socioeconomic status and their disadvantageous psychosocial and health risk profile [166]. Socio-cultural resilience and coping strategies, strong intra-ethnic cohesion, and social embedding have been assumed to explain this paradox [166–168].

[9] Some of these approaches have been established to explain lower migrant mortality but can be applied to morbidity.

Inverse selection processes apply to return migration ('salmon bias effect' and 'unhealthy remigration'), with elderly and ill people returning to their countries of origin [164]. The geographical distance, migration conditions, and severity of illness determine the return migration selection [164, 165]. Consequently, the group of non-remigrants represent a selected population with, for example, refugees, transatlantic immigrants, and sick and elderly people being overrepresented.

Recording problems include (unequal) remigration and under-recording of deaths and illness. Remigration of selected health profiles contributes to an underestimation of the burden of diseases amongst immigrants and a misinterpretation of morbidity [165]. Further recording problems involve the delay between immigration and study entry of immigrants (late-entry bias). Assuming that unhealthy, dissatisfied, and unsuccessful (e.g. in terms of socioeconomic integration) immigrants will remigrate or move on within this period, the risk of illness amongst immigrants is underestimated. Moreover, unregistered emigration and unrecorded illnesses and deaths abroad contribute to this underreporting and underestimation [159, 165].

5.2 International Empirical Findings on Immigrants' Health

Considering the differences within the immigrant population with regard to predisposing individual factors, predeparture conditions, travel conditions, and conditions at arrival, health vulnerability and health concerns amongst immigrants vary significantly [38]. Consequently, the state of research on mortality and health of migrants does not present a clear picture. Below, the main international findings on mortality, mental health, and physical health are presented. These are mainly limited to the three central immigrant groups in this thesis and approximately comparable groups in industrialised western countries.

5.2.1 Mortality

There is vast and largely uniform empirical evidence on the mortality advantage of immigrants [169–172]. This has been determined for different regions of destination (e.g. for high-income countries in general [170], Central European countries [173], Sweden [174], Denmark [175],

Germany [176, 177], France [178], Israel [179], Brazil [180], Canada, and the United States [167, 181]).

It seems that almost all immigrant groups (e.g. refugees [175], asylum seekers [182], Hispanics [167, 183], Asian immigrants [180], Latin American and Caribbean immigrants [184], Turkish immigrants [173, 176], and immigrants from the former Soviet Union [177]) have lower mortality rates. However, these advantages for specific immigrant groups partly differ across the host countries; for example, in Sweden, general lower mortality risks have only been reported for non-European immigrants but not for European immigrants [174], and in an international review, lower risks have only been determined for refugees but not for asylum seekers [170].

A detailed look at different causes of death reveals further variances. Lower levels of mortality amongst immigrants have been largely uniformly reported for the main causes of death, namely cancer mortality [172, 173, 175, 180] and cardiovascular mortality [175, 183, 185]. Moreover, there has been similar evidence for specific causes of death (e.g. there are mortality advantages amongst immigrants suffering from type 2 diabetes [186], HIV-tuberculosis [187], and COVID-19 [188]). However, there is a higher mortality ratio amongst immigrants for external causes and tuberculosis (the latter particularly for immigrants from Asian and African regions) [170, 172] and for infectious diseases [189, 190].

Data artefacts, cultural effects, and selection effects have been discussed to explain the mortality advantages of immigrants [169]. Since there usually is a convergence of mortality risks over time (i.e. with increasing duration of stay [174, 178, 181, 191]), and mortality advantages are most pronounced amongst immigrants to richer countries [171], positive selected immigration, as postulated within the healthy migrant effect, proved to be plausible [169]. Moreover, the empirical findings highlight the interplay of predeparture conditions and post-arrival conditions on individual mortality risks.

5.2.2 Mental Health

Due to the stressors associated with migration, mental disorders are a significant health concern for immigrants [192–194]. However, it proved to be difficult to estimate the prevalence of mental

illness [195] because the group of immigrants is very heterogeneous [196], and prevalence as well as risk factors vary substantially across immigrant groups [197].

The findings on depression and depressive symptoms do not show conclusive evidence of a higher prevalence amongst immigrants, particularly without differentiation of destination countries and immigrant groups [198]. The studies reporting significant differences are mostly singular and focussed on specific subgroups; there have been findings on higher proportions of depressed people amongst first-generation immigrants [199], higher odds of depression amongst Irish immigrants in Britain [200], significantly increased depression prevalence amongst elderly Turkish and Moroccan immigrants in the Netherlands [201], and higher prevalence of depression in elderly first-generation immigrants in Northern and Western Europe [202]. However, there have been concurrent results on higher rates of depression amongst refugees, asylum seekers, and irregular immigrants [199, 203–205]. Similarly, the prevalence of posttraumatic stress disorder (PTSD) and anxiety [195, 204, 206] has been reported to be very high amongst refugees and asylum seekers, whilst there is no clear pattern, or significant difference to non-migrants, for other immigrant groups.

More differentiated findings emerge for schizophrenia and psychotic diseases, where immigrants were found to have generally higher risks [194, 207, 208]. The risk rates for schizophrenia are particularly increased amongst second-generation immigrants [209, 210], ethnic minorities [211], and refugees [212]. For psychoses, there are similar associations, namely, there were higher risks of developing psychoses for refugees (compared to non-refugees and non-migrants) [194, 213], and for immigrants from non-European countries to European countries [208].

In terms of psychosocial well-being, higher levels were found for first-generation immigrants in the United States [214] and Asian immigrants in the United States [215] and lower life satisfaction and well-being for immigrants in Europe [216]; adolescent immigrants from Eastern European and non-Western or non-European countries in Italy [217]; and refugees and asylum seekers in the United Kingdom [218].

Consistently higher rates of dementia have been reported for immigrants. In the United States, the dementia prevalence and the frequency of Alzheimer's disease of black-skinned immigrants and

Hispanic immigrants exceeded those of white individuals [219, 220]. For immigrants in Europe, generally increased rates of dementia amongst immigrants were reported, with Asian and African immigrants having the highest rates [221].

Although there are inconsistent findings across the mental health indicators, immigrant groups, and host countries, the results illustrate the rather negative impact migration processes yield on this domain of health. Different drivers for this association have been discussed. Firstly, the frequency of mental health problems of refugees and asylum seekers points to the importance of detrimental exposures within all phases of migration [197]. Secondly, differences across the host countries point to the importance of legal frameworks [196], supporting conditions [199], and cultural differences (e.g. in the diagnosis and treatment rates of mental disorders [196]). Thirdly, perceived discrimination [222], the individual level of acculturation [223], language abilities [224], and poorly planned migration [200] contribute to higher mental health risks. Finally, socioeconomic disadvantages [225, 226] and lower levels of educational, employment attainment, and human capital [198, 215, 227] as well as low incomes [200] moderate the negative migration effect on mental health. Although forward-focussed coping strategies and social support counteract disadvantageous conditions [228, 229], the major disadvantages of refugees and asylum seekers illustrate the importance of precarious conditions prior to and during migration.

5.2.3 Physical Health

The state of research on physical health amongst immigrants has thus far been less comprehensive. In terms of self-rated health (SRH),[10] mixed results have been published. There have been findings on lower rates of poor SRH for immigrants in Canada [232, 233] but higher rates of poor SRH for foreign-born Asians in the United States [234], immigrants in Sweden, particularly for first-generation immigrants [235], and immigrants across Europe [236]. No general differences in SRH amongst immigrants were determined for the United States or Canada. However, the two latter studies found internal variance in that foreign-borns had higher risks to transition to poor SRH over time and that immigrants living in the United States for 15 years and longer had increased

[10] By definition, SRH does not only determine physical health. However, due to its high predictive validity with respect to mortality (230) and the significant contribution of physical health aspects to SRH variance (231), the findings were classified in this section.

odds of poor SRH [237, 238]. For the group of newly arrived refugees, relatively high shares of at least good SRH have been found for Syrian, Afghan, and Iraqi refugees in Austria (85%) [239] and for Palestinian refugees in Jordan (80%) [205]. On the contrary, Dowling et al. have reported poor general health of refugees in Australia persisting throughout a three-year follow-up [240].

The profile of communicable and infectious diseases represents an important morbidity concern amongst immigrants [241, 242]. Respiratory, gastrointestinal, and dermatologic infections have been reported to be a significant morbidity burden in newly arrived immigrants and refugees in Europe [192] in terms of a high prevalence of Chagas disease in Latin-American immigrants [243], increased incidence rates of HIV-tuberculosis co-infections [187], and high rates of respiratory infections, (previous or current) tuberculosis, and hepatitis B amongst immigrants at the Greek-Turkish border [244]. For refugees and asylum seekers, increased risks of malaria and scabies [245] as well as latent and active tuberculosis and hepatitis B have been reported [246]. However, there are clear differences depending on the country of origin; for instance, leishmaniasis was the most frequent infectious disease amongst Syrian immigrants, whilst louse-borne relapsing fever was most frequent among Eritrean immigrants [245].

Below, findings on the profiles of non-communicable diseases are shown. Regarding stroke, there has been evidence of similar or higher risks for most immigrant groups in Western Europe compared to the host population [247], whilst strokes and transient ischemic attacks were much less likely amongst immigrants in Canada [248]. However, the risks varied according to origin; for example, in Europe, North America, and Australia, stroke was more common amongst Sub-Saharan and South-Asian immigrants but less likely amongst North African and Chinese immigrants [249].

With regard to heart diseases and cardiovascular diseases, there was evidence of higher rates of heart diseases for immigrants in Austria [250], similar or higher risks and additionally worsened risks over time for ischemic heart diseases amongst immigrants in Western Europe [247], and higher prevalence of cardiovascular diseases amongst Middle Eastern, South Asian, and some European immigrants in Australia [251]. On the contrary, lower rates of hypertension and heart diseases were found for foreign-born people in the United States [234]. Analyses stratifying for region of origin indicate the internal variance; for instance, coronary heart disease was more

common in South-Asian immigrants but less common in Sub-Saharan and North African immigrants in Europe, North America, and Australia [249], and in Denmark, refugees as well as immigrants from Afghanistan, Iraq, Turkey, Eastern Europe, and Central Asia had higher incidences of coronary heart disease than native-born Dens, whilst there were no differences for immigrants from Somalia, South and Middle America, and Sub-Saharan Africa [252].

Findings on musculoskeletal diseases largely referred to migrant workers and reported increased risk of work-related ill health in terms of occupational morbidity and work-induced injuries and accidents [253, 254]. Moreover, there was evidence of increased rates of musculoskeletal diseases in general amongst asylum seekers in Switzerland [255]. The risk of osteoporosis was reported to be almost twofold amongst non-citizens in the United States [256]. In contrast, the risk of osteoporotic fractures was lower by 25% amongst male and by 17% amongst female first-generation immigrants in Sweden (but not amongst second-generation immigrants) [257, 258]. The rates of arthritis were lower amongst immigrants, particularly Asian immigrants, in Canada [259, 260]. Rheumatic diseases were more frequent amongst first-generation Iraqi and Finnish immigrants in Sweden but less frequent amongst most first-generation immigrants from Southern, Western, and Eastern European and Baltic countries. For second-generation immigrants, these differences vanished (with very few exceptions, such as German immigrants) [261].

The risk of cancer is usually low amongst recently arrived immigrants but increases with the length of stay and vanishes for second-generation immigrants [262, 263] but varies across different types of cancer. In Canada, immigrants from developing countries had the lowest cancer incidence, whilst immigrants from the United Kingdom and Ireland had no cancer advantages over non-migrant Canadians. Moreover, immigrants all had strongly reduced risks for lung cancer [263]. In Sweden, lower cancer incidence, particularly colon cancer, was reported for Turkish and North African immigrants [264]. In the United States, highest cancer incidences were filed for non-Hispanic white women and non-Hispanic Black men and the lowest for Asian and Pacific immigrant men and women [265]. However, clear differences depending on origin became apparent; for instance, for Asian and Pacific immigrants, the incidence of breast, colorectal, kidney, lung, and prostate cancer was particularly low but high for liver and stomach cancer. Liver and stomach cancer were also

more frequent amongst American Indians and Alaska Natives, who otherwise had a cancer profile similar to that of non-migrants [265].

Finally, largely uniformly higher risks of diabetes in immigrants have been reported; for example, in Europe, Australia, and North America, immigrants have higher risks of diabetes and develop diabetes at an earlier age than the host population [249]. In Europe only, the prevalence and incidence amongst immigrants exceed those of the non-migrant population [266]. In the United States, the association is less clear as both higher prevalence in African and Middle Eastern immigrants only [267] and lower rates amongst foreign-born individuals have been reported [234].

A nativity effect has been cited as causing partly diverging health profiles of and within immigrant populations, especially with regard to infectious diseases [234, 242, 245]; the prevalence of infectious diseases usually reflects the pathogens in the countries of origin [245]. Within the group of asylum seekers and refugees, poor conditions during migration may contribute to increased risks [246]. Access barriers to insurance coverage and healthcare [187, 236, 241, 253, 266], a lack of continuity in healthcare [255], precarious working conditions [253], a lack of language abilities [233], and an intersection of disadvantageous environmental, genetic, social, socioeconomic, and contextual characteristics have also been discussed [187, 236, 249, 258, 261, 263, 266]. However, the adverse effects of acculturation [234, 235], lifestyle patterns [251], and changes in lifestyle in the course of acculturation [249] have been described as the main drivers of health differentials. Particularly, the adoption of and convergence towards western lifestyle and norms and the simultaneous loss of health-beneficial cultural aspects contribute to health deterioration and increasing disease risks over time [237, 249, 264]. Adverse health behaviours, such as alcohol consumption, smoking, physical inactivity, as well as being obese or overweight, which tend to be more common amongst immigrants [268–271], promote deterioration in health [251, 267]. Overall, immigrants' health is vulnerable to social and behavioural changes [232].

5.3 Empirical Findings on the Health of Immigrants in Germany

The analyses within this thesis are restricted to the three largest immigrant groups (Turkish immigrants, EGI, recent refugees and asylum seekers) in Germany over the past decades. The subsequent sections outline empirical findings on their health status.

5.3.1 Data Sources

In Germany, different official and non-official data sources provide information on the mortality and morbidity of the immigrant population. An overview of the main sources is given in Table 3.

The main source for the composition of the total population in Germany is the population projection, based on updates of the last census (latest version: *Census 2011*). By law, marriages and divorces, births, deaths (including cause-of-death statistics), and migration are filed, and information on dates, sex, place of residence, and family status is routinely added. Moreover, citizenship is recorded but only differentiating between German and non-German citizenship [272]. Thus, the official population statistics only allow analyses on mortality and cause of death (but not morbidity) without differentiation of the migration background. Foreign nationals in Germany are fully recorded in the Central Register of Foreign Nationals. This register is intended particularly for public authorities, such as those involved in the asylum procedure, and includes information on foreign nationals who do/did not live only temporarily in Germany. It basically involves individual information about names, date and place of birth, sex, and citizenship [273]. Whilst the Central Register of Foreign Nationals covers some social characteristics (e.g. religious affiliation and the purpose of residence permissions, such as education), no general health information is available[11] [273]. Longitudinal analyses are only possible to a limited extent because the data are deleted upon acquisition of German citizenship or if the application of admission has been rejected.

Survey data derived from representative samples partially provide information on the situation of the population with a migration background in Germany.[12] The German Microcensus is the largest annual survey and provides the updates for the population projection. It contains information on one's own and parental migration background. However, only health characteristics relevant to employment (e.g. reduced working hours or incapacity to work due to illness) are recorded regularly, whilst more detailed information (e.g. on diseases or disability) is integrated every four years [9, 276]. Similarly, the German Socio-Economic Panel (GSOEP), which represents the longest-

[11] Additional information is provided only to the authorities responsible for the public health services (e.g. on the screening for pulmonary tuberculosis, health screening accoding to the Asylum Act, and vaccinations).
[12] Below, only the most important surveys are outlined. For a comprehensive overview, I refer to [17, 274]. A comparative database of datasets enabling research on refugees' health is provided by the RefuDat project [275].

running annual household survey in Germany, rather focusses on socioeconomic characteristics. Several indicators on migration background are included, and starting in 2002, a broad health module on mental and physical health has been incorporated [277]. Whilst the survey structure enables longitudinal analyses, the samples size prevents a detailed and differentiated analysis of the immigrant population.[13] An important survey within health monitoring in Germany is the German Health Update, which has been conducted as a trend study consisting of six waves between 2009 and 2021. It contains some health information, but the migration status is only recorded via the country of birth and citizenship. Thus, only first-generation immigrants and non-German nationals can be identified. Moreover, the sample size does not allow stratified and reliable analyses of the population with a migration background [280, 281]. The German Health Interview and Examination Survey for Children and Adolescents, which is also embedded in the national health monitoring, combines a detailed recording of the migration background (own and parental migration history and origin) and health characteristics. However, it only includes cross-sectional information on children and adolescents up to the age of 29 [282, 283]. The equivalents for adults (the German National Health Interview and Examination Survey and the German Health Interview and Examination Survey for Adults) were only conducted from 1997 to 1999 and 2008 to 2011, respectively, and do not provide current information. Similarly, other survey data on immigrants have proven to be outdated (e.g. the Foreigner Survey of the German Youth Institute, which was conducted in 1996 and 1997 [284]).

Further health surveys and health claim data are problematic because they are only regional. For instance, the Myocardial Infarction Registry Augsburg and the Erlangen Stroke Project do not cover sufficient numbers of immigrants (as do the German General Social Survey and the German Ageing Survey) or only cover citizenship or no characteristics on the migration background at all (e.g. health claims data and diagnostic data from hospitals, the Cancer Registration, and the official Nursing Care Statistics). Moreover, surveys and data collections of foreigners and immigrants often lack comprehensive health indicators and/or cover only a small sample (e.g. the BAMF Study on Refugees 2014, the representative survey on Selected groups of migrants in Germany, or statistics

[13] Starting in 2016, a survey of refugees who arrived since 2013 in Germany has been implemented in the GSOEP (IAB-BAMF-SOEP Survey of Refugees). For more details, I refer to [278, 279].

on benefits for asylum seekers). The German Emigration and Remigration Panel Study only considers German citizens.

International studies with a subsample from Germany essentially allow further levels of analyses, such as the comparison of immigrants with non-migrants from the respective countries of origin, but usually the country-specific samples are small. Both the European Social Survey (conducted every two years since 2002) and the European Values Study (embedded into the World Values Survey and conducted every nine years since 1981) cover information on SRH, impairments due to illness or disability (European Social Survey), depressive symptoms (European Values Study), and the respondent's place of birth and year of arrival, citizenship, and the parental place of birth. However, 1,500 to 2,000 respondents per wave in Germany are insufficient to perform differentiated analyses. The Survey of Health, Ageing and Retirement in Europe is a long-running panel and combines broad information on health and migration background, but the sample is also small. The Generations and Gender Survey essentially allows the differentiation of the migration backgrounds and includes health information but only provides outdated data and a limited sample size (apart from Turkish immigrants).

Overall, the availability of social science data on migration and health in Germany is limited. Dyck et al. have identified 46 data sources; however, most of them only included information on citizenship and thus do not fully meet the heterogeneity of the immigrant population [274]. The current state of research allows an overview of the health situation of immigrants in Germany but not holistic explanations and analyses accounting for the diverse contexts of origin.

Table 3: Data sources on immigration and health in Germany

Study/Data Source	Sample Size	Health Indicators	Indicators on Migration Background	Annotation
Official Population Statistics	Full census	Deaths (including cause-of-death statistics)	Citizenship (German vs. non-German)	Routine recording, compulsory registration
Census	1/3 of the population (+ projection to the total population)	None	Citizenship, year of immigration, country of origin (own + parental)	Obligation to participate, data not available for scientific research by law
Central Register of Foreign Nationals	All permanent foreigners	Information on health and tuberculosis screening	Place of birth, citizenship	Routine recording of foreign persons (i.e. deletion upon naturalisation or rejection of application of admission), data not available for scientific research
German Microcensus	1% of the population (~800,000 individuals)	Work-related indicators (e.g. incapacity to work due to illness)	Country of birth, year of immigration, citizenship (incl. information on naturalisation) for all household members and parents	Annual survey, rotating panel with an obligation to participate for four years (if selected)
German Socio-Economic Panel	~10,000 to 32,000 individuals	Broad health module since 2002, incl. physical and mental health, health behaviours	Citizenship, place of birth, residence status, refugee status, year of immigration (largely own + parental)	Longitudinal household survey
German Health Update Survey (GEDA)	~20,000 individuals	Indicators on almost all health domains and health behaviours	Country of birth, citizenship	Trend study
German Health Interview and Examination Survey for Children and Adolescents (KiGGS)	~12,000 to 15,000 individuals in the cross-section, ~10,000 in the longitudinal design	Indicators on almost all health domains and health behaviours via questionnaires, physical examinations, medical interviews, and laboratory studies	Parents: citizenship, country of birth, year of immigration; children: country of birth, age at immigration	Covers only children, adolescents, and young adults (ages 0 to 29 years)
German National Health Interview and Examination Survey (BGS98)	~7,000 individuals	General health, diseases, utilisation of health services, eating habits, physical activity	Citizenship, country of birth	Survey in the years 1997 to 1999
German Health Interview and Examination Survey for Adults (DEGS)	~8,000 individuals	Indicators on almost all health domains and health behaviours via questionnaires, physical examinations, medical interviews, and laboratory studies	None (only internal migration within Germany)	Follow-up of the BGS98, survey in the years 2008 to 2011

Study/Data Source	Sample Size	Health Indicators	Indicators on Migration Background	Annotation
Foreigner Survey	~2,500 individuals	General health status, psychosomatic complaints	Origin, broad set of information on life passages in country of origin in Germany (e.g. education), sense of identification with country of origin and Germany	Survey conducted once in 1996/1997; Greek, Italian, and Turkish young adults between the ages of 18 to 28 years
German General Social Survey (ALLBUS)	~3,000 to 3,500 individuals	Indicators on almost all health domains and health behaviours via questionnaire	Citizenship, country of birth, naturalisation, year of immigration, country where the youth was spent	Cross-sectional surveys every two years since 1980 with partly constant content
German Ageing Survey (DEAS)	~5,000 individuals (in years with refreshment: ~10,000 individuals)	Indicators on almost all health domains and health behaviours, testing procedures on cognitive and physical health	Citizenship, place of birth, year of immigration, residence status	Ages 40+ years, panel of seven waves since 1996
BAMF Study on Refugees 2014	~2,800 individuals	Health satisfaction, work incapacity due to illness	Citizenship, country of birth, migration history, migration motives	Covers persons entitled to asylum and recognised refugees from Afghanistan, Syria, Iraq, Iran, Eritrea, and Sri Lanka who applied for asylum between 2008 and 2012
Selected groups of migrants in Germany 2006/2007	~4,500 individuals	None	Nationality, citizenship, country of birth (own and parental), year of immigration, legal status, language abilities (in German and mother tongue)	Representative survey on immigrants from Turkey, Italy, Greece, Poland, and former Yugoslavia
Selected groups of migrants in Germany 2015	~2,500 individuals	Unemployment due to health reasons	Country of birth (own and parental), citizenship, year of immigration, migration motives,	Representative survey on immigrants from Poland and Romania, Turkish citizens in Germany, and German citizens with a Turkish migration background
German Emigration and Remigration Panel Study (GERPS)	~5,500 (fourth wave) to 11,000 (first wave) individuals	Self-rated health, overall life satisfaction	Country of destination, broad set of information on migration processes and experiences	Covers emigrated and remigrated German citizens only; currently comprises four waves since 2018
Myocardial Infarction Registry Augsburg	Full recording of individuals with an infarction in the region of Augsburg	Information on myocardial infarction incl. anamnesis and follow-up	Citizenship (own and parental), country of birth	
Erlangen Stroke Project	Full recording of individuals with a stroke in the region of Erlangen	Information on stroke incl. long-term follow-up	Citizenship (own and parental), country of birth	

Study/Data Source	Sample Size	Health Indicators	Indicators on Migration Background	Annotation
Ludwigshafen Stroke Study	Full recording of individuals with a stroke or transient ischemic attack in the region of Ludwigshafen	Detailed information on stroke and transient ischemic attack	Citizenship	Recording in the years 2006 to 2012
Cancer Registration	Full recording of individuals with cancer in Germany	Detailed information on cancer, further information varies regionally	None	
Health claims data	Insured individuals of the insurer	ICD-coded diagnoses, work incapacity, care need, medications	Usually none	Routine recording of accountings
Hospital diagnostic data	Full recording of treated individuals in hospitals	ICD-coded diagnoses, treatments	None (country of residence of individuals with residence abroad)	Routine recording of accountings
Nursing Care Statistics	Full recording of care beneficiaries	Information on care need	None	Routine recording of accountings
Statistics on benefits for asylum seekers	Full recording of recipients of benefits under the Asylum Seekers Benefits Act	None	Citizenship, type of residence permission	Routine recording of benefits
European Social Survey	Subsample in Germany: ~3,000 individuals per wave	Self-rated health, impairments due to illness or disability	Citizenship, country of birth (own and parental), affiliation to ethnic minorities	Cross-sectional survey, conducted biannually in 38 countries, survey of nine waves since 2002
European Values Study (World Values Study)	Subsample in Germany: ~5,000 individuals per wave	Self-rated health, depressive symptoms	Citizenship	Cross-sectional survey of five waves since 1981 (every nine years)
Survey of Health, Ageing and Retirement in Europe (SHARE)	Subsample in Germany: 900 to 3,000 individuals per wave, in all: ~140,000 individuals	Indicators on almost all health domains and health behaviours, testing procedure on grip strength	Citizenship, country of birth (of the individuals; starting in wave 5 also of the parents)	Largest European panel study, includes 28 European countries and Israel, panel of eight waves (every two to three years), ages 50+ years
Generations and Gender Survey (GGS)	~10,000 (first wave) to ~3,200 (second wave) individuals; additional survey on Turkish citizens ~4,000 (first wave) to ~1,000 (second wave) individuals	Self-rated health, long-standing illness or chronic conditions, impairments due to illness or disability, care need, well-being	Citizenship, year of naturalisation (own, parental, spousal)	Panel study with two waves 2005 and 2008/2009 (2006 and 2010 for the survey on Turkish citizens in Germany); embedded into the international Generations & Gender Programme

5.3.2 Empirical Findings

In Germany, migration background represents one crucial domain of health inequalities [94, 285]. Despite the data restrictions, health research recognises the vulnerability of immigrants and the need to analyse their health in a differentiated manner [105, 280, 286]. Previous findings have suggested that the general health status of the non-migrant population and immigrants in Germany is roughly similar [18, 109], where immigrants have increased risks for some diseases and disorders but lower risks for others. Health problems which diminished in the course of the epidemiological progress are partly more common in the immigrant population (e.g. infant mortality [17], tuberculosis [287], HIV [288], and Helicobacter pylori [17]). Moreover, additional health problems emerge, (e.g. children born by immigrant mothers have a higher prevalence to be large for gestational age [289], and psychosocial problems [17] as well as diabetes [290] are more frequent amongst immigrants). For elderly immigrants, worse self-rated mental health [291]; for children with a two-sided migration background, higher levels of poor general health [292]; and for first-generation immigrants (as well as second-generation immigrants in most aspects), lower levels of social well-being [293] have been reported On the contrary, there have been findings on lower cancer incidence and mortality [173, 294] for immigrants and lower rates of neurodermatitis and attention deficit hyperactivity disorder for children with a two-sided migration background [292]. Moreover, there were findings on similar rates of depressive symptoms, anxiety, PTSD, and traumas amongst traditional non-refugee immigrant groups (compared to the non-migrant population) [295], and high rates of these disorders amongst refugees [296]. These results illustrate the health heterogeneity of the immigrant population in Germany.

Immigrant children and adolescents as well as elderly and female immigrants have been identified as particularly vulnerable groups because they are confronted with multiple (health) burdens, the stressors caused by migration emerge in a vulnerable phase of their lives, and they are less aware of preventive measures and entitlements to benefits (e.g. care services [17, 297–299]). Moreover, health risks differ depending on origin and legal status [106], where refugees and individuals without a secure status are exposed to particularly high health risks (e.g. due to precarious working conditions, a lack of health insurance, and psychological stress) [17, 106, 300]. Below, the health profiles of the three largest immigrant groups are outlined.

Turkish Immigrants

For Turkish immigrants, descriptive results indicate differences in health outcomes compared to NMG. There have been findings on better SRH amongst second-generation Turkish immigrants (but not for first-generation Turkish immigrants) [108] but more depressive symptoms [301], higher rates of tuberculosis [287], and higher rates of Helicobacter pylori [17]. For the age group 50 to 79, both the LE and the proportion of expected years with limitations were found to be higher for both sexes [302].

Applying multivariate analyses, most of these differences vanished (e.g. adjusting for socioeconomic status, age profiles, and coping resources, largely no differences between Turkish immigrants and non-migrants remained [108, 301]). Significant differences were mainly shown in more differentiated analyses. Regional differences have been reported in that Turkish first-generation immigrants only in East Germany rated their health better than non-migrant counterparts [108], age differences in that first-generation Turks aged 45 years and older had worse SRH than non-migrant counterparts [108], and sex differences in that female (first- and second-generation) Turkish immigrants had higher risks for chronic illness, poor SRH, and psychological problems [299] but lower prevalence of coronary heart disease in the region of Giessen [303]. The rates of gestational diabetes were found to be higher amongst Turkish women [304]. Moreover, for the region of Hamburg, diverging cancer profiles of Turkish immigrants (compared to non-migrants) have been reported: neoplasms were slightly more frequent amongst Turkish males, and cancer of respiratory organs was more frequent amongst Turkish males of younger birth cohorts but less frequent amongst those of older birth cohorts. Amongst Turkish women, the incidence of cancers of the respiratory system and genital organs, skin cancer, and breast cancer was lower [305]. Significant differences between Turkish immigrants and NMG have been found with regard to lower levels of mental health [291] and the increased prevalence of being overweight/obese amongst Turkish children and adolescents [282] and adults [94]. The overall mortality has been reported to be lower in Turkish immigrants [176].

EGI

For EGI, there have been mixed results. Whilst, on the one hand, significantly higher rates of poor SRH [306] and higher general scores of physical complaints [307] have been reported, there has been evidence of lower rates of illness [59, 308]. Considering specific symptoms and diseases, this discordancy intensifies. Complaints of fatigue, exhaustion, and heart palpitations [306], the rates of tuberculosis (especially for Romanian immigrants but to a lesser extent also for immigrants from Poland and the Russian Federation) [165, 287], high rates of high blood pressure and frequent pain [309], the incidence of lung cancer in males, and stomach cancer in females [310] are higher amongst EGI. On the contrary, similar rates of asthma, hypertension, and chronic bronchitis [311], acute myocardial infarctions [312], and all-site cancer [310] but even lower incidence rates of breast cancer and lung cancer amongst EGI women [310] have been ascertained. In terms of diabetes, there were inconsistent findings (i.e. on lower levels [311] and higher rates [309]). In terms of mental health, there is evidence of higher values of depressive symptoms and anxiety in EGI [307, 313] but similar general mental health to NMG [291]. Moreover, there has been evidence of lower cardiovascular mortality [314] but higher mortality rates due to external causes and suicide amongst male EGI due to accidents amongst female EGI [315].

These diverging findings might partly be driven by the definition and identification of the EGI; whilst some studies involved EGI from former Soviet Union countries (e.g. [309, 310, 314]), others included EGI according to the official definition in Germany (e.g. [59, 308, 311]), and still others differentiated by countries of origin (e.g. [307]). In addition, the length of stay might partially explain internal heterogeneity, with some studies highlighting the healthy migrant effect proven for EGI [109, 308, 316].

Refugees and Asylum Immigrants

For the group of asylum immigrants and refugees, the studies thus far have mainly included infectious diseases and mental health problems, whilst physical health concerns have been less explored [317]. In terms of overall health status, a comparative study on non-migrants, individuals with a direct or indirect migration background, refugees who immigrated prior to 2013, and refugees who immigrated since 2013 determined best SRH, above-average physical health, and

below-average psychological health amongst refugees who immigrated since 2013 [318]. However, these results were largely shaped by the young age profile of the group of new refugees. Other studies concluded above-average mental SRH [22] or physical health [319] but do not provide a comparison with NMG or other immigrant groups.

Regarding infectious diseases, there have been consistent findings on increased risks of tuberculosis amongst refugees [317]. In 2019, 50% of the filed tuberculosis cases in Germany were due to foreigners and a large share due to foreigners originating from refugee countries (e.g. 7% from Eritreans, 7% from Somalians, 4% from Afghans, and 2% from Syrians [287]). In contrast, the long distance of migration contributes to very low levels of malaria (which has a short incubation period) amongst refugees in Germany [242]. In terms of non-communicable diseases, there has been evidence of increased incidence of diseases of the respiratory system, the musculoskeletal system, and the intestinal tract based on claims data of refugees in the region of Bremen [320] and high levels of pain in the region of Halle [321], whereas for refugees in the region of Munich, low levels of non-communicable diseases have been identified [322]. The huge body of research on mental health largely covered PTSDs and indicated increased rates (e.g. amongst war refugees [323], Yugoslav refugees [324], recent Afghan, Syrian, and Iraqi refugees [325], and recent Syrian refugees [326]). Moreover, increased risks of mental disorders [22] and lowest levels of mental health (compared to other immigrants and NMG) have been reported [327]. In addition, female refugees have been identified to be particularly vulnerable in terms of significantly lower physical health and slightly reduced mental health [318, 319] as well as reduced health-related quality of life [327].

To summarise, there are clear differences in the health profiles across immigrant groups. In essence, it may be concluded that (recently arrived) refugees and asylum seekers had the highest risks of poor mental health and infectious diseases but the best physical health [318, 327]. Both the migration conditions and the age structure significantly contribute to this polarisation. The results that refugees who immigrated prior to 2013 have the worst physical health and converge to NMG and non-refugee migrants in terms of mental health [318] indicate the power of mental disorders shortly after migration and the convergence of health outcomes over time. A similar tendency can be summarised for Turkish immigrants: whilst there are significant health differences amongst first-generation Turkish immigrants, many of these vanished in the second generation. Their health

profile is largely defined by lifestyle-related risk factors and diseases. In the group of EGI, in addition to lifestyle factors, mental problems particularly appear to promote further health problems.

Possible Explanations for the Health Differences across Immigrant Groups

Migration-related characteristics aside, lifestyle factors, differences in healthcare utilisation, language and cultural barriers, and socioeconomic differences have essentially been discussed as the main drivers of health disparities within the immigrant population in Germany and compared to NMG. Immigrants have been reported to consume less alcohol [94, 282] but to eat less healthy and to be less physically active [94, 328]. As a result, immigrants are more likely to be obese and to suffer from hypertension [9, 303]. In particular, the simultaneous maintenance of unhealthy lifestyle from the country of origin and adaptation of unhealthy 'western' lifestyles favours deterioration in physical health [292, 329]. The generally lower utilisation of healthcare services amongst immigrants [330] has been demonstrated for Turkish immigrants in terms of measures of (psychosomatic) rehabilitation [331, 332]; for EGI in terms of psychosocial and medical institutions, general practitioners, and most medical specialists [306]; and for refugees and asylum seekers, in terms of ambulatory physicians [333]. For children with a migration background, lower rates of vaccination against measles and less use of the children's screening examinations have been reported [282]. Both formal barriers and unequal access to healthcare for immigrants (and in particular for refugees and asylum seekers) [334], as well as language, cultural, and religious barriers, exacerbate this problem [303, 330, 335, 336].

However, socioeconomic disadvantages are largely uniformly cited to cause health disadvantages [94, 108, 291, 292, 318]. The group of immigrants differs (internally and from NMG) in terms of occupational inclusion, income, and levels of education [9, 64], where the socioeconomic status on average is highest amongst non-migrants, followed by EGI, Turkish immigrants, and refugees [55] (see section 2.3). These disadvantages affect health both directly and indirectly in terms of worse working conditions, worse living conditions, and limited availability for prevention and curation amongst immigrants [176]; lower levels of health knowledge and health awareness [94]; and the

abovementioned unfavourable health behaviours. Finally, precarious socioeconomic profiles promote social exclusion, lower levels of social support, and fewer coping resources [108, 299, 337].

However, there is still a research gap regarding the impact of social and socioeconomic features on health outcomes including an internal differentiation of the immigrant population, recent immigrants groups, a longitudinal perspective, and a comparison to NMG. This thesis aims to answer the questions of 1) which social determinants are influential for immigrants' health (Studies I, II, and III) and 2) which similarities and differences exist when comparing immigrant groups (Studies I and III), immigrant groups and non-migrants (Studies I and II), and immigrant groups across borders (Study III). In addition to the consideration of the three largest immigrant groups in Germany, which differ in their demographic structure and behaviour, immigration period (associated with different policies and social conditions), migration motives and aspirations, regions of origin, epidemiologic origin, legal position, and initial social situation, these levels of comparison allow the identification of both general explanations for differences in health outcomes and group-specific risk factors or protective factors.

6. Materials and Methods

In the following sections, the data used in the three studies, the included measurements and sets of covariates, the definition of the immigrant group under consideration, and the applied statistical methods are explained. Table 4 provides an overview of the statistical methods and the framework of the models used.

6.1 Data Sources

Requirements derived from the aims and hypotheses were placed on the data. For instance, large datasets with a sufficient number of cases were required to analyse subgroups (i.e. immigrants and by gender), longitudinal data were needed to analyse underlying mechanisms, and data including characteristics at the macro level were used to depict the multi-layered SDH model.

6.1.1 Study I: German Microcensus 2005/2009

The German Microcensus is an annual official multipurpose survey representative of residents in Germany. The stratified random sample comprises 1% of the population (about 810,000 people in 370,000 households per year). The data provide detailed information on the labour market structure and demographic characteristics in Germany, including information on households and families, health status, migration background, and other sociodemographic and socioeconomic characteristics [338]. Its contents, the sufficient sample size to perform analyses stratified by migration background and gender, the inclusion of households as survey units, the replicable survey design, and the data quality justify the suitability of the microcensus for Study I.

The analyses covered the years 2005 and 2009 (hereafter referred to as Microcensus 2005/2009). In these survey years, an additional health module had been integrated into the questionnaire. Moreover, for the first time, the Microcensus 2005 included detailed information on the migration background of the respondents [51]. The year 2009 was included to increase the sample size and thus the number of individuals with a migration background. The distance of four years to 2005 ensured that every household/person is included in the dataset only once because the microcensus

is designed as a partially rotating panel in which households are surveyed annually for up to four years. For the study, the 70% scientific use file was analysed.

6.1.2 Study II: German Socio-Economic Panel

The GSOEP is the largest and longest-running yearly representative household panel in Germany. The first survey was conducted in 1984; since then, the panel has been supplemented by several additional samples. The survey households are randomly selected using a clustered (usually) two-stage process (primary units: electoral districts, secondary units: households), resulting in an annual sample of about 30,000 people in 15,000 households. The GSOEP is designed as a multidisciplinary panel and essentially includes information on employment, income and family biographies, educational participation, personality traits, household characteristics, and living situation. In 2002, a broad health module was integrated into the questionnaire biannually. Information regarding the migration background has been included since 1984, and since 2002, it has been possible to differentiate the migration background in more detail using the GSOEP [277, 339–342].

The analyses include the years 2000 to 2018 (hereafter referred to as GSOEP 2000–2018). The health status was modelled from 2002 onwards to incorporate the detailed and constantly measured health information of the health module. Due to high annual response rates and low panel attrition [343, 344], the sample size, the comprehensive collection of information on health and migration background, and the thematic areas, the GSOEP data were particularly suitable for the longitudinal causal analysis conducted in Study II. The consideration of the EGI, which is culturally close to the autochthonous population in Germany, enables quantification of the effect of migration.

6.1.3 Study III: IAB-BAMF-SOEP Survey of Refugees 2016/Refugee Health and Integration Survey

The IAB-BAMF-SOEP Survey of Refugees is designed as an annual panel study of refugee households in Germany and was conducted for the first time in 2016 (hereafter referred to as IAB-BAMF-SOEP 2016). The random sample was based on the German Central Register of Foreign Nationals, included adult refugees who arrived in Germany between 2013 and 2016, and involved 4,527 people. The IAB-BAMF-SOEP 2016 includes modules of the GSOEP and will prospectively

be implemented into the GSOEP. The survey consisted of a household and a personal questionnaire and included information on educational, employment, and migration biography; social participation; language proficiency; personality traits and attitudes; family situation; and health [278, 279, 345].

The IAB-BAMF-SOEP 2016 was one of the first surveys to collect information on the most recent cohorts of refugees in Germany. The novel target population, the utilisation of established and harmonised measurements, and the data quality (ensured by e.g. data quality management, trained interviewers, and appropriate language versions of the questionnaires [279, 346]) were the motivations for the selection of the IAB-BAMF-SOEP 2016 for Study III. Considering the compared data (see below), only the cross-sectional data from 2016 were analysed.

The Refugee and Health Integration Survey (hereafter referred to as ReHIS) was conceptualised as an interim survey within the second and third waves of a survey on the economic and labour market participation of refugees in Austria (FIMAS). The interviews were conducted in early 2018; covered information on individual characteristics, health, and patterns of healthcare utilisation; and included refugees from Afghanistan, Syrian, and Iraq who immigrated in Austria between 2011 and 2018. The sample included individuals who participated in an earlier FIMAS wave and agreed to partake in the ReHIS (780 people); it contained 515 participants [347, 348].

Several items within the ReHIS questionnaire were based on the IAB-BAMF-SOEP 2016. Considering the similarity with the IAB-BAMF-SOEP 2016 (with regard to target population, survey time, and included information), the analysis of the ReHIS data proved to be effective to determine macro effects.

6.2 Methods and Statistical Analysis

6.2.1 Study I: Logistic Regressions and Multilevel Regressions

Multilevel models are widely used to model hierarchically structured data. They are capable of specifying and explaining variation in an outcome through processes and characteristics on multiple and/or higher levels simultaneously and measuring the interacting effect of covariates on different levels of an outcome variable [349, 350]. In Study I, multilevel regression models were applied to

reflect the associations amongst individual health, individual and household migration background, determinants at the household and contextual level, and the covariates. Since the health status was represented by a binary outcome (1: long-standing ill persons, 0: healthy persons), a multilevel approach for binary outcomes was applied. This is essentially based on (binary) logistic regression, which has the form (adapted from [350, 351])

(1) $\text{Logit}(Y_i = 1) = \ln\left[\frac{p_i}{1-p_i}\right] = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k$,

where Y_i denotes the outcome variable for unit *i*, p_i denotes the probability of occurrence of the outcome of interest (i.e. long-standing illness), β_0 denotes the intercept, $\beta_1 \ldots \beta_k$ denote the logit coefficients, and $x_1 \ldots x_k$ denote the independent variables. The model parameters are estimated using the maximum likelihood function [350, 351]. In the case of hierarchically structured data, information on the individual level *i* in model (1) are supplemented by additional levels (e.g. by information on the household and contextual level). Thus, the multilevel logistic regression for the household-clustered data in Study I had the form:

(2) $\text{Logit}(Y_{ij} = 1) = \ln\left[\frac{p_{ij}}{1-p_{ij}}\right] = \beta_0 + \beta_1 x_{ij} + \cdots + \beta_k x_{kj} + u_j$,

where *j* indicates the household level. Thus, Y_{ij} denotes the health outcome for unit i at household level j, and $x_{1j} \ldots x_{kj}$ denote the independent variables at individual level *i* and household level *j*. u_j is the random effect on the household level *j* [350].

For the sex-specific models calculated in Study I, the (binary) logistic regression (as shown in form [1]) was applied.

6.2.2 Study II: Generalised Estimating Equations (GEE)

Study II was based on longitudinal data with repeated observations of the respondents. GEE account for the resulting within-subject correlation of responses and allow the estimation of unbiased and efficient parameters [352, 353]. GEE modelling is based on the generalised linear model (GLM) approach, formalised as

(3) $\hat{Y} = \beta_0 + \beta_1 x_1 + \cdots + \beta_k x_k$,

where $\hat{Y}$ denotes the predicted values of *Y*, β_0 denotes the intercept, and $\beta_1 \ldots \beta_k$ denote the logit coefficients for the *k* predictors *x* (adapted from [354]). However, GEE are better suited to adjust for the correlation of individual observations by assuming correlation structures [355]. Since within GEE models, the expected values of the outcome are not estimated but the result of an applied transformation, a link function must be defined [353, 355]. GEE models are population-averaged (PA) (i.e. they determine the average expected value of the population). The expected value $E(y_{it} | x_{it})$ is formally defined as (adapted from [352, 355–357]):

(4) $E(y_{it} | x_{it}) = \beta_0^{PA} + \beta_1^{PA} x_{it}$,

where y_{it} is the outcome variable for unit *i* at time *t*, β_0^{PA} denotes the (PA) slope, and β_1^{PA} denotes the (PA) coefficients for the predictor variables *x*.

A link function g for the link between dependent and independent variable is then applied to (4):

(5) $E(y_{it} | x_{it}) = g(\beta^{PA} x_{it})$,

where β^{PA} denotes the vector of parameters, and x_{it} denotes the vector of covariates. GEE models thus estimate averaged expected values, and β^{PA} reflects the average effect of covariates [352, 353, 356, 357].

The GEE models in Study II were applied specifying an independent within-person residual covariance matrix which proved to be the best covariance structure (based on the qic routine in Stata [358]) and with the identity link function for normally distributed outcomes.

6.2.3 Study III: Probit Regressions, Average Marginal Effects, Propensity Score Matching, and Average Treatment Effect

In Study III, probit regressions were applied to separately estimate average marginal effects (AMEs) for the two countries included, and, on the whole, sample propensity score matching (PSM) was applied to estimate the average treatment effect (ATE).

Probit regressions are nonlinear binary response models to predict the probability that an observation—considering the set of explaining variables—falls into the outcome category of interest. They have the formula (adapted from [359]):

(6) $P(Y = 1|X) = \phi\,(\Sigma\beta_k\, X_k)$,

where *Y* denotes the outcome variable, ϕ denotes the cumulative distribution function of the standard normal distribution, and *β* denotes the parameters for the vector of *X* of *k* independent variables [359]. In Study III, the outcome of interest ($Y = 1$) was (very) good self-rated health (vgSRH).

The probit regression models were used to estimate AMEs, which represent the average change in probability that respondents reported vgSRH when an explanatory variable (*x*) changes by one unit whilst the other covariates are fixed. Positive coefficients indicate that the corresponding group reported vgSRH more often than the reference group (and vice versa). AMEs are comparable across different models [351].

PSM is usually applied to compare a group of treated individuals with a group of untreated individuals and refers to a matching of individuals of the treatment group with units of the untreated group who are as similar as possible with regard to the matching parameters. This approach enables estimation of the sole causal treatment effects. [360–362] In Study III, treated individuals were defined as those living in Austria (i.e. those with an unrestricted access to healthcare). PSM was used to adjust for compositional differences between 'treated' refugees in Austria and 'untreated' refugees in Germany in terms of sex, nationality, age, partnership status, and education. The efficacy of the treatment was estimated via the ATE, which has the form (adapted from [363]):

(7) $ATE = \sum_i^N (Y_1 - Y_0)$,

where Y_1 is the observed outcome of treated individuals, and Y_0 is the counterfactual outcome of untreated individuals, estimated for the individuals *i*, …, *N* [363]. A 5:1 nearest neighbour propensity score matching with a caliper width of 0.3 was specified, which proved to be the best specification [364, 365].

Table 4: Methods and analytical strategies in the studies

Methods	Outcome/ Health Indicator	Main Independent Variable(s)	Immigrant Group(s)	Covariates	Strategies of Analysis
Study I: The Contextual and Household Contribution to Individual Health Status in Germany: What Is the Role of Gender and Migration Background?					
Logistic Regression Models Multilevel Regression Models	General long-standing illness for at least four weeks Based on: 'Have you been ill or had an accidental injury within the last four weeks (before the interview)?'	Generation composition within the household (number of generations, number of children); presence of the partner in the household (yes/no)	Native-born Germans, EGI, Turkish immigrants, other immigrants Based on own and parental migration background and ethnic background	Household level: Net equivalent income; migration background of the household; place of residence Individual level: sex; age; family status; education; occupational status; body mass index; smoking habits; year of interview	Univariate methods: descriptive statistics for the whole sample and stratified by sex Multivariate methods: block-wise logistic regression models with interaction effects main independent variables*migration background → differences by gender and migration background block-wise two-level regression models (individual level and household level) → general differences by migration background and main independent variables
Study II: The effect of informal caregiving on physical health among non-migrants and Ethnic German Immigrants in Germany: a cohort analysis based on the GSOEP 2000–2018					
GEE	Physical health changes between baseline (BL) and follow-up Based on: physical component summary (PCS)	Informal caregiving status (no/currently/ former); caregivers identified if providing care ≥2 hours per day, and/or living with a person in need of care	Non-migrant Germans, EGI Based on: own and parental migration background and immigrant category	Household level: time-variant: household composition; household income at BL*income change Individual level: time-constant (at BL): age; sex; family status; PCS; education time-variant: mental health; employment status at BL*change in working hours since BL; distance BL to follow-up	Univariate methods: descriptive statistics for the whole sample and by immigrant group; physical health at BL and physical health changes for the whole sample and by caregiving status and immigrant group Bivariate methods: chi²-test and t-test → differences by migration background Multivariate methods: block-wise GEEs with interaction effects caregiving status*migration background → differences by migration background
Study III: Health determinants among refugees in Austria and Germany: A propensity-matched comparative study for Syrian, Afghan, and Iraqi refugees					
Probit Regression Models	SRH Based on 'How would you describe your health?', 'In general, would you say your health is…?'	Country of destination (Germany/Austria)	Refugees from Syria, Afghanistan, and Iraq Based on country of origin	Individual level: sex; age; partnership status; education; length of stay; length of the asylum process	Univariate methods: share of refugees with vgSRH in Germany and Austria Multivariate methods: country-specific block-wise probit regression models (AME) → general effects and differences by country Estimation of ATE applying PSM → causal effects due to comparable groups

7. Summary of the Studies

This chapter provides an overview of the background and the results of the three central studies of this dissertation (see section 11 for the original publications).

7.1 Study I: The Contextual and Household Contribution to Individual Health Status in Germany: What Is the Role of Gender and Migration Background?

7.1.1 Background and Hypotheses

Considering the household production of health and the new household economics approach, households represent crucial determinants of health production because, within the framework of available resources and competing outcomes, they strive to maximise health outcomes of their members [366]. In this context, households are the locus of health production as they are characterised by strong and long-lasting emotional ties, provide resources, shape social integration, and include daily tasks and demands. Consequently, household characteristics determine mortality and morbidity risks [366–369]. Being married, living in a partnership, and parenting (for middle-aged people, usually concordant with 'living together with children') were found to be associated with better health outcomes [370, 371]. On the contrary, living alone was linked to lower levels of health [372]. For other living arrangements (e.g. three-generation households), there were less clear results, particularly because more complex structures are accompanied by a complex interplay of determinants at the household level and other levels. However, there is a tendency towards lower levels of health within less common living arrangements [373–376].

Against the background of the change in family structures and household structures in Germany over the past decades, these findings are particularly relevant. The average household size decreased from 2.27 in 2001 to 1.99 in 2019 [53], the number of couples living together with children lowered by 22% between 1995 and 2015, and at the same time the number of households with three and more generations decreased by 40% [377]. However, the composition of households differs according to migration background. On average, immigrants live in larger households and more frequently live in nuclear family households or multigeneration households [55]. Thus, both the

formation of households and the ways in which and extent to which household characteristics affect health are culturally shaped. Deduced from this, four hypotheses have been tested:

Hypothesis 1.1—Family segregation hypothesis: Living in one-generation households (i.e. living alone or living without children and/or [grand]parents[-in-law]) is accompanied by lower levels of family ties and social, economic, and cultural resources and thus increases health risks [378–380]. Due to more traditional family and household norms amongst the population of immigrants [381, 382], it was further hypothesised that the disadvantages of non-familial household structures are more pronounced amongst immigrants.

Hypothesis 1.2—Partner hypothesis: Due to the positive health selection into marriage [383] and the protective effect of a partnership on health [384], a positive effect of a partner in the same household on health outcomes was hypothesised. Considering the higher value of marriage amongst immigrants [385, 386], the absence of a partner was hypothesised to be more disadvantageous for immigrants than for Germans without a migration background.

Hypothesis 1.3—Gender hypothesis: Considering gendered household and family demands [369, 387], it was assumed that the effect of the household is strongly gendered, where women are more affected by household characteristics. Cultural differences amongst persons with a migration background contribute to more pronounced household-related gender differences amongst immigrants [388].

Hypothesis 1.4—Social mediator hypothesis: Referring to structural differences with regard to socioeconomic and social resources between immigrants and non-migrants, the mediating effect of these characteristics was examined. The underlying hypothesis was that different initial social and socioeconomic settings explain health differences by migration background, household composition, and gender.

7.1.2 Population under Study

The analyses were restricted to individuals between the ages of 30 and 64 living in private households. The age selection enables an analysis of a homogenous sample in terms of life situation and refers to the ages in which (own) children usually already/still live at home. The analyses are

based on 382,111 individuals (323,577 were native-born Germans[14]; 10,043 Turkish immigrants; 13,147 Aussiedler[15]; and 35,346 'other' immigrants). Due to the heterogeneity of the 'other' group, their results are not discussed.

7.1.3 Summary of the Results

The (gendered) logistic regression models revealed an association of long-standing illness and generation composition within the household regarding the presence of the partner. Lower levels of illness were found for individuals in two-generation households (2G-HH) with children compared to one-generation households (1G-HH) and for those living with a partner. Both the generation effect and the partner effect differences were more pronounced amongst women. Moreover, female Aussiedler had lower risks of illness than native German women. There were no significant ethnic differences in the subsample of males.

The interaction effects revealed that many of the effects apply equally to all subgroups, but there were a few exceptions (see Figure 5 and Figure 6).

[14] Equatable to NMG as they are referred to in the previous and further course.
[15] Equatable to EGI as they are referred to in the previous and further course.

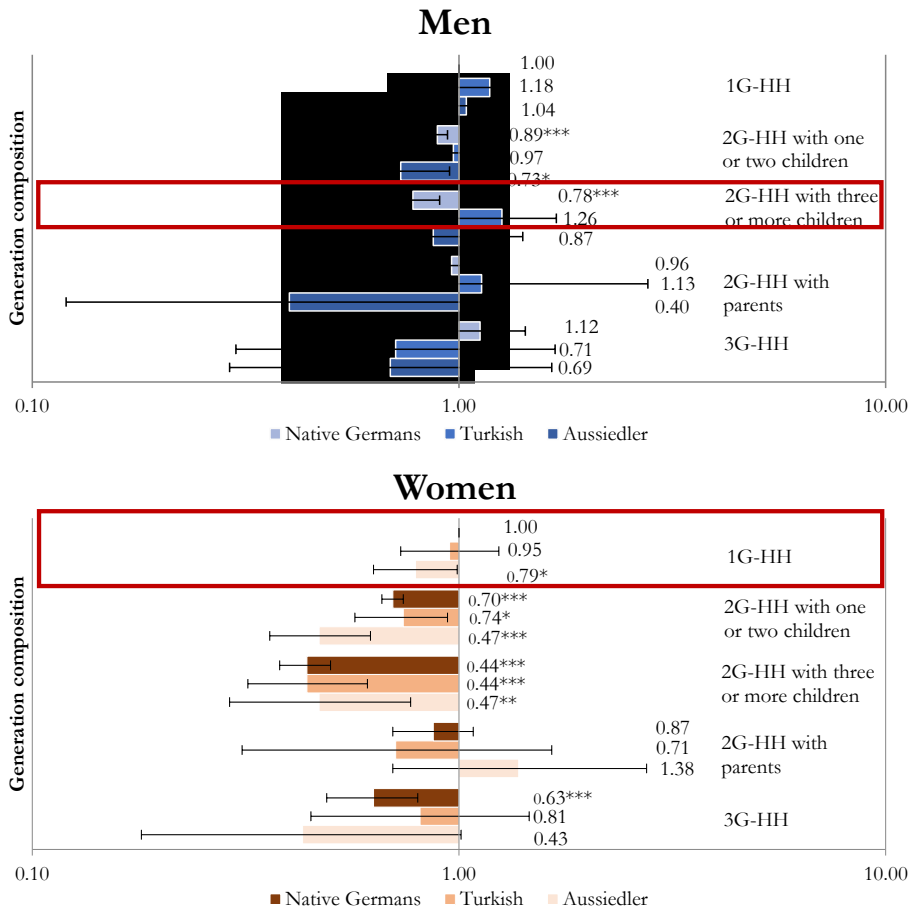

Figure 5: Household effect according to migration background: odds and 95% confidence intervals of long-standing illness for men and women

Note: Reference are native-born Germans in 1G-HH (OR=1); logarithmic scale; adjusted for all covariates; the red frame indicates significant differences (i.e. the 95% confidence intervals, in comparison of the immigrant groups with the same generation composition, do not overlap); 3+G-HH: three- or more generation households.
Source: German Microcensus 2005/2009, n=188,108 (men), n=194,005 (women); ***p<0.001, **p<0.01, *p<0.05

Compared to native German women, the risk of illness was 21 percentage points (PP) lower amongst female Aussiedler living in 1G-HH (p=0.043). The risk of Turkish men in 2G-HH with three or more children significantly exceeded that of their German counterparts by 48 PP (Figure 5). Female Aussiedler living with a partner had a lower risk by 23 PP than native German counterparts (p=0.019; Figure 6).

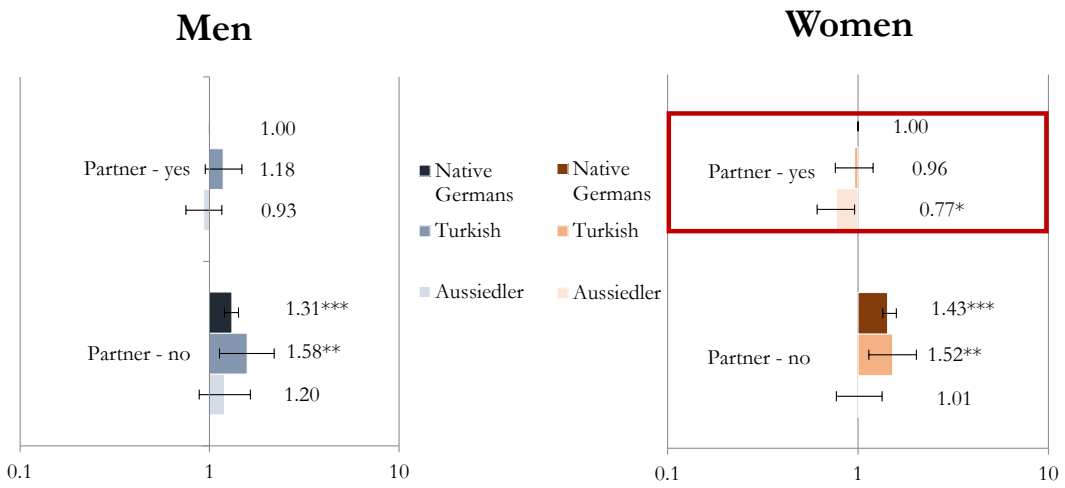

Figure 6: Partner effect according to migration background: odds and 95% confidence intervals of long-standing illness for men and women

Note: Reference are native-born Germans with partner (OR=1); logarithmic scale; adjusted for all covariates; the red frame indicates significant differences (i.e. the 95% confidence intervals, in comparison of the immigrant groups with the same partner status, do not overlap).
Source: German Microcensus 2005/2009, n=188,108 (men), n=194,005 (women); ***p<0.001, **p<0.01, *p<0.05

Finally, the multilevel logistic regression models identified that the risk of illness was 45 PP lower amongst individuals in 2G-HH with three or more children (p<0.001), 25 PP lower amongst those 2G-HH with one or two children (p<0.001), and 23 PP lower amongst those in 3+G-HH (p= 0.004; each compared to 1G-HH). These differences were robust and persisted adjusting for other social, economic, and lifestyle characterising and for contextual covariates. The lack of a partner was associated with an increased risk of illness by 44 PP (p<0.001) and was only partly explained by socioeconomic, household, and contextual characteristics. These characteristics also had a decisive impact on the health differences according to migration background. After adjustment, only the risk of Aussiedler fell below that of native Germans by 17 PP (p=0.028).

7.1.4 Discussion

This study showed that household characteristics contribute to health differences, which is in line with the theoretic framework and previous studies [371, 372]. The effects were partly gendered. In terms of health, it is beneficial to live in 2G-HH, to live together with children, or to live with a partner. These patterns largely apply regardless of the migration background. Thus, the household composition represents a general social determinant of health. However, amongst the examined Turkish immigrants and Aussiedler, there were a few groups which reacted differently to the

household composition: living in a 2G-HH with many children was more detrimental for health amongst Turkish men, and the health of female Aussiedler was less dependent on adverse household effects (of living in an 1G-HH or living without a partner). The latter is particularly interesting considering the fact that female Aussiedler, adjusting for structural differences, already had better health outcomes. The extent of other, nonfamilial coping strategies might be highlighted to explain this association. Taking into account the cross-sectional study design, (ethnically differentiated) selection processes into (non-)family living arrangements, parenthood, and atypical household forms must also be discussed.

7.2 Study II: The effect of informal caregiving on physical health among non-migrants and Ethnic German Immigrants in Germany: a cohort analysis based on the GSOEP 2000–2018

7.2.1 Background and Hypotheses

Informal care is one of the essential pillars in the caregiving of those sick and elderly, and it is becoming increasingly important within ageing populations [389, 390]. A large proportion of people in need of care in Germany are already cared for (informally) at home [391]. A second structural change affects the increasing proportion of people with a migration background in Germany [392], who gradually also reach care-relevant ages and might be more likely to be ill due to their migration history (see sections 4 and 5.3). These developments contribute to a significant increase in the need for care in Germany [393, 394]. Since providing care is detrimental to the caregiver's health [395–399], this poses a major challenge for health systems [398, 399]. Considering stress and coping models [400] and earlier findings [401–403], it must be assumed that caregiving immigrants are even more affected by care-related physical health disadvantages due to an accumulation of disadvantageous characteristics. Analysing the population of EGI in Germany, who are the largest and oldest immigrant group but, due to legal regulation and their cultural ancestry, are similar to the autochthonous population [59] (see section 2.3), the association and interrelation of informal caregiving, migration background, and physical health were investigated. The following hypotheses were analysed.

Hypothesis 2.1—Strains and coping hypothesis: Due to lower levels of coping resources, higher strains to provide informal care within families, and lower rates of utilisation of external services amongst immigrants [403–405], it was hypothesised that providing informal care is more detrimental to health amongst immigrants than amongst non-migrants.

Hypothesis 2.2—Accumulation hypothesis: The inference and accumulation of health-, care-, and migration-related disadvantages contribute to worse physical health amongst caregiving immigrants in the long term.

7.2.2 Population under Study

The analyses were restricted to non-caregiving NMG and EGI in Germany at baseline (BL) and at least one year prior to BL and with at least one subsequent follow-up health measurement with or without caregiving. Thus, prevalent caregivers were excluded to enable a precise analysis of the transition into caregiving, the duration of caregiving, and the caregiving history on health changes. The number of observed health changes per subject ranged from one to eight. The analyses were based on 102,066 observations of 26,354 individuals. Of these, 5,254 (5.1%) observations refer to 1,720 (6.5%) EGI.

7.2.3 Summary of the Results

The descriptive analysis indicated negative health selection into caregiving (i.e. individuals with lower levels of health at BL turned into caregivers [PCS: non-caregivers: 51.43, caregivers: 48.66]). This adverse selection was more pronounced amongst EGI (non-caregivers: 50.36, caregivers: 46.53–46.64). The physical health declines of caregivers (-2.63) exceeded those of non-caregivers (-1.96), but the physical health declines of EGI (-1.65) were smaller than of NMG (-2.03). The greatest health deterioration was found amongst former caregiving EGI (-3.89).

The estimated GEE models largely repeated these results. Even when adjusting for individual, household, and socioeconomic characteristics, the physical health disadvantages of EGI (b=-0.32, p=0.005) and of caregivers (former caregivers: b=-0.32, p=0.007; current caregivers: b=-0.44, p=0.003) exceeded those of the counterparts. Both household characteristics and socioeconomic characteristics partly explained the health differences according to migration background and

caregiving. The interacting effect of migration background and caregiving status (Figure 7) illustrated a significantly increased health disadvantage of currently caregiving EGI (b=-1.28, p=0.040).

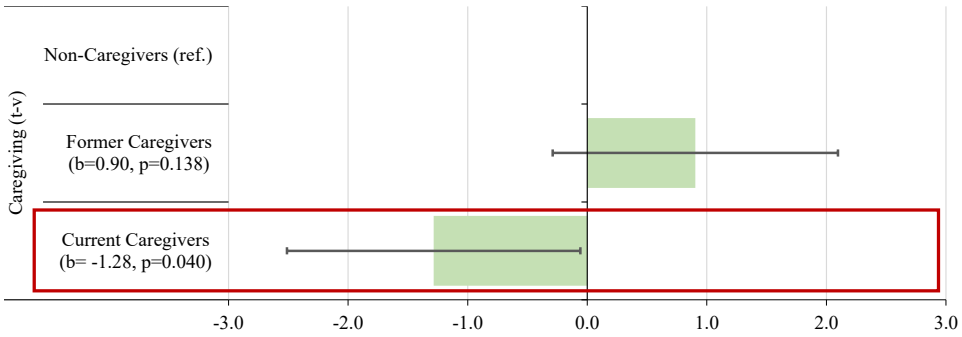

Figure 7: Interaction effect caregiving*migration background for EGI

Note: Reference are NMG (i.e. coefficients represent additional differences compared to NMG counterparts); adjusted for all covariates; the red frame indicates significant differences (i.e. the 95% confidence intervals, in comparison to NMG, do not overlap).
Source: GSOEP 2000–2018; N=102,066, n=26,354

7.2.4 Discussion

The findings of this paper indicate the negative impact of caregiving on the caregiver's physical health, which is in line with earlier results [397]. These effects worked both with the transition into caregiving and beyond. The patterns of caregiving and the extent of care-related health disadvantages differed depending on the migration background. Neither characteristics related to the care situation or individual characteristics nor socioeconomic changes associated with transition into caregiving explained these differences. Against this background, it might be discussed to what extent migration background was the direct and indirect cause of this. Stress and coping models [400] and the SDH approach (see section 4) suggest a sequence of poor initial health amongst immigrants (due to the migration experience), economic and social disadvantages (due to lower levels of health), lower levels of coping resources (due to lower economic and social embedding), and negative selection into disadvantageous circumstances followed by increased response to disadvantageous influences. Considering that these care-related health disadvantages were found for EGI, who are culturally close to the non-migrant population in Germany and socioeconomically better integrated than other immigrant groups, illustrates the direct effect of the migration background. It might be assumed that the negative effect of providing care on physical

health is even more pronounced amongst other immigrant groups. Consequently, the increasing proportion of informal care must be observed critically, and special attention should be paid to the health of immigrant caregivers.

7.3 Study III: Health determinants among refugees in Austria and Germany: A propensity-matched comparative study for Syrian, Afghan, and Iraqi refugees

7.3.1 Background and Hypotheses

Germany and Austria have been the destinations of large refugee immigration in recent years. Within the last 10 years (2010–2020), 285,000 refugees applied for asylum in Austria [406] and 2,200,000 in Germany [62]. In both countries, refugee migration reached its peak in 2015 and 2016, and large shares of these asylum seekers came from Afghanistan, Syria, and Iraq [62, 406]. Thus far, a number of studies had examined the mental health situation of refugees in Germany. Renner et al. (2020) have identified mental disorders of Syrian refugees, Kaltenbach et al. (2017) have qualified the mental health problems of the large refugee cohorts 2015/2016, and Nesterko et al. (2020) have determined high mental healthcare needs of refugees in Leipzig [22, 326, 407]. However, only little was and is known about the general health of refugees and key determinants of refugee health in Germany and other Central European countries [14].

Considering that health is affected by superior conditions, such as policies towards immigrants (see section 4), health differences of refugees across countries appear to be likely, where barriers to health services are cited as an essentially explanatory factor [326, 334, 408]. However, there is a research gap regarding other dimensions of health or overall health and large quantitative studies.

Therefore, in Study III, the general health status of recent refugee cohorts was analysed in more detail. The comparative perspective with Austria, which in terms of refugee immigration, economic situation, health profile, and social circumstances is largely similar to Germany but pursues a different, more liberal, and less restrictive health policy for refugees, enables an analysis of general health determinants amongst refugees as well as the influence of access barriers. For Study III, two hypotheses were examined:

Hypothesis 3.1—Policy hypothesis: We hypothesised that refugees in Germany have health disadvantages compared to refugees in Austria due to access barriers to healthcare utilisation in the former.

Hypothesis 3.2—Transferability of determinants hypothesis: Derived from established health models, it was hypothesised to find a transferability of traditional social determinants of health to the group of refugees and similar social determinants of health amongst refugees across the two countries.

7.3.2 Population under Study

The analyses were restricted to Afghan, Syrian, and Iraqi refugees in Germany and Austria who immigrated between 2013 and 2016. The sample comprised 2,854 refugees in Germany and 374 refugees in Austria. The matched sample (applying PSM) consisted of 506 refugees in Germany and 374 refugees in Austria.

7.3.3 Summary of the Results

Refugees in Germany (share: 72%; 95% CI: 70%; 73%) were less likely to report vgSRH than those in Austria (89%; 95% CI: 85%; 92%; $p<0.001$). The share of individuals who reported vgSRH was, compared to the country-specific average, low amongst females in Germany (65%), Afghans in Germany (66%) and Austria (75%), refugees aged 45–59 in Germany (48%) and Austria (67%), widowed or divorced refugees in Germany (44%), refugees with low levels of education in Germany (66%), and refugees who were waiting for their decision in the asylum process in Germany (66%). The findings largely persisted in the multivariate analyses, with few exceptions: only applying probit regressions, gradually with increasing age, was it less likely that individuals reported vgSRH (age group 18–24 [ref.]: b=0, up to age group 45–59 [oldest group]: b=-0.34). Refugees still in the asylum process in Germany did not have any significant health disadvantages, but those with a duration of the asylum process of 15 or more months were significantly more likely to report vgSRH (b= 0.04; Figure 8).

Finally, PSM was applied for a comparative analysis to adjust for structural differences between the refugee samples in Germany and Austria and to estimate less biased country differences in terms

of health. The estimated ATE was 0.12, indicating that the average probability to report vgSRH was 12% higher for refugees in Austria than in Germany (Table 5).

Table 5: Specifications and outcome (ATE) of PSM

Criterion	Value
Matching variables	Sex, nation, age group, partnership status, education
Maximum number of nearest neighbours	5
Caliper width	0.3
Number of matched individuals in Germany	506
Number of matched individuals in Austria	374
Mean bias	3.3
LR chi²	346.95 (p<0.001) before matching; 5.40 (p=0.979) after matching
Rosenbaum's bounds Γ	2.7 (p=0.031) – 2.8 (p=0.052)
Average Treatment Effect (95% CI)	**0.12 (0.04; 0.20)**

Source: IAB-BAMF-SOEP 2016/ReHIS.

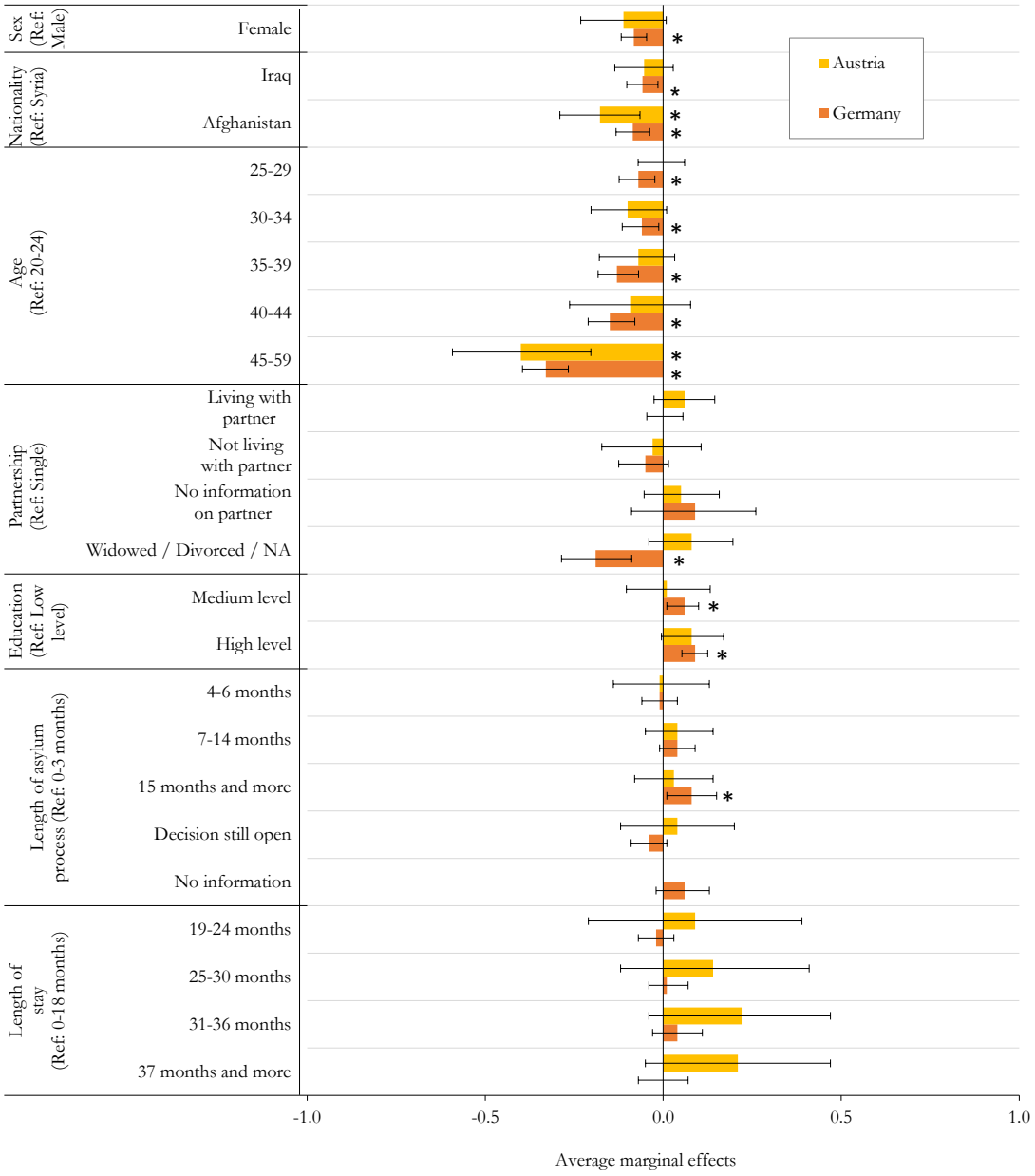

Figure 8: Results of probit regression: average marginal effects (and 95% CI) for vgSRH by country

Note: Average marginal effects based on probit regressions, adjusted for all covariates (with separate models for length of asylum process and length of stay); asterisks denote significant within-country differences compared to the reference group (Ref; $p<0.05$).
Source: IAB-BAMF-SOEP 2016/ReHIS; n= 2,854 (Germany), n=374 (Austria).

7.3.4 Discussion

The results of this study elucidated considerable variance in terms of health of refugees in Germany and Austria. These were only to a small extent explained by traditional health determinants such as structural differences between the refugee populations in Germany in Austria. From this, four conclusions can be drawn. Firstly, established (predisposing) determinants of health, as derived from non-migrant populations and other immigrant groups, also apply to the subgroup of refugees,

which is in line with earlier findings [409, 410]. In particular, age and sex were relevant for health differences, but, additionally, social determinants (e.g. the level of education and the partnership situation) partly affect health. Secondly, refugee-specific characteristics, exemplified by the length of stay and the length of the asylum process, were only of minor importance. This discrepancy with earlies studies [411, 412] might be explained by period effects and/or country-specific effects. Moreover, amongst refugees, further and more important pre-migration and post-migration stressors have already been identified [240, 410]. However, due to missing (comparative) information within the IAB-BAMF-SOEP 2016 and the ReHIS, these could not be adapted in this study. Thirdly, refugees in Germany reported lower levels of health than counterparts in Austria, which indicated that there are also health differences within supposedly homogenous immigrant groups (in terms of migration period, countries of origin, and host countries). Derived from this, this highlights, fourthly, that the conditions in the host country were an additional determinant of health. The importance of access to healthcare for refugees, as shown in previous contributions [21, 334], was the focus of this study. The finding that refugees in Germany, which offers restricted access to refugees, reported worse health supported this assumption. However, unobserved and subjacent mechanisms might be considered. These might act at the political, societal, or individual level (e.g. in terms of integration measures, discrimination against minorities, predisposing characteristics, or selection into one of the host countries).

8. Summary of the Main Results and Reflection on the Hypotheses

8.1 Summary of the Main Results

- In the middle-age groups (30 to 65 years), EGI had lower risks of long-standing illness than NMG. This difference was mainly driven by health advantages of EGI women. Turkish immigrants and NMG did not differ from each other.
- The household composition was an important determinant of health for NMG and immigrants. Differences were found 1) in terms of lower risks of long-standing illness amongst female EGI in 1G-HH and those living without a partner, indicating a lower dependency on partnership and parenthood amongst female EGI, and 2) in terms of increased risks amongst Turkish men in 2G-HH with three or more children, which might indicate economic and care strains.
- Social determinants only partly explained health differences amongst NMG, EGI, and Turkish immigrants regarding the migration-household-health nexus.

- Adult prevalent non-caregiving EGI (i.e. non-caregiving at and at least one year prior to the first observation) had greater physical health deterioration over time than NMG counterparts.
- Caregiving was associated with health deterioration. The trajectory into (informal) caregiving was more negatively health selected amongst EGI compared to NMG. Health deterioration of currently caregiving EGI significantly exceeded that of NMG counterparts.
- Social determinants explained only a small proportion of the health differences between EGI and NMG, particularly between the (non-)caregiving groups. However, they partly suppressed and mediated the interaction of caregiving status and migration background. Socioeconomic characteristics made a larger contribution than family and household characteristics.

- Refugees in Austria reported better SRH than counterparts in Germany. In both countries of destination, refugees from Syria had better health than those from Iraq and Afghanistan.
- Health policies towards (refugee) immigrants apparently contributed to health inequalities. (Temporary) Access barriers, such as those which exist in Germany, were associated with health disadvantages.

- Social determinants characterised health outcomes of refugees. Besides an adverse age gradient, health differences depending on sex and education were found. However, these characteristics did not explain the country differences. The significant differences by country of origin highlighted the additional and independent effect of predisposing characteristics on refugee health.

8.2 Reflection on the Hypotheses

To approach the conclusions, the hypotheses are first reflected on and briefly discussed.

Hypothesis 1.1—Family segregation hypothesis: Living in one-generation households is accompanied by lower levels of family ties and social, economic, and cultural resources and thus increases health risks. The disadvantages of nonfamilial household structures are more pronounced amongst immigrants.

This hypothesis can be confirmed. In line with previous studies, living in 1G-HH was associated with significantly increased risks of poor health [378, 380]. Amongst those living alone, the risk of long-standing illness was increased by 25 PP compared to individuals in 2G-HH with one or two children, by 45 PP compared to those in 2G-HH with three or more children, and by 23 PP compared to those in 3+G-HH (each $p<0.005$). People in 1G-HH and those in 2G-HH with (grand-)parents did not differ in terms of health. These findings illustrate the relevance of social support and familial connectedness on health [413, 414] but might also reflect positive health selection into parenthood and the positive impact parenthood has on health-related behaviours [413]. However, these effects largely applied similarly to NMG, EGI, and Turkish immigrants, and the second part of the hypothesis must be mostly rejected. Only Turkish men in 2G-HH with three or more children had significantly increased health risks compared to NMG counterparts, and female EGI in 1G-HH were found to have significantly lower risks of long-standing illness than NMG counterparts.

These unexpected findings might be explained by the duration of stay in Germany of the examined immigrants. More than 90% of the analysed Turkish immigrants and more than 85% of the EGI have been in Germany for more than 10 years, and more than 70% Turkish immigrants and 25%

EGI more than 30 years. Other studies have highlighted that living arrangements of immigrants are usually less traditional shortly after immigration but characterised by necessities and possibilities (e.g. living together with fellow migrant relatives instead of the nuclear family or living alone) [415]. Derived from the stress theories and the disruption hypothesis, a short-term disruption and reduction of family cohesion followed by a stabilisation of living arrangements appears to be plausible. Cultural adaptation might contribute to the weakening of traditional family norms amongst immigrants over time, and thus deviations have less of an adverse effect. Finally, the health domain must be considered; earlier results have suggested that living in non-family households increases the risk of depression in immigrants but not their general health status [416].

Hypothesis 1.2—Partner hypothesis: Living with a partner in the same household positively affects health outcomes. The absence of a partner is more disadvantageous for immigrants than for Germans without a migration background.

This hypothesis cannot be confirmed completely. Whilst there was evidence for both sexes of health differences caused by the absence of a partner, the interaction effects according to migration background and partnership status did not indicate increased health risks amongst immigrants who lived without a partner in the same household. The opposite was found for female Aussiedler, who had significantly better health outcomes when living with a partner. Further interaction effects were not found. Thus, the partner effect applies largely independently of the migration history. This might indicate that amongst the immigrants who have already lived in Germany for a long time, social support is not only provided by partners. Moreover, amongst immigrants, living in a partnership might also be linked to integration barriers. Whilst exogamous marriages and intergroup relationships might favour social and cultural integration, endogamous partnerships, which are most common amongst immigrants and very pronounced amongst Turkish immigrants [417, 418], might reduce the extent of adaptation [419, 420]. Thus, living without a partner might be associated with a need for and openness to (interethnic) networks, which positively affect health outcomes [421].

A current study has also indicated that cohabitation is almost irrelevant in first-generation immigrants but becomes more likely in second-generation (Turkish) immigrants [422]. Thus, living

alone might be subject to a stigma but be chosen very deliberately in first-generation immigrants and gain acceptance in the second generation. When interpreting these results, however, it must be taken into account that the lack of a partner in the household itself (also amongst NMG) is associated with higher risks of long-standing illness, but these are not even higher amongst immigrants (with the reversed exception of EGI women). Furthermore, the lack of a partner particularly affects psychological health amongst immigrants [423], which cannot be reflected by analysing long-standing illness.

Hypothesis 1.3—Gender hypothesis: The impact of household characteristics on health outcomes is strongly gendered, where women are more affected by household characteristics. Household-related gender differences are more pronounced amongst persons with a migration background.

Referring to the gender-specific logistic regression models, a gender-gradient of the effect of household characteristics was determined. Amongst women, health differences due to differences in terms of the household composition, the partnership status, and the family status were more pronounced than amongst men. However, again, differences related to the migration background were not determined. Whilst the results suggest that the effects were very similar in women regardless of the migration background, the effects in men were more (but largely not significantly) divergent. These results might be driven by selection processes during migration, as part of which healthier, more liberal, less religious, and more modern individuals decide to migrate. The increasing integration associated with increasing length of stay and the acculturation of values of second-generation migrants contributes to a reduction of gender inequalities depending on the migration background [424–427].

Hypothesis 1.4—Social mediator hypothesis: Different initial social and socioeconomic settings explain health differences by migration background, household composition, and gender.

The reflection on this hypothesis must be divided into two parts. On the one hand, health differences according to differences in household composition were very robust and persisted even adjusting for social- and socioeconomic variations. On the other hand, socioeconomic and social differences strongly affected the health gradient amongst NMG, EGI, and Turkish immigrants. Adjusting for structural differences, the initially severe health disadvantage of Turkish immigrants

over NMG could no longer be proven, whereby in particular the education and occupation differences moderated the association. The latter also applied when considering EGI, but a suppression (amongst the whole group of EGI and the subgroup of EGI women) was shown to the effect that significant health advantages of EGI over NMG were proven, once additionally adjusting for lifestyle differences and contextual characteristics. The health disadvantages found for individuals in pure migrant households (in respect to the health equality of pure non-migrant households and mixed households) illustrate the compensating effect of brokering interethnic social bridges for the integration and health of immigrants [428, 429]. This association was particularly pronounced amongst women. Gender-related health differences were only determined adjusting for socioeconomic differences; women had significantly lower risks of long-standing illness. Both amongst women and amongst men, socioeconomic characteristics were significantly associated with health differences, but these did not explain the association of household composition and long-standing illness amongst men and women. Health disadvantages of those living in 1G-HH over other household compositions (with the exception of women in 2G-HH with [grand-]parents and men in 2G-HH with [grand-]parents or 3+G-HH) persisted even adjusting for social and socioeconomic characteristics.

Hypothesis 2.1—Strains and coping hypothesis: Providing informal care negatively affects health outcomes and is more detrimental to health amongst immigrants than amongst non-migrants.

This study confirmed the findings of earlier studies [397, 430] and proved the negative impact caregiving has on physical health outcomes. Compared to non-caregivers, both individuals who were caregivers in the past and individuals who were caregivers at the time of observation had greater deterioration in terms of physical health over time. Social characteristics (i.e. family status and household composition) and socioeconomic characteristics (i.e. education, employment status, and household income and their changes over time) moderated and mediated this association. With regard to differences according to migration background, partly different patterns of the caregiving-health association of NMG and EGI were proven. Firstly (without adjusting for further characteristics), greatest health deterioration was determined for currently caregiving EGI. The extent of differences compared to NMG reduced when adjusting for socio-demographic characteristics and health-related covariates but increased once adjusting for household

characteristics and socioeconomic determinants. Significant differences were only apparent in the full model, indicating a suppression effect with regard to the socioeconomic characteristics amongst EGI. EGI who provided care at the time of the interview had significantly higher physical health declines than EGI counterparts. Thus, migration background and caregiving act as two mutually interacting and reinforcing dimensions of health inequalities. For the group of former caregivers, no differences between NMG and EGI were found. Thus, the hypothesis cannot be fully confirmed.

Hypothesis 2.2—Accumulation hypothesis: The interference and accumulation of health-, care-, and migration-related disadvantages contribute to health disadvantages amongst caregiving immigrants in the long term.

The results indicated that this hypothesis cannot be confirmed. Caregiving EGI partly had disadvantages in terms of physical health. However, exceeding caregiving-related health deterioration was not proved in the long term amongst EGI but only at the time of active caregiving. Considering former caregivers, NMG and EGI did not significantly differ from each other. However, selection effects into caregiving must be considered: EGI were slightly less likely to turn into caregivers (6.9% amongst NMG, 6.0% amongst EGI), and, on average, EGI with lower levels of physical health turned to caregiving. Considering the lower potential for downward change in the time course, a scale attenuation effect in the form of a floor effect might have contributed to the insignificance.

The additional caregiver disadvantages amongst currently caregiving EGI over NMG counterparts might have been caused by lower utilisation of external and within-family organisational, financial, and care-related support (analogous to healthcare services [306], [431]) and thus lower levels of coping resources. The accumulation of disadvantages seemed to have less of a long-term effect but more during a simultaneous occurrence. Thus, rethinking the life course approach (see section 4.4), no generally different pathways of caregiving EGI and NMG could be demonstrated. It must be taken into account that this study did not directly measure the care duration but the care status in a biographically perspective. However, sensitivity analyses indicated increased health deterioration

after long periods of care, especially many years after the turn to caregiving. Social determinants only partially explain these differences.

Hypothesis 3.1—Policy hypothesis: Refugees in Germany have health disadvantages compared to refugees in Austria due to access barriers to healthcare utilisation in the former.

The results confirmed the poorer health of Iraqi, Afghan, and Syrian refugees in Germany compared to counterparts in Austria. The crude share of refugees reporting vgSRH was lower by 17 PP in Germany [72% (95%CI: 0.70; 0.73) vs. 89% (95%CI: 0.85; 0.92)]. It is noticeable that all subgroups in Germany had lower shares of vgSRH on average than counterparts in Austria. This gap remained in the PSM-matched sample. Applying PSM and adjusting for social, socio-demographic, and additional migration-specific covariates, the difference decreased slightly but persisted significantly; the probability of vgSRH amongst refugees in Germany was 12 PP lower. Thus, basic social characteristics did not explain country differences. Although the underlying mechanism of access barriers in Germany appears plausible [21], it could not clearly be verified. Unobserved heterogeneity, period effects, unequal selection into the sample, and the use of different instruments for data collection might have biased the results. Moreover, differences at the societal and country levels (e.g. in terms of policies towards immigrants and refugee immigration) and different societal perceptions of refugee immigration might be noted as these are associated with additional burdens, strains, and stressors [432–434]. However, due to the presumably greater health selection amongst refugees in Germany due to the geographical distance [435], and because the survey in Germany took place sooner after immigration (considering the healthy migrant effect and the salmon bias, see section 5.1), the policy effect might even have been underestimated.

Hypothesis 3.2—Transferability of determinants hypothesis: Traditional social determinants of health are transferable to the group of refugees and apply to both refugees in Germany and Austria.

This hypothesis can be confirmed. Considering the unadjusted shares of vgSRH, both in Germany and Austria, the results indicated a sex gradient, an age gradient, differences by partnership status, and an education gradient. Men, younger refugees, and those with higher education levels were most likely to report vgSRH, and those who were widowed, divorced, or did not answer this question, especially respondents who were married but did not live together with their partner,

reported lowest shares of vgSRH. In a multivariable view, these findings largely only held up for refugees in Germany. There were very similar tendencies in Austria, which probably did not reach statistical significance due to the small sample size. In contrast, presumed migration-specific characteristics largely did not affect health outcomes and showed inconsistent results (e.g. lowest levels of vgSRH were apparent for refugees in Germany with a long length of stay and for counterparts in Austria with a short length of stay).

These findings might also point to an interaction amongst country of destination, (health) policies, and pathways of integration. The differences amongst Afghan, Syrian, and Iraqi nationals additionally indicated a dependency on origin. Thus, above all, traditional health determinants were found to affect health differentials of refugees in the two countries of destination considered.

9. Discussion, Implications, and Conclusions

The aim of this thesis was to obtain insights into the health of immigrants in Germany and to evaluate the impact of social determinants. Applying established theoretical concepts such as the SDH framework, several indicators of social inequality have been considered. In favour of distinct analyses recognising the internal heterogeneity within the immigrant population, the three largest immigrant groups in Germany were differentiated and partly compared to the non-migrant population. Below, the findings are discussed in respect to their implications, strengths, shortcomings, and additional research needs.

9.1 Strengths, Scientific Value, Shortcomings, and Limitations

9.1.1 Strengths and Scientific Value

The breadth of studies on the health of immigrants in Germany has thus far been limited and has not been able to provide conclusive results (see section 5.3). Major weaknesses were the lack of

- current findings based on current data
- inclusion of the migration background (including the non-migrant population)
- internal differentiation of the immigrant population
- longitudinal analyses of health changes
- broad analyses of underlying determinants taking into account theoretical models
- general health analyses

These deficits were addressed and partly remedied in the studies presented.

Analysing current and suitable data, it was possible to gain important insights into the present situation of immigrants in Germany. High-quality data from official statistics and survey data have been analysed within their scope of possibilities. By using four different data sources, it was possible to analyse different health indicators as well as individual groups of immigrants. Established health indicators have been used which measure general health and are usually less biased by cultural or ethnic differences [436–439]. The health indicators rather reflected self-assessed health and health limitations (with the exception of Study I). These indicators appeared to be advantageous as

immigrants were reported to be less likely to consult physicians [330, 440], and thus objective health indicators (e.g. based on medical diagnoses) might underestimate the burden of disease amongst immigrants. Moreover, unlike mental health, physical health is strongly correlated with the risks of disability, care need, and mortality [441], which are important parameters for public health.

Applying advanced statistical methods, it was possible to demonstrate health differences within the immigrant population and in terms of different health indicators and that deeper dimensions are linked to different health risks. A strength which should be emphasised is that all analyses integrated characteristics at and beyond the individual level. Particularly by considering interaction effects, it was possible to show health-promoting mechanisms in the context of migration in detail. It is noticeable that the majority of the mechanisms apply independently of the migration background, but additionally there are subtle differences depending on household characteristics, caregiving histories, and (political) living circumstances. Each study was, to the best of my knowledge, the first on its respective focus on immigrants in Germany. This exploratory character contributed to the rejection of some hypotheses but helped to obtain important findings for theory, consecutive research, and policy.

A particular strength of Study I was the large database, which allowed the differentiation of three groups (NMG, EGI, and Turkish immigrants), gender stratification, and household-clustered multilevel regression models. The identification of immigrants was based on the broad definition of 'persons with a migration background' and covered first- and second-generation immigrants. Due to the consideration of two diverging groups of persons with a migration background, it could be proved that immigrant groups do not only differ structurally from one another but also with regard to their pathogenesis. The analyses focussed on representative samples of the respective population in Germany, and the choice of the health indicator of 'long-standing illness' allowed an examination of the general state of health and health-related limitations beyond subjective health assessment. The broad set of covariates included numerous determinants of health as derived from the theoretical approaches and increased the reliability of the results.

Study II was one of the first to analyse the impact of informal caregiving on physical health for immigrants and NMG in Germany. Physical health was already found to depend directly and

indirectly on mental health [442], which studies on the effects of caregiving thus far usually considered, and is usually more subject to exposures and mental health problems in the medium and long terms. Especially in the longitudinal analysis of the comparably old populations of EGI and NMG, and considering the temporal pathways postulated in established theories, this health domain appeared to be under-researched and expedient.

Moreover, the longitudinal perspective allowed the display of the care history and trajectories over time and enabled first conclusions about the individual and societal consequences of ageing immigrant populations. The GEE were suitable for addressing intra-individual time series problems (i.e. within-person clustered data due to repeated observations) and provided robust results (even in the case of misspecification). Analysing first- and second-generation EGI in comparative perspective to NMG and adjusting for crucial determinants of health inequalities enabled the identification of less biased and more specific migration effects on health outcomes.

In Study III, the assumptions about the health disadvantages of refugee immigrants due to healthcare access barriers [21, 408] were applied to a cross-country comparison. We succeeded in taking the macro level, which was often neglected due to the lack of harmonised international data, into account in the analysis of health differences. For this purpose, the analyses were based on one of the current immigrant groups and the most current possible data. The selected methods made it possible to compare the populations and to quantify the country effect. As one of the first studies, we examined the group of newly arrived refugees, whereby, on the basis of nationality, three groups of origin could be differentiated. This consideration allows a detailed look at the group with supposedly similar flight and migration motivations and experiences, as well as immigration conditions, and illuminates that these characteristics precisely do not have an identical effect.

In the sense of the theoretical positions and the model provided by Zimmerman et al. [13], the findings provide important insights into the (pre-migration) dimensions of health differences in immigrants. Although the set of covariates was small in favour of the country comparison, the findings illustrate subgroups with particularly increased health risks (e.g. women) within the vulnerable immigrant group of refugees.

9.1.2 Shortcomings and Limitations

In addition to the strengths mentioned, several weaknesses emerged in the analysis. The limitations might explain partly contrary results and unexplained variations by migration background and with the main explanatory variables.

Firstly, problems related to the consideration of the migration background appear in culturally shaped self-selection into (voluntary) survey participation and panel attrition, and thus there is a lack of representativeness [443–445]. Linguistic problems, a lack of a current sampling frame, and the culturally diverse perception of surveys contribute to a smaller and selected coverage of immigrants, particularly of refugees [446–448]. Moreover, self-selection applies depending on health status [443] and most of the central variables (e.g. disability/care need [444], household structure [446]). A mutual reinforcement of the self-selection mechanisms as well as higher rates of participation of healthy and young persons, particularly more integrated immigrants and those with better language abilities, might be assumed. This might be associated with an underestimation of the burden of disease amongst immigrants and group differences between immigrants. Additionally, health evaluation varies across cultures and depending on cultural distance [449–451]. Thus, the assessment of immigrants from more distant cultures (in this thesis, refugees and Turkish immigrants) may be too poor. Presumably, the covariates included in the analyses cannot fully adjust for a potential bias.

Secondly, data restrictions include the availability of information and the inclusion of covariates. Considering the complex interplay of pathways into illness on the individual level, which are additionally altered and mediated by the migration background itself and further factors at the individual, meso, and macro levels, the choice and thoroughness of covariates might be noted. It was based on theory and empirical findings, but to avoid over-adjustment and multicollinearity, and due to limited information provided in the datasets, only a limited set was integrated in each study. Consequently, it was not possible to comprehensively map complex theoretical models such as the SDH model, to account for the complex characteristics associated with a migration background, and to apply further levels of stratification. One largely neglected level was the characteristics of and conditions in the context of origin, which appears important considering life

course approaches, and are essential criteria within the theories of social exclusion and intersectionality. Moreover, the selected health indicators must be discussed with regard to their limited informative value. The predominantly subjective health measures do not enable a demonstration of specific health needs amongst immigrants but only derive determinants of general health.

Thirdly, whilst internal differentiation of the immigrant population has been applied with regard to origin and legal status, further criteria of differentiation (e.g. migrant generation, specific immigration period, length of stay) had largely to be neglected due to data restrictions.

Fourthly, the cross-sectional design of Studies I and III did not enable the depiction of life courses or trajectories and is associated with limitations to determine causality (the latter is also true for Study II due to missing confounders). Additionally, the double truncation and censoring of the data is particularly problematic when analysing immigrants since certain vulnerable phases (e.g. shortly after immigration) are not recorded. Methods and adaptation strategies to deal with this data restriction were not applied.

Fifthly, the results relate primarily to contemporary Germany, whereas a transfer to other (temporal, regional) contexts would have to be verified. As described above and as found in the studies, health differences amongst immigrants are shaped by circumstances prior to, during, and after immigration. Thus, different associations might be found to other countries of destination, immigrant groups, and points in time.

Finally, specific limitations of the three studies must be mentioned. To begin, Study I was based on rather old data. At the start of the study, the Microcensus data of 2005 and 2009 were amongst the first published data enabling the differentiation of the migration background. However, in the meantime, they have been supplemented by more recent data. Furthermore, the health indicator of long-standing illness might be problematic in that it was not defined within the questionnaire, was more relevant for the working population, and was characterised by comparably high non-response. In the context of the migration background, these problems might be associated with systematic bias. Lastly, the restriction to private households within the Microcensus could have led to an underestimation of the burden of disease, and the heterogeneity of the 1G-HH examined

(this group includes distinct groups, e.g. singles, couples without children, or persons in living communities) might be imprecise. However, these limitations are less likely to explain or bias the main associations.

In Study II, the inclusion criteria, the lack of age selection, and missing information on the care circumstances must be highlighted as limitations. Within the GSOEP, information on (informal) care was integrated, but important additional information (e.g. the utilisation of care services or attendance allowance) and characteristics of the care recipient were not provided. Moreover, information beyond the household and subjective characteristics such as the perceived burden of care or the motive to provide care were not covered. These characteristics might both differ by migration background and have an impact on the effects of care on health. In contrast, an age selection for the analyses was dismissed due to the age structure of EGI and the number of cases. However, this might be associated with a heterogeneity of care arrangements (e.g. with regard to the intergenerational relationship or problems of reconciliation amongst family, work, and care). Moreover, the baseline selection of non-caregivers excluded long-term caregivers, whilst, due to left censoring, individuals who provided care in the past may not have been excluded, and the care history might have been assessed incorrectly.

The main problems in Study III lie in the representativeness and the conceivable unobserved heterogeneity. Whilst the IAB-BAMF SOEP Survey of Refugees 2016 was based on a random sample [345], the ReHIS data were based on a survey in initial reception centres [348]. Thus, it must be assumed that the latter are not fully representative for the group of refugees in Austria. Although statistical adjustment and PSM were applied to counteract this limitation, the generalisability of the results must be questioned. Furthermore, unobserved heterogeneity across the samples and across the countries might have biased the results. Above all, it might be discussed to what extent these could have biased the main findings (i.e. the country difference). Finally, the temporal gap of two years between the surveys might be associated with period effects. Accordingly, the determined country differences might also be attributed to the course of time.

9.2 Implications for Theory, Research, and Policy

Based on these findings, implications for theory, research, and politics may be derived.

9.2.1 Implications for Theory

Although the majority of theoretical approaches (see section 4) were not direct subjects of this thesis, several conclusions can be drawn regarding them. To begin, due to a lack of information on the health status of the immigrants shortly after migration and the lack of a comparison with the population in the respective countries of origin, the health transition assumption could not be tested. However, considering the synthetic cohorts of immigrants (based on the length of stay) as in Studies I and III, there is evidence of health deterioration amongst immigrants over time. Whether these results are actually driven by the transition between health regimes or selection effects according to the healthy migrant effect or ageing processes cannot be verified.

Also with regard to stress theories, information on the migration phase and shortly afterwards is missing, but the detected medium- and long-term health deterioration of immigrants indicates disadvantages which might be related to migration-related stressors. This assumption is supported by the identified increased health risks of Turkish immigrants (over NMG and EGI; Study I), for whom migration is associated with greater stressful life changes due to cultural, religious, and linguistic distance. Moreover, the greater health deterioration of EGI over time (Study II) might indicate a direct stress-related migration effect.

Another theoretical approach to provide explanations is the disruption and adaptation hypothesis, which is confirmed by the findings regarding household characteristics. Both being married but living apart from the partner (Study III) and living in 1G-HH (Study I) were associated with lower levels of health amongst immigrants, which indicates the importance of familial and social disruption, even beyond the initial phase after immigration. However, sensitivity analyses conducted for Study III showed high rates of vgSRH amongst refugee immigrants (which exceeded the age-adjusted rates of NMG) and contradicted the assumption of disruptive effects. Although the long-term health disadvantages of immigrants suggest a rejection of the adaptation hypothesis, the positive effects of social adaptation cannot be ruled out beyond doubt. However, it should be considered that 1) adaptation processes might have taken place but were suppressed by other changes/deteriorations (e.g. in terms of social or economic downward mobility, marginalisation,

or isolation), and 2) the adaptation hypothesis is generally in contradiction to the health transition theory or the healthy migrant effect.

A review of the life course approach was not part of this thesis and proves to be difficult due to a lack of information on the life course of immigrants in the used survey data, especially on the circumstances prior to and during migration. Considering the integration of several dimensions of inequalities in the performed analyses, which largely proved to have an explanatory contribution to health differences between NMG and immigrants, there is evidence of the accumulation assumption. Further concepts, in terms of timing effects or resilience, were not testable.

Similarly, the SDH model could not be fully applied and tested. However, determinants of any dimension/layer could be proved. The individual core characteristics (age, sex, origin), lifestyle characteristics (caregiving [Study II], smoking habits, BMI [Study I]), household characteristics (Studies I, II, and III), living and working conditions (largely measured by socioeconomic status or education [Studies I, II, and III] but also by living arrangements [Study I]), and general conditions (health policies [Study III]) each affect health outcomes. Demographic characteristics as well as living and working conditions had the greatest impact on health and health differences and had very similar effects for NMG and immigrants.

Finally, the frameworks of social exclusion and intersectionality were not empirically tested within this thesis due to the lack of data, but they provide important approaches to understand the essential role of socioeconomic status and social characteristics for the migration-health relationship. In addition, they deliver further explanations for the remaining health differences. Taking into account the determinants integrated into the analyses and the identified interaction effects, an explanation about the pooling and reinforcement of adverse effects appears plausible. Moreover, subjective perceptions of and individually diverse reactions to discrimination and exclusion, as well as hidden mechanisms and interplays, could justify that not all differences are quantifiable and qualifiable.

Thus, the results within this thesis yield information on the validity of (parts of) theoretical frameworks, and the theories proved (partially) suitable to provide approaches for health differences amongst immigrant groups as well as between immigrants and NMG. However, they

are unable to depict the broad causal relationship between migration and health. Whilst demographic models largely lack subjective experiences in terms of discrimination, as well as characteristics of (perceived or manifested) institutional and social exclusion, the sociological approaches partly lack concrete, personal determinants of health and struggle to explain general mechanisms.

9.2.2 Implications for Research

The findings of the three studies stated a high impact of economic and social factors on health inequalities. It should be an endeavour of future research to gain insights into the underlying pathways, temporal courses, and mechanisms of the pathogenesis of health problems in order to identify vulnerable phases and vulnerable groups.

Special focus should be placed on the interplay of pre-, during, and post-migration characteristics and circumstances because only the holistic perspective allows researchers to derive interventions and to establish favourable conditions for current and future immigrant groups. The results suggest that post-migration factors make a significant contribution but cannot explain all health differences. A stronger integration of the theoretical approaches has so far been neglected in many studies but might provide information on possible dimensions of health inequalities. To the best of my knowledge, little consideration was given to determinants at the meso and macro levels (i.e. the outer layers postulated in the SDH model). The three studies presented highlight the value of these but also recognise the importance of individual characteristics. Moreover, additional levels of stratification should be integrated. Besides sex, which is a central dimension of health inequalities [38] and was proven to be associated with partially differentiating mechanisms in the pathogenesis of illness in Study I, these might include age, country of origin, length of stay in Germany, educational levels, the extent of integration, and/or perceived levels of discrimination. Similarly, regional analyses might help to map further inequalities [108].

Studies I and II raise the question of why there are migration-related health differences in household composition and caregiving. The presented interpretation about normative reasons and the accumulation of disadvantageous circumstances appears plausible but should be verified. To do so, it would be necessary to integrate suitable measurements for subjective values and to analyse

underlying motivations in more detail. Similarly, the conclusions of Study III remain speculative, and research should aim to understand country differences more precisely. Particularly, the comparison of countries enables researchers to explore possible interventions (also beyond political regulations).

The current state of research on immigrants in Germany often remains superficial by conducting descriptive or bivariate analyses. These might contribute to a misspecification of pathogens amongst immigrants or (depending on the outcome considered) to an under- or overestimation of the burden of disease. As the analyses within this thesis highlight, health inequalities in the context of immigration are often nuanced and only become clear in the interaction of factors. Moreover, the health outcomes considered in previous studies were not very diverse as, for refugees, there were mainly studies on infectious diseases or mental health. In contrast, objective medical indicators were less culturally sensitive and might enable the determination of pathways to illness.

Furthermore, an essential criterion to enable detailed analyses and conclusions lies in the improvement of available data. There is an urgent need for more up-to-date data including information on migration background, health, and further determinants. Thus far, available data only allow limited representation of the heterogeneity of the population in Germany as well as the complexity of the concept of health. Considering theories and the current state of research, longitudinal data would be particularly desirable to better model time dependencies. These should also include small subgroups such as female refugees, older immigrants, or immigrants from countries of origin which are numerically less represented.

Finally, the findings presented should be verified in further countries, for other (immigrant) groups, and with different health indicators.

9.2.3 Implications for Policy

As the results of this thesis demonstrate, immigrants are not per se vulnerable in terms of health. However, there are group-specific risk factors and health concerns. There were only minor differences between EGI and NMG, but there were indications of additional health challenges within the group of ageing EGI. Greater differences have been determined for Turkish immigrants,

and it must be questioned to what extent socioeconomic disadvantages and social circumstances will affect their health in the long term and in the course of ageing. For the group of refugees, no conclusive picture can yet be drawn, but the analyses emphasise the (structural and health-related) heterogeneity within this group. Above all, a need to promote the health of older immigrants, women and girls, and refugees, particularly from certain countries of origin, can be derived. Therefore, these groups should be the focus of preventive measures and interventions.

The analyses showed moderate differences between immigrants and the non-migrant population for the selected health indicators. Although the recognition of the health vulnerability of immigrants has already been known for a long time [17, 452], measures to reduce these inequalities are still available to a limited extent only. As demonstrated, social and socioeconomic determinants, and thus modifiable characteristics which are partly shaped by policies, strongly affect health outcomes amongst immigrants. However, that differences amongst immigrants and compared to the non-migrant population decrease once adjusting for structural differences veils the rather hypothetical and ideal-typical convergence in terms of educational and occupational attainment. Within the German educational system, access opportunities are unequal and require German-language abilities in order to remain viable [453–455]. Thus, measures to reduce structural and institutional discrimination and to enhance the economic and social integration might improve health chances for immigrants. These might include access to the labour market, secure working conditions, language courses, or inclusive educational and retraining policies. The example of EGI points to the positive association of social inclusion and health opportunities and the subordinate importance of the migration background.

Study III and earlier findings further showed the relevance of health knowledge, utilisation of medical services and prevention measures, access barriers, and lifestyle on health outcomes. Awareness-raising and involvement of immigrants could thus prevent illness but also long-term health risks, which are becoming increasingly important considering the ageing immigrant population. Culturally sensitive offers and linguistic aids which take the diverse population into account appear to be particularly necessary in this context. These do not necessarily have to take place in Germany but might also be offered online by people in the country of origin [456]. As Study II highlighted, interventions and offers should go beyond pure healthcare and include offers

for counselling, informing, and applying for extended benefits and support with regard to care allowance or benefits. Here it seems important to accompany vulnerable phases, such as the transition into caregiving.

The demographic component of immigration (i.e. the increasing population diversity) and the ageing of immigrants are also linked to special and novel challenges for health policy. In the years and decades to come, many immigrants will reach retirement, as well as disease-prone and care-dependent ages, which might be associated with new kinds of (medical and care-related) healthcare requirements. The cultural diversity might contribute to the fact that previously 'common' needs, with regard to care provision, will be less required, and, on the other hand, a different spectrum of diseases and medical care needs will become more common.

Moreover, another aspect relates to the perception and visibility of immigrants in Germany. After a long period of negation of Germany as a country of immigration, the recognition of the existence and importance of immigrants in the society might lead to a greater social and political opening and consideration of immigrants and their needs. This might contribute to social and socioeconomic improvements for the immigrant population and reduce cultural, linguistic, and religious barriers.

Finally, although immigrant groups themselves, their situation, and determinants of health are only comparable across countries to a limited extent (see chapter 2 and 3), the results also provide important insights into an international context. First, the mere process of migration, as well as being an immigrant, is linked to positive and negative short-term and long-term health differences. Legally aligned, culturally and phenotypically similar immigrant groups, and groups which are/were not temporarily marginalised face fewer disadvantages. The findings on refugees in Germany and Austria (Study III) might therefore presumably also be transferred to other recent refugees (from similar countries) immigrating in Central, Western, and Northern European countries or Northern American countries and labour migrants with precarious living and working conditions, such as those in Qatar. The findings on Turkish immigrants might similarly represent mechanisms for further groups of (European) labour migrants (and their descendants) in European countries, such as immigrants from Turkey or the former Yugoslavia in Austria or Italian immigrants in Switzerland.

Transferability of the findings on EGI might be assumed for educational migrants in industrialised countries, holders of a green card in the United States or an EU blue card, or family migrants of established and integrated immigrants. In contrast, no clear congruence is assumed for immigrants of former (European) colonies, such as Indian immigrants in the United Kingdom and Senegalese, Moroccan, or Central African immigrants in France. Although these are subject to (partly) better legal inclusion, similar to EGI in Germany, they supposedly are faced with lower levels of social inclusion due to social marginalisation.

9.3 Future Research Directions and Prospects

From the limitations (see section 9.1.2), the implications (see section 9.2), and current demographic and global developments, future research directions and prospects may be deduced.

First, the lack of comprehensive high-quality data, which include information on the migration background, has long been recognised, and a greater involvement of persons with a migration background in epidemiological studies and health reporting has been called for [94, 106]. Recent large-scale studies in Germany partly address this demand and provide new analytical potential. The Family Research and Demographic Analyses (FReDA), launched in 2021, covers information on migration biographies and health. The panel surveys will be conducted twice a year over a period of ten years and implement the Generations and Gender Survey every three years as well as the Panel Analysis of Intimate Relationships and Family Dynamics (pairfam) [457]. This database enables trend analyses and panel analyses, life course approaches, and international comparisons of the middle-aged population. Moreover, the German National Cohort started in 2014 as a panel of about 200,000 individuals and included a large set of health indicators and characteristics to identify the migration background of the respondents [458]. This dataset will enable in-depth longitudinal analyses of health determinants and health differences amongst immigrant groups and compared to the non-migrant population.

Second, a shift or expansion of the level of consideration and comparison of the immigrant group appears expedient. By comparing similar immigrant groups with regard to their origin or across countries of destination and by comparing immigrants, stayers (in their countries of origin), and

return migrants, important knowledge may be gained about the impact of initial conditions, migration itself, and host-country-specific conditions [161, 459, 460].

Third, future research should focus on gender differences, which were identified as key dimensions of health inequalities both in this thesis and earlier studies [38]. Since 'women are the keepers of the culture' [461, 462], they presumably are more affected by the stressors associated with migration, need longer amounts of time for assimilation processes, and thus may be exposed to greater health risks. The gender perspective should also include specific diseases, which might enable more detailed analyses of causal pathways and underlying determinants. Discussing the example of increased risks of diabetes amongst immigrants in Germany [290, 304] or the gender gap in morbidity and mortality [121, 463], the importance of health-related lifestyle on health differences becomes clear. However, little is known about the interplay of social determinants, socioeconomic status, migration background, gender, and lifestyle and their impact on health outcomes, resulting in a lack of practical and quickly implementable recommendations and interventions.

Fourth, taking into account the demographic composition of the immigrants already living in Germany, it will becoming increasingly important for research to understand processes of (unhealthy) ageing amongst immigrants, long-term temporal pathways, and generational transitions. Important questions will also include to what extent processes of selective remigration affect the immigrant population in Germany and how the care of the remaining population with a migration background can be ensured. Applying the assumption of the healthy migrant effect, an increase of the burden of disease amongst immigrants could soon be assumed, whilst other theories such as the salmon bias do not support this expectation. Health monitoring and population analyses should address this issue.

Finally, new immigrant groups are likely to emerge as the focus of research. Whilst immigration of EGI and Turkish (labour and family) immigrants has lessened over the last years, immigration from other countries of origin and immigrant groups has increased [62]. In 2020, immigrants from Romania were the largest group, and most applications for asylum were filed by people from Nigeria and Somalia [62]. Additionally, depending on the results of the EU membership negotiations with Montenegro, Serbia, and Turkey, and the EU applicant countries Albania and

North Macedonia, the right of free movement might be associated with novel immigrant inflows. New relevant groups might also include family immigrants following the refugee migration and, in response to political circumstances and civil wars, refugees from Ethiopia and Afghanistan.

9.4 Conclusion

The results of this thesis have underscored that health outcomes in Germany are affected by migration background and underlie a close nexus of individual, origin-related, migration-related, and household characteristics as well as socioeconomic, social, and political circumstances. The origin from regions with disadvantageous starting conditions (which in some cases also represented the cause of migration) and the need to cope with the experiences of the migration process and to undergo the phase of integration in a country which is at least partially culturally different affect health and are predominantly associated with health disadvantages. Socioeconomic, social, and legal disadvantages exacerbate these, whilst other individual characteristics and household-related characteristics can have both protective and jeopardising effects.

However, these characteristics cannot fully explain health differences within the immigrant population and compared to the non-migrant population. The differences shown between EGI and Turkish immigrants, as well as the worse situation of refugees in Germany compared to those in Austria, additionally indicate that some immigrant groups have better opportunities to be included in terms of social structures, policy frameworks, and/or health-promoting measures. Moreover, ageing immigrants as well as those in vulnerable phases face increased health risks.

Consequently, from a demographic perspective, in the medium and long terms, immigration is not a solution for natural demographic changes and can neither compensate for the demand for labour nor counteract demographic ageing. Instead, the increasing diversity of the population combined with the ageing of the immigrant population itself creates a burden with regard to health diversity, health needs, and care need. The results of this thesis help to better understand these needs, and together with findings from earlier studies, they allow an optimistic perspective that the health differences of immigrants in Germany are moderate and might partly be reduced or even prevented by modifiable characteristics and conditions at the individual, societal, and political levels.

10. References

1 van Nimwegen N, van der Erf R. Europe at the Crossroads: Demographic Challenges and International Migration. *Journal of Ethnic and Migration Studies* 2010;36(9):1359–79.

2 Edmonston B, Raymer J, Salzmann T. Introduction. In: Salzmann T, Edmonston B, Raymer J, eds. Demographic Aspects of Migration. Wiesbaden: VS Verlag für Sozialwissenschaften 2010:11–27.

3 Schmid J. Bevölkerungsentwicklung und Migration in Deutschland. *Aus Politik und Zeitgeschichte* 2001(43):20–30.

4 United Nations, Department of Economic and Social Affairs, Population Division. International Migrant Stocks 2020 2020. Available at: https://www.un.org/development/desa/pd/content/international-migration-1.

5 Hannigan A, O'Donnell P, O'Keeffe M, et al. How do variations in definitions of "migrant" and their application influence the access of migrants to health care services? Copenhagen 2016.

6 Kristiansen M, Razum O, Tezcan-Güntekin H, et al. Aging and health among migrants in a European perspective. *Public Health Rev* 2016;37:20.

7 Berlinghoff M. Geschichte der Migration in Deutschland 2018. Available at: https://www.bpb.de/gesellschaft/migration/dossier-migration/252241/deutsche-migrationsgeschichte.

8 Oltmer J. Migration im 19.-21. Jahrhundert, 3rd edn. Berlin: De Gruyter Oldenbourg 2016.

9 Statistisches Bundesamt (Destatis). Bevölkerung und Erwerbstätigkeit: Bevölkerung mit Migrationshintergrund - Ergebnisse des Mikrozensus 2019. Wiesbaden 2020.

10 Rechel B, Mladovsky P, Devillé W, et al., eds. Migration and health in the European Union. Maidenhead, Berkshire: McGraw-Hill Open Univ. Press 2011.

11 Davies A, Basten A, Frattini C. Migration: A Social Determinant of the Health of Migrants: Background Paper. Geneva 2006.

12 Giacco D. Identifying the critical time points for mental health of asylum seekers and refugees in high-income countries. *Epidemiol Psychiatr Sci* 2019;29:e61.

13 Zimmerman C, Kiss L, Hossain M. Migration and health: a framework for 21st century policy-making. *PLoS Med* 2011;8(5):e1001034.

14 WHO. Report on the health of refugees and migrants in the WHO European region. No public health without refugee and migrant health. Copenhagen: WHO 2018.

15 Spallek J, Zeeb H, Razum O. What do we have to know from migrants' past exposures to understand their health status? a life course approach. *Emerg Themes Epidemiol* 2011;8(1):6. doi:10.1186/1742-7622-8-6.

16 Kupfer A, Gamper M. Migration als gesundheitliche Ungleichheitsdimension? Natio-ethno-kulturelle Zugehörigkeit, Gesundheit und soziale Netzwerke. In: Klärner A, Gamper M, Keim-Klärner S, et al., eds. Soziale Netzwerke und gesundheitliche Ungleichheiten. Wiesbaden: Springer Fachmedien Wiesbaden 2020:369–97.

17 Neuhauser H, Razum O. Migration und Gesundheit: Schwerpunktbericht der Gesundheitsberichterstattung des Bundes. Berlin: Robert-Koch-Inst 2008.

18 Spallek J, Razum O. Migration und Gesundheit. In: Richter M, Hurrelmann K, eds. Soziologie von Gesundheit und Krankheit, 1st edn. Wiesbaden: Springer VS 2016:153–66.

19 WHO. Constitution of the World Health Organization 1948.

20 Steptoe A, Deaton A, Stone AA. Subjective wellbeing, health, and ageing. *The Lancet* 2015;385(9968):640–48.

21 Bozorgmehr K, Razum O. Effect of Restricting Access to Health Care on Health Expenditures among Asylum-Seekers and Refugees: A Quasi-Experimental Study in Germany, 1994-2013. *PLoS ONE* 2015;10(7):e0131483.

22 Nesterko Y, Jäckle D, Friedrich M, et al. Health care needs among recently arrived refugees in Germany: a cross-sectional, epidemiological study. *Int J Public Health* 2020;65(6):811–21. doi:10.1007/s00038-020-01408-0.

23 Chatterji P, Alegria M, Takeuchi D. Psychiatric disorders and labor market outcomes: evidence from the National Comorbidity Survey-Replication. *J Health Econ* 2011;30(5):858–68. doi:10.1016/j.jhealeco.2011.06.006.

24 Wickramage K, Vearey J, Zwi AB, et al. Migration and health: a global public health research priority. *BMC Public Health* 2018;18(1):987.

25 Rößger F. Demographic perspectives on international migration. Dissertation. Rostock 2015.

26 Greenwood MJ. Research on Internal Migration in the United States: A Survey. *Journal of Economic Literature* 1975;13(2):397–433.

27 Massey DS, Arango J, Hugo G, et al. Theories of International Migration: A Review and Appraisal. *Population and Development Review* 1993;19(3):431–66. http://www.jstor.org/stable/2938462.

28 International Organization for Migration (IOM). Glossary on Migration. Geneva 2019.

29 Zlotnik H. The Concept of International Migration as Reflected in Data Collection Systems. *Int Migr Rev* 1987;21(4):925–46.

30 U.S. Census Bureau. Measuring Migration in a Census 2019.

31 Willekens F, Massey D, Raymer J, et al. International Migration. International migration under the microscope. *Science* 2016;352(6288):897–99.

32 Rienzo C, Vargas-Silva C. Migrants in the UK: An Overview 2017. Available at: https://eumigro.eu/sites/default/files/materials/05.04._ex._briefing-migrants_uk_overview.pdf.

33 Massey DS. Patterns and Processes of International Migration in the 21st Century: (Paper prepared for the Conference on African Migration in Comparative Perspective, Johannesburg, South Africa, 4-7 June, 2003) 2003.

34 Wickramasinghe A, Wimalaratana W. International Migration and Migration Theories. *Social Affairs: A Journal for the Social Sciences* 2016;1(5):13–32.

35 Manning P, Trimmer T. Migration in World History. New York Routledge: Routledge 2020.

36 Castles S, Miller MJ. The age of migration: International population movements in the modern world, 2nd edn. Basingstoke, Hampshire: Macmillan 1998.

37 Bade KJ. Migration in European history. Malden, MA: Blackwell Pub 2003.

38 International Organization for Migration (IOM). World Migration Report 2020. Geneva 2019.

39 The World Bank. Migration and Remittances Factbook 2011: The World Bank 2010.

40 Widgren J, Stacher I. Internationale Wander- und Fluchtbewegungen - eine globale Herausforderung. In: Currle E, Wunderlich T, eds. Deutschland - ein Einwanderungsland? Berlin, Boston: De Gruyter 2001.

41 Dustmann C. Economic Change, Social Challenge. In: Dustmann C, ed. Migration: Economic change, social challenge, 1st edn. Oxford, New York: Oxford University Press 2015.

42 Audebert C, Doraï MK. Migration in A Globalised World New Research Issues and Prospects. Amsterdam: Amsterdam University Press 2010.

43 Statistisches Bundesamt (Destatis). Wanderungen zwischen Deutschland und dem Ausland: Deutschland, Jahre, Kontinente (Code 12711-0010) 2021. Available at: https://www-genesis.destatis.de/genesis/online.

44 Oltmer J, Gall L. Migration im 19. und 20. Jahrhundert. München: Oldenbourg 2010.

45 Joppke C. Immigration and the nation-state: The United States, Germany, and Great Britain. Oxford: Oxford Univ. Press 1999.

46 Gans P, ed. Räumliche Auswirkungen der internationalen Migration. Hannover: Akad. für Raumforschung und Landesplanung ARL 2014.

47 Hanewinkel V, Oltmer J. Länderprofil Deutschland: focus Migration. Osnabrück 2017.

48 Salentin K. Sampling the Ethnic Minority Population in Germany. The Background to "Migration Background" 2014.

49 Will A-K. The German statistical category "migration background": Historical roots, revisions and shortcomings. *Ethnicities* 2019;19(3):535–57.

50 Green S. Germany: A Changing Country of Immigration. *German Politics* 2013;22(3):333–51.

51 Statistisches Bundesamt (Destatis). Mikrozensus. Wiesbaden 2006.

52 Bundesamt für Migration und Flüchtlinge (BAMF). Migrationsbericht 2018: Zentrale Ergebnisse. Nürnberg 2019.

53 Statistisches Bundesamt (Destatis). Bevölkerung und Erwerbstätigkeit: Haushalte und Familien. Ergebnisse des Mikrozensus. Wiesbaden 2020.

54 Haug S, Müssig S, Stichs A, eds. Muslimisches Leben in Deutschland, 1st edn. Nürnberg: Bundesamt für Migration und Flüchtlinge 2009.

55 Woellert F, Klingholz R. Neue Potenziale: Zur Lage der Integration in Deutschland. Berlin 2014.

56 Schührer S. Türkeistämmige Personen in Deutschland: Erkenntnisse aus der Repräsentativuntersuchung "Ausgewählte Migrantengruppen in Deutschland 2015" (RAM). Nürnberg 2018.

57 Hartmann J. Do second-generation Turkish migrants in Germany assimilate into the middle class? *Ethnicities* 2016;16(3):368–92.

58 Guveli A, Ganzeboom HBG, Platt L, et al. Intergenerational Consequences of Migration: Socio-economic, Family and Cultural Patterns of Stability and Change in Turkey and Europe. Houndmills, Basingstoke, Hampshire: Palgrave MacMillan 2015.

59 Worbs S, Bund E, Kohls M, et al. (Spät-)Aussiedler in Deutschland. Eine Analyse aktueller Daten und Forschungsergebnisse: Universitätsbibliothek Tübingen 2013.

60 Statistisches Bundesamt (Destatis), Wissenschaftszentrum Berlin für Sozialforschung (WZB), Bundesinstitut für Bevölkerungsforschung (BiB). Datenreport 2021: Ein Sozialbericht für die Bundesrepublik Deutschland. Bonn 2021.

61 Worbs S, Bund E, Böhm A. Asyl - und dann?: Die Lebenssituation von Asylberechtigten und anerkannten Flüchtlingen in Deutschland. BAMF-Flüchtlingsstudie 2014. Nürnberg 2016.

62 Bundesamt für Migration und Flüchtlinge (BAMF). Das Bundesamt in Zahlen 2020: Asyl. Nürnberg 2021.

63 Brücker H, Kunert A, Mangold U, et al. Geflüchtete Menschen in Deutschland - eine qualitative Befragung: Refugees in Germany - qualitative interviews 2016.

64 Brücker H, Rother N, Schupp J, et al. Flucht, Ankunft in Deutschland und erste Schritte der Integration 2016.

65 Krabbe PFM. The measurement of health and health status: Concepts, methods and applications from a multidisciplinary perspective. Amsterdam, Boston, Heidelberg und 9 weitere: Academic Press Elsevier 2017.

66 Erhart M, Wille N, Ravens-Sieberer U. Die Messung der subjektiven Gesundheit: Stand der Forschung und Herausforderungen. In: Richter M, Hurrelmann K, eds. Gesundheitliche Ungleichheit. Wiesbaden: VS Verlag für Sozialwissenschaften 2006:321–38.

67 Lippke S, Renneberg B. Konzepte von Gesundheit und Krankheit. In: Renneberg B, Hammelstein P, eds. Gesundheitspsychologie. Berlin, Heidelberg: Springer Berlin Heidelberg 2006:7–12.

68 Saracci R. The World Health Organisation needs to reconsider its definition of health. *BMJ* 1997;314(7091):1409–10.

69 Misselbrook D. W is for wellbeing and the WHO definition of health. *Br J Gen Pract* 2014;64(628):582.

70 Engel GL. The need for a new medical model: a challenge for biomedicine. *Science* 1977;196(4286):129–36.

71 Verbrugge LM, Jette AM. The disablement process. *Social Science & Medicine* 1994;38(1):1–14.

72 Nagi S. Some conceptual issues in disability and rehabilitation. In: Sussman MB, ed. Sociology and Rehabilitation. Washington, DC 1965:100–13.

73 Antonovsky A. The salutogenic model as a theory to guide health promotion. *Health Promot Int* 1996;11(1):11–18.

74 Larson JS. The measurement of health: Concepts and indicators. New York: Greenwood Press 1991.

75 Young TK. Population health: Concepts and methods, 2nd edn. New York, Oxford: Oxford University Press 2005.

76 Marmot M. Social determinants of health inequalities. *The Lancet* 2005;365(9464):1099–104.

77 Huber M, Knottnerus JA, Green L, et al. How should we define health? *BMJ* 2011;343:d4163.

78 Bergner M. Measurement of Health Status. *Medical Care* 1985;23(5):696–704.

79 Sadana R. Development of standardized health state descriptions. In: Murray CJL, Salomon JA, Mathers CD, et al., eds. Summary measures of population health: Concepts, ethics, measurement and applications. Geneva: World Health Organization 2002:315–28.

80 Bombak AE. Self-rated health and public health: a critical perspective. *Front Public Health* 2013;1:15. doi:10.3389/fpubh.2013.00015.

81 Roser M. Life Expectancy 2019.

82 Oeppen J, Vaupel JW. Demography. Broken limits to life expectancy. *Science* 2002;296(5570):1029–31.

83 Omran AR. The epidemiologic transition: a theory of the epidemiology of population change. 1971. *Milbank Q* 2005;83(4):731–57.

84 WHO. Life expectancy at birth (years) 2021. Available at: https://www.who.int/data/gho/data/indicators/indicator-details/GHO/life-expectancy-at-birth-(years).

85 WHO. World health statistics 2019: monitoring health for the SDGs, sustainable development goals. Geneva 2019.

86 WHO. Healthy life expectancy (HALE) at birth (years) 2021. Available at: https://www.who.int/data/gho/data/indicators/indicator-details/GHO/gho-ghe-hale-healthy-life-expectancy-at-birth.

87 Barrett R, Kuzawa CW, McDade T, et al. Emerging and Re-emerging Infectious Diseases: The Third Epidemiologic Transition. *Annu. Rev. Anthropol.* 1998;27(1):247–71.

88 WHO. Global health risks: Mortality and burden of disease attributable to selected major risks. Geneva, Switzerland: World Health Organization 2009.

89 Waxman A. WHO's global strategy on diet, physical activity and health. *Scandinavian Journal of Nutrition* 2004;48(2):58–60.

90 Crimmins EM, Preston SH, Cohen B, eds. International differences in mortality at older ages: Dimensions and sources. Washington, DC: National Academies Press 2010.

91 WHO. Global Health Expenditure Database 2021. Available at: https://apps.who.int/nha/database.

92 Blümel M, Spranger A, Achstetter K, et al. Health System Review 2020.

93 Thomson S, Osborn R, Squires D, et al. International Profiles of Health Care Systems, 2012: Australia, Canada, Denkmark, England, France, Germany, Iceland, Italy, Japan, the Netherlands, New Zealand, Norway, Sweden, Switzerland, and the United States 2012.

94 Robert Koch-Institut. Gesundheit in Deutschland. Gesundheitsberichterstattung des Bundes: RKI-Bib1 (Robert Koch-Institut) 2015.

95 OECD/European Observatory on Health Systems and Policies. Germany: Country Health Profile 2019. Brussels 2019.

96 Spree R. Der Rückzug des Todes. Der epidemiologische Übergang in Deutschland während des 19. und 20. Jahrhunderts. *Historical Social Research* 1998;23(1/2):4–43.

97 Lampert T, Richter M, Schneider S, et al. Soziale Ungleichheit und Gesundheit: Stand und Perspektiven der sozialepidemiologischen Forschung in Deutschland. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2016;59(2):153–65.

98 Knesebeck Ovd, Lüschen G, Cockerham WC, et al. Socioeconomic status and health among the aged in the United States and Germany: A comparative cross-sectional study. *Social Science & Medicine* 2003;57(9):1643–52.

99 Schöllgen I, Huxhold O, Tesch-Römer C. Socioeconomic status and health in the second half of life: findings from the German Ageing Survey. *Eur J Ageing* 2010;7(1):17–28.

100 Tetzlaff F, Epping J, Tetzlaff J, et al. Socioeconomic inequalities in lung cancer - a time trend analysis with German health insurance data. *BMC Public Health* 2021;21(1):538. doi:10.1186/s12889-021-10576-4.

101 Hoebel J, Kuntz B, Kroll LE, et al. Socioeconomic Inequalities in the Rise of Adult Obesity: A Time-Trend Analysis of National Examination Data from Germany, 1990-2011. *Obes Facts* 2019;12(3):344–56. doi:10.1159/000499718.

102 Perna L, Mielck A, Lacruz ME, et al. Socioeconomic position, resilience, and health behaviour among elderly people. *Int J Public Health* 2012;57(2):341–49.

103 Kibele EUB, Jasilionis D, Shkolnikov VM. Widening socioeconomic differences in mortality among men aged 65 years and older in Germany. *J Epidemiol Community Health* 2013;67(5):453–57.

104 Wenau G, Grigoriev P, Shkolnikov V. Socioeconomic disparities in life expectancy gains among retired German men, 1997-2016. *J Epidemiol Community Health* 2019;73(7):605–11.

105 Schenk L. Migration und Gesundheit--Entwicklung eines Erklärungs- und Analysemodells für epidemiologische Studien. *Int J Public Health* 2007;52(2):87–96.

106 Razum O, Wenner J. Social and health epidemiology of immigrants in Germany: past, present and future. *Public Health Rev* 2016;37:4.

107 Rommel A, Saß AC, Born S, et al. Die gesundheitliche Lage von Menschen mit Migrationshintergrund und die Bedeutung des sozioökonomischen Status: Erste Ergebnisse der Studie zur Gesundheit Erwachsener in Deutschland (DEGS1). *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2015;58(6):543–52.

108 Wengler A. The health status of first- and second-generation Turkish immigrants in Germany. *Int J Public Health* 2011;56(5):493–501.

109 Knipper M, Bilgin Y. Migration und Gesundheit. Sankt Augustin: Konrad-Adenauer-Stiftung 2009.

110 Stenzel M. Migration und Gesundheit. In: Stauder J, Rapp I, Eckhard J, eds. Soziale Bedingungen privater Lebensführung. Wiesbaden: Springer Fachmedien Wiesbaden 2016:283–303.

111 Razum O, Twardella D. Time travel with Oliver Twist--towards an explanation for a paradoxically low mortality among recent immigrants. *Trop Med Int Health* 2002;7(1):4–10.

112 Vandenheede H, Willaert D, Grande H de, et al. Mortality in adult immigrants in the 2000s in Belgium: a test of the 'healthy-migrant' and the 'migration-as-rapid-health-transition' hypotheses. *Trop Med Int Health* 2015;20(12):1832–45. doi:10.1111/tmi.12610.

113 Du Desgrées Loû A. Santé des immigrés la transition épidémiologique à l'échelle individuelle. *Rev Prat* 2019;69(5):550–54.

114 Spallek J, Reeske A, Zeeb H, et al. Models of migration and health. In: Thomas F, ed. Handbook of Migration and Health: Edward Elgar Publishing 2016:44–58.

115 Kuo W. Theories of migration and mental health: An empirical testing on Chinese-Americans. *Social Science & Medicine (1967)* 1976;10(6):297–306.

116 Shuval JT. Migration, Health, and Stress. In: Cockerham WC, ed. The Blackwell companion to medical sociology. Oxford: Blackwell 2001:126–43.

117 Sluzki CE. Migration and the Disruption of the Social Network. In: McGoldrick M, Hardy KV, eds. Re-visioning family therapy: Race, culture, and gender in clinical practice, 2nd edn. New York: Guilford Press 2008:39–47.

118 Berry JW. Acculturation and Health. In: Kazarian SS, ed. Cultural clinical psychology: Theory, research, and practice. New York: Oxford University Press 1998:39–57.

119 Abraido-Lanza AF, Armbrister AN, Florez KR, et al. Toward a theory-driven model of acculturation in public health research. *Am J Public Health* 2006;96(8):1342–46.

120 Rumbaut RG. Migration, Adaptation, and Mental Health: The Experience of Southeast Asian Refugees in the United States. In: Adelman H, ed. Refugee Policy: Canada and the United States. Staten Island: York Lanes Press 1991:383–427.

121 Jackson PB, Williams DR. The Intersection of Race, Gender, and SES: Health Paradoxes. In: Schulz AJ, Mullings L, eds. Gender, race, class, and health: Intersectional approaches, 1st edn. San Francisco, CA: Jossey-Bass 2006:131–62.

122 Bhugra D. Migration and mental health. *Acta Psychiatr Scand* 2004;109(4):243–58.

123 Carta MG, Bernal M, Hardoy MC, et al. Migration and mental health in Europe (the state of the mental health in Europe working group: appendix 1). *Clin Pract Epidemiol Ment Health* 2005;1:13.

124 Mayer J, Riphahn RT. Fertility assimilation of immigrants: Evidence from count data models. *Journal of Population Economics* 2000(13):241–61.

125 Goldstein S. Interrelations between migration and fertility in Thailand. *Demography* 1973;10(2):225–41.

126 Kulu H. Migration and Fertility: Competing Hypotheses Re-examined. *European Journal of Population* 2005;21(1):51–87.

127 Lu Y. Test of the 'healthy migrant hypothesis': a longitudinal analysis of health selectivity of internal migration in Indonesia. *Social Science & Medicine* 2008;67(8):1331–39. doi:10.1016/j.socscimed.2008.06.017.

128 Hervitz HM. Selectivity, Adaptation, or Disruption? A Comparison of Alternative Hypotheses on the Effects of Migration on Fertility: The Case of Brazil. *Int Migr Rev* 1985;19(2):293–317.

129 Ben-Shlomo Y, Kuh D. A life course approach to chronic disease epidemiology: conceptual models, empirical challenges and interdiscliplinary perspectives. *Int J Epidemiol* 2002(31):285–93.

130 Kuh D, Ben-Shlomo Y, Lynch J, et al. Life course epidemiology: Glossary. *Journal of Epidemiology & Community Health* 2003(57):778–83.

131 Ben-Shlomo Y, Redwood S. A life-course perspective on migrant health. In: Kumar BN, Diaz E, eds. Migrant Health: CRC Press 2019:77–88.

132 Marmot M, Allen J, Bell R, et al. WHO European review of social determinants of health and the health divide. *The Lancet* 2012;380(9846):1011–29.

133 Graham H, Kelly MP. Health Inequalities: Concepts, Frameworks and Policy 2004.

134 Whitehead M, Dahlgren G. Concepts and principles for tackling social inequalities in health: Levelling up Part 1. Copenhagen 2007.

135 Dahlgren G, Whitehead M. European strategies for tackling social inequalities in health: Levelling up Part 2. Copenhagen 2006.

136 Dahlgren G, Whitehead M. Policies and strategies to promote social equity in health: Background document to WHO - Strategy paper for Europe 2007.

137 Whitehead M, Dahlgren G. What Can Be Done About Inequalities in Health? *Lancet* 1991;338(8774):1059–63.

138 CSDH. Closing the gap in a generation: Health equity through action on the social determinants of health: Final report of the commission on social determinants of health. Geneva 2008.

139 Trees D. Resolution on the "Health of Migrants in Vietnam": Discussion Paper, Submitted to the International Organization for Migration (IOM) in Vietnam 2013.

140 Taket A, Crisp BR, Nevill A, et al. Part 1 - Introducing theories of social exclusion and social connectedness. In: Taket A, Crisp BR, Nevill A, et al., eds. Theorising social exclusion. London: Routledge 2009:3–34.

141 Bhalla A, Lapeyre F. Social Exclusion: Towards an Analytical and Operational Framework. *Development & Change* 1997;28(3):413–33.

142 United Nations. Leaving no one behind: The imperative of inclusive development. New York, NY: United Nations 2016.

143 Rawal N. Social Inclusion and Exclusion: A Review. *Dhaulagiri Journal of Sociology and Anthropology* 2008;2:161–80.

144 Mewes R, Asbrock F, Laskawi J. Perceived discrimination and impaired mental health in Turkish immigrants and their descendents in Germany. *Compr Psychiatry* 2015;62:42–50. doi:10.1016/j.comppsych.2015.06.009.

145 Twenge JM, Catanese KR, Baumeister RF. Social exclusion causes self-defeating behavior. *J Pers Soc Psychol* 2002;83(3):606–15.

146 Pascoe EA, Smart Richman L. Perceived discrimination and health: a meta-analytic review. *Psychological Bulletin* 2009;135(4):531–54.

147 Crenshaw K. Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory and Antiracist Politics. *University of Chicago Legal Forum* 1989(1):139–67.

148 Williams LF. On the Ethics of Research on the triple Oppression of Black american Women. *Humanity & Society* 1984;8(4):506–13.

149 King DK. Multiple Jeopardy, Multiple Consciousness: The Context of a Black Feminist Ideology. *Signs: Journal of Women in Culture and Society* 1988;14(1):42–72.

150 Homan P, Brown TH, King B. Structural Intersectionality as a New Direction for Health Disparities Research. *Journal of health and social behavior* 2021;62(3):350–70. doi:10.1177/00221465211032947.

151 Bauer GR. Incorporating intersectionality theory into population health research methodology: challenges and the potential to advance health equity. *Soc Sci Med* 2014;110:10–17. doi:10.1016/j.socscimed.2014.03.022.

152 Heard E, Fitzgerald L, Wigginton B, et al. Applying intersectionality theory in health promotion research and practice. *Health Promot Int* 2020;35(4):866–76.

153 Rai SS, Peters RMH, Syurina EV, et al. Intersectionality and health-related stigma: insights from experiences of people living with stigmatized health conditions in Indonesia. *Int J Equity Health* 2020;19(1):206. doi:10.1186/s12939-020-01318-w.

154 Schulz AJ, Mullings L, eds. Gender, race, class, and health: Intersectional approaches, 1st edn. San Francisco, CA: Jossey-Bass 2006.

155 Mullings L, Schulz AJ. Intersectionality and Health: An Introduction. In: Schulz AJ, Mullings L, eds. Gender, race, class, and health: Intersectional approaches, 1st edn. San Francisco, CA: Jossey-Bass 2006:3–17.

156 Kirkcaldy B, Wittig U, Furnham A, et al. Migration und Gesundheit. Psychosoziale Determinanten. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2006;49(9):873–83.

157 Fu H, VanLandingham MJ. Disentangling the effects of migration, selection and acculturation on weight and body fat distribution: results from a natural experiment involving Vietnamese Americans, returnees, and never-leavers. *J Immigr Minor Health* 2012;14(5):786–96.

158 Domnich A, Panatto D, Gasparini R, et al. The "healthy immigrant" effect: does it exist in Europe today? *Italian Journal of Public Health* 2012;9(3).

159 Razum O, Rohrmann S. Der Healthy-migrant-Effekt: Bedeutung von Auswahlprozessen bei der Migration und Late-entry-Bias. *Gesundheitswesen* 2002;64(2):82–88.

160 Kohls M. Selection, Social Status or Data Artefact - What Determines the Mortality of Migrants in Germany? In: Salzmann T, Edmonston B, Raymer J, eds. Demographic Aspects of Migration. Wiesbaden: VS Verlag für Sozialwissenschaften 2010:153–77.

161 Constant AF, Milewski N. Self-selection in physical and mental health among older intra-European migrants. *The Journal of the Economics of Ageing* 2021;19:100322.

162 Constant AF. The Healthy Immigrant and Health Convergence. Maastricht 2017.

163 Jass G, Massey DS. Immigrant health: Selectivity and acculturation 2004.

164 Abraido-Lanza AF, Dohrenwend BP, Ng-Mak DS, et al. The Latino mortality paradox: A test of the "salmon bias" and healthy migrant hypotheses. *Am J Public Health* 1999;89(10):1543–48.

165 Kohls M. Morbidität und Mortalität von Migranten in Deutschland, 1st edn. Nürnberg: Bundesamt für Migration und Flüchtlinge 2011.

166 Ruiz JM, Hamann HA, Mehl MR, et al. The Hispanic health paradox: From epidemiological phenomenon to contribution opportunities for psychological science. *Group Processes & Intergroup Relations* 2016;19(4):462–76.

167 Markides KS, Eschbach K. Aging, migration, and mortality: current status of research on the Hispanic paradox. *J Gerontol B Psychol Sci Soc Sci* 2005;60 Spec No 2:68–75.

168 Franzini L, Ribble JC, Keddie AM. Understanding the Hispanic paradox. *Ethn Dis* 2001;11(3):496–518.

169 Guillot M, Khlat M, Elo I, et al. Understanding age variations in the migrant mortality advantage: An international comparative perspective. *PLoS ONE* 2018;13(6):e0199669. doi:10.1371/journal.pone.0199669.

170 Aldridge RW, Nellums LB, Bartlett S, et al. Global patterns of mortality in international migrants: a systematic review and meta-analysis. *The Lancet* 2018;392(10164):2553–66.

171 Shor E, Roelfs D. A Global Meta-analysis of the Immigrant Mortality Advantage. *Int Migr Rev* 2021:019791832199634.

172 Verropoulou G, Tsimbos C. Mortality by Cause of Death Among Immigrants and Natives in a South European Country: The Case of Greece, 2011. *J Immigr Minor Health* 2016;18(2):337–44.

173 Spallek J, Arnold M, Razum O, et al. Cancer mortality patterns among Turkish immigrants in four European countries and in Turkey. *European Journal of Epidemiology* 2012;27(12):915–21. doi:10.1007/s10654-012-9746-y.

174 Juárez SP, Drefahl S, Dunlavy A, et al. All-cause mortality, age at arrival, and duration of residence among adult migrants in Sweden: A population-based longitudinal study. *SSM Popul Health* 2018;6:16–25. doi:10.1016/j.ssmph.2018.07.007.

175 Norredam M, Olsbjerg M, Petersen JH, et al. Inequalities in mortality among refugees and immigrants compared to native Danes--a historical prospective cohort study. *BMC Public Health* 2012;12:757. doi:10.1186/1471-2458-12-757.

176 Razum O, Zeeb H, Akgün HS, et al. Low overall mortality of Turkish residents in Germany persists and extends into a second generation: merely a healthy migrant effect? *Trop Med Int Health* 1998;3(4):297–303.

177 Deckert A, Winkler V, Meisinger C, et al. Suicide and external mortality pattern in a cohort of migrants from the former Soviet Union to Germany. *J Psychiatr Res* 2015;63:36–42. doi:10.1016/j.jpsychires.2015.02.020.

178 Wallace M, Khlat M, Guillot M. Mortality advantage among migrants according to duration of stay in France, 2004-2014. *BMC Public Health* 2019;19(1):327. doi:10.1186/s12889-019-6652-1.
179 Ott JJ, Paltiel AM, Winkler V, et al. Chronic disease mortality associated with infectious agents: a comparative cohort study of migrants from the Former Soviet Union in Israel and Germany. *BMC Public Health* 2008;8:110. doi:10.1186/1471-2458-8-110.
180 Iwasaki M, Mameri CP, Hamada GS, et al. Secular trends in cancer mortality among Japanese immigrants in the state of São Paulo, Brazil, 1979-2001. *Eur J Cancer Prev* 2008;17(1):1–8.
181 Ng E. The healthy immigrant effect and mortality rates. *Health Reports* 2011;22(4):25–30.
182 van Oostrum IEA, Goosen S, Uitenbroek DG, et al. Mortality and causes of death among asylum seekers in the Netherlands, 2002-2005. *J Epidemiol Community Health* 2011;65(4):376–83. doi:10.1136/jech.2009.087064.
183 Reynales-Shigematsu LM, Guerrero-López CM, Hernández Ávila M, et al. Divergence and convergence in cause-specific premature adult mortality in Mexico and US Mexican Hispanics from 1995 to 2015: analyses of 4.9 million individual deaths. *Int J Epidemiol* 2018;47(1):97–106.
184 Shor E, Roelfs D, Vang ZM. The "Hispanic mortality paradox" revisited: Meta-analysis and meta-regression of life-course differentials in Latin American and Caribbean immigrants' mortality. *Soc Sci Med* 2017;186:20–33. doi:10.1016/j.socscimed.2017.05.049.
185 Singh GK, Siahpush M. All-cause and cause-specific mortality of immigrants and native born in the United States. *Am J Public Health* 2001;91(3):392–99.
186 Bennet L, Udumyan R, Östgren CJ, et al. Mortality in first- and second-generation immigrants to Sweden diagnosed with type 2 diabetes: a 10 year nationwide cohort study. *Diabetologia* 2021;64(1):95–108. doi:10.1007/s00125-020-05279-1.
187 Tavares AM, Fronteira I, Couto I, et al. HIV and tuberculosis co-infection among migrants in Europe: A systematic review on the prevalence, incidence and mortality. *PLoS ONE* 2017;12(9):e0185526. doi:10.1371/journal.pone.0185526.
188 Indseth T, Grøsland M, Arnesen T, et al. COVID-19 among immigrants in Norway, notified infections, related hospitalizations and associated mortality: A register-based study. *Scand J Public Health* 2021;49(1):48–56. doi:10.1177/1403494820984026.
189 Williamson LM, Rosato M, Teyhan A, et al. AIDS mortality in African migrants living in Portugal: evidence of large social inequalities. *Sex Transm Infect* 2009;85(6):427–31. doi:10.1136/sti.2008.034066.
190 Stirbu I, Kunst AE, Bos V, et al. Differences in avoidable mortality between migrants and the native Dutch in The Netherlands. *BMC Public Health* 2006;6:78. doi:10.1186/1471-2458-6-78.
191 Harding S. Mortality of migrants from the Indian subcontinent to England and Wales: effect of duration of residence. *Epidemiology* 2003;14(3):287–92.
192 Pavli A, Maltezou H. Health problems of newly arrived migrants and refugees in Europe. *J Travel Med* 2017;24(4).
193 Bas-Sarmiento P, Saucedo-Moreno MJ, Fernández-Gutiérrez M, et al. Mental Health in Immigrants Versus Native Population: A Systematic Review of the Literature. *Arch Psychiatr Nurs* 2017;31(1):111–21. doi:10.1016/j.apnu.2016.07.014.
194 Abbott A. The mental-health crisis among migrants. *Nature* 2016;538(7624):158–60.
195 Henkelmann JR, Best S de, Deckers C, et al. Anxiety, depression and post-traumatic stress disorder in refugees resettling in high-income countries: systematic review and meta-analysis. *BJPsych Open* 2020;6(4):e68. doi:10.1192/bjo.2020.54.
196 Lindert J, Schouler-Ocak M, Heinz A, et al. Mental health, health care utilisation of migrants in Europe. *European Psychiatry* 2008;23:14–20.
197 Priebe S, Giacco D, El-Nagib R. Public health aspects of mental health among migrants and refugees: a review of the evidence on mental health care for refugees, asylum seekers and irregular migrants in the WHO European Region 2016.
198 Foo SQ, Tam WW, Ho CS, et al. Prevalence of Depression among Migrants: A Systematic Review and Meta-Analysis. *Int J Environ Res Public Health* 2018;15(9). doi:10.3390/ijerph15091986.

199 Close C, Kouvonen A, Bosqui T, et al. The mental health and wellbeing of first generation migrants: a systematic-narrative review of reviews. *Global Health* 2016;12(1):47. doi:10.1186/s12992-016-0187-3.

200 Ryan L, Leavey G, Golden A, et al. Depression in Irish migrants living in London: case-control study. *Br J Psychiatry* 2006;188:560–66.

201 van der Wurff FB, Beekman ATF, Dijkshoorn H, et al. Prevalence and risk-factors for depression in elderly Turkish and Moroccan migrants in the Netherlands. *J Affect Disord* 2004;83(1):33–41.

202 Aichberger MC, Schouler-Ocak M, Mundt A, et al. Depression in middle-aged and older first generation migrants in Europe: results from the Survey of Health, Ageing and Retirement in Europe (SHARE). *Eur Psychiatry* 2010;25(8):468–75. doi:10.1016/j.eurpsy.2009.11.009.

203 Blackmore R, Boyle JA, Fazel M, et al. The prevalence of mental illness in refugees and asylum seekers: A systematic review and meta-analysis. *PLoS Med* 2020;17(9):e1003337. doi:10.1371/journal.pmed.1003337.

204 Lindert J, Ehrenstein OS von, Priebe S, et al. Depression and anxiety in labor migrants and refugees--a systematic review and meta-analysis. *Soc Sci Med* 2009;69(2):246–57. doi:10.1016/j.socscimed.2009.04.032.

205 Alduraidi H, Waters CM. Depression, Perceived Health, and Right-of-Return Hopefulness of Palestinian Refugees. *J Nurs Scholarsh* 2018;50(2):163–71. doi:10.1111/jnu.12363.

206 Bustamante LHU, Cerqueira RO, Leclerc E, et al. Stress, trauma, and posttraumatic stress disorder in migrants: a comprehensive review. *Braz J Psychiatry* 2018;40(2):220–25. doi:10.1590/1516-4446-2017-2290.

207 Hutchinson G, Haasen C. Migration and schizophrenia: the challenges for European psychiatry and implications for the future. *Soc Psychiatry Psychiatr Epidemiol* 2004;39(5):350–57.

208 Selten J-P, van der Ven E, Termorshuizen F. Migration and psychosis: a meta-analysis of incidence studies. *Psychol Med* 2020;50(2):303–13. doi:10.1017/S0033291719000035.

209 Cantor-Graae E, Selten J-P. Schizophrenia and migration: a meta-analysis and review. *Am J Psychiatry* 2005;162(1):12–24.

210 Selten J-P, Cantor-Graae E, Kahn RS. Migration and schizophrenia. *Curr Opin Psychiatry* 2007;20(2):111–15.

211 Fearon P, Kirkbride JB, Morgan C, et al. Incidence of schizophrenia and other psychoses in ethnic minority groups: results from the MRC AESOP Study. *Psychol Med* 2006;36(11):1541–50. doi:10.1017/S0033291706008774.

212 Dapunt J, Kluge U, Heinz A. Risk of psychosis in refugees: a literature review. *Transl Psychiatry* 2017;7(6):e1149. doi:10.1038/tp.2017.119.

213 Brandt L, Henssler J, Müller M, et al. Risk of Psychosis Among Refugees: A Systematic Review and Meta-analysis. *JAMA Psychiatry* 2019;76(11):1133–40.

214 Harker K. Immigrant Generation, Assimilation, and Adolescent Psychological Well-Being. *Social Forces* 2001;79(3):969–1004.

215 Hao L, Johnson RW. Economic, Cultural, and Social Origins of Emotional Well-Being. *Res Aging* 2000;22(6):599–629.

216 Baltatescu S. Subjective Well-Being of Immigrants in Europe and Their Evaluation of Societal Conditions. An Exploratory Study. In: Pop L, Matiuta C, eds. European Identity and Free Movement of Persons. Oradea: University of Oradea Publishing House 2005:128–43.

217 Borraccino A, Charrier L, Berchialla P, et al. Perceived well-being in adolescent immigrants: it matters where they come from. *Int J Public Health* 2018;63(9):1037–45. doi:10.1007/s00038-018-1165-8.

218 Carswell K, Blackburn P, Barker C. The relationship between trauma, post-migration problems and the psychological well-being of refugees and asylum seekers. *Int J Soc Psychiatry* 2011;57(2):107–19.

219 Chen C, Zissimopoulos JM. Racial and ethnic differences in trends in dementia prevalence and risk factors in the United States. *Alzheimers Dement (N Y)* 2018;4:510–20. doi:10.1016/j.trci.2018.08.009.

220 Lines LM, Shreif NA, Wiener JM. Racial and ethnic disparities among individuals with Alzheimer's disease in the United States: A literature review. Research Triangle Park 2014.

221 Selten J-P, Termorshuizen F, van Sonsbeek M, et al. Migration and dementia: a meta-analysis of epidemiological studies in Europe. *Psychol Med* 2021;51(11):1838–45. doi:10.1017/S0033291720000586.

222 Veling W, Selten J-P, Susser E, et al. Discrimination and the incidence of psychotic disorders among ethnic minorities in The Netherlands. *Int J Epidemiol* 2007;36(4):761–68. doi:10.1093/ije/dym085.

223 Han H-R, Kim M, Lee HB, et al. Correlates of depression in the Korean American elderly: focusing on personal resources of social support. *J Cross Cult Gerontol* 2007;22(1):115–27. doi:10.1007/s10823-006-9022-2.

224 Amit K, Riss I. The Subjective Well-Being of Immigrants: Pre- and Post-migration. *Soc Indic Res* 2014;119(1):247–64.

225 Hjern A, Wicks S, Dalman C. Social adversity contributes to high morbidity in psychoses in immigrants--a national cohort study in two generations of Swedish residents. *Psychol Med* 2004;34(6):1025–33.

226 Amit K, Litwin H. The Subjective Well-Being of Immigrants Aged 50 and Older in Israel. *Soc Indic Res* 2010;98(1):89–104.

227 Nabi F. The Impact of the Migration on Psychosocial Well-Being: A Study of Kurdish Refugees in Resettlement Country. *J Community Med Health Educ* 2013;04(02).

228 Aikawa M, Kleyman K. Immigration, coping, and well-being: Implications for communities' roles in promoting the well-being of immigrants and refugees. *J Prev Interv Community* 2021;49(1):81–92. doi:10.1080/10852352.2019.1633066.

229 Bak-Klimek A, Karatzias T, Elliott L, et al. The Determinants of Well-Being Among International Economic Immigrants: A Systematic Literature Review and Meta-Analysis. *Applied Research Quality Life* 2015;10(1):161–88.

230 Idler EL, Benyamini Y. Self-Rated Health and Mortality: A Review of Twenty-Seven Community Studies. *Journal of health and social behavior* 1997;38:21–37.

231 Singh-Manoux A, Martikainen P, Ferrie J, et al. What does self rated health measure? Results from the British Whitehall II and French Gazel cohort studies. *J Epidemiol Community Health* 2006;60(4):364–72.

232 Kim I-H, Carrasco C, Muntaner C, et al. Ethnicity and postmigration health trajectory in new immigrants to Canada. *Am J Public Health* 2013;103(4):e96-104. doi:10.2105/AJPH.2012.301185.

233 Bergeron P, Auger N, Hamel D. Poids, santé générale et santé mentale: la situation de divers sous-groupes d'immigrants au Canada. *Can J Public Health* 2009;100(3):215–20.

234 Huh J, Prause JA, Dooley CD. The impact of nativity on chronic diseases, self-rated health and comorbidity status of Asian and Hispanic immigrants. *J Immigrant Health* 2008;10(2):103–18.

235 Leão TS, Sundquist J, Johansson S-E, et al. The influence of age at migration and length of residence on self-rated health among Swedish immigrants: a cross-sectional study. *Ethn Health* 2009;14(1):93–105.

236 Nielsen SS, Krasnik A. Poorer self-perceived health among migrants and ethnic minorities versus the majority population in Europe: a systematic review. *Int J Public Health* 2010;55(5):357–71.

237 Alang SM, McCreedy EM, McAlpine DD. Race, Ethnicity, and Self-Rated Health Among Immigrants in the United States. *J Racial Ethn Health Disparities* 2015;2(4):565–72. doi:10.1007/s40615-015-0106-y.

238 Newbold KB. Self-rated health within the Canadian immigrant population: risk and the healthy immigrant effect. *Soc Sci Med* 2005;60(6):1359–70.

239 Buber-Ennser I, Kohlenberger J, Rengs B, et al. Human Capital, Values, and Attitudes of Persons Seeking Refuge in Austria in 2015. *PLoS ONE* 2016;11(9):e0163481.

240 Dowling A, Enticott J, Kunin M, et al. An Investigation into the Association of Pre- and Post-Migration Experiences on the Self-Rated Health Status Among New Resettled Adult Humanitarian Refugees to Australia: A Longitudinal Study. *SSRN Journal* 2018.

241 Castelli F, Sulis G. Migration and infectious diseases. *Clin Microbiol Infect* 2017;23(5):283–89. doi:10.1016/j.cmi.2017.03.012.

242 Stich A. Häufige Infektionskrankheiten bei Migranten. *Internist (Berl)* 2016;57(5):409–15.

243 Requena-Méndez A, Aldasoro E, Lazzari E de, et al. Prevalence of Chagas disease in Latin-American migrants living in Europe: a systematic review and meta-analysis. *PLoS Negl Trop Dis* 2015;9(2):e0003540. doi:10.1371/journal.pntd.0003540.

244 Eonomopoulou A, Pavli A, Stasinopoulou P, et al. Migrant screening: Lessons learned from the migrant holding level at the Greek-Turkish borders. *J Infect Public Health* 2017;10(2):177–84. doi:10.1016/j.jiph.2016.04.012.

245 Isenring E, Fehr J, Gültekin N, et al. Infectious disease profiles of Syrian and Eritrean migrants presenting in Europe: A systematic review. *Travel Med Infect Dis* 2018;25:65–76. doi:10.1016/j.tmaid.2018.04.014.

246 Eiset AH, Wejse C. Review of infectious diseases in refugees and asylum seekers-current status and going forward. *Public Health Rev* 2017;38:22. doi:10.1186/s40985-017-0065-4.

247 Sohail QZ, Chu A, Rezai MR, et al. The Risk of Ischemic Heart Disease and Stroke Among Immigrant Populations: A Systematic Review. *Can J Cardiol* 2015;31(9):1160–68. doi:10.1016/j.cjca.2015.04.027.

248 Vyas MV, Austin PC, Pequeno P, et al. Incidence of Stroke in Immigrants to Canada: A Province-wide Retrospective Analysis. *Neurology* 2021. doi:10.1212/WNL.0000000000012555.

249 Agyemang C, van den Born B-J. Non-communicable diseases in migrants: an expert review. *J Travel Med* 2019;26(2).

250 Biffl G. Socio-Economic Determinants of Health and Identification of Vulnerable Groups in the Context of Migration. The Case of Austria. Vienna 2003.

251 Dassanayake J, Dharmage SC, Gurrin L, et al. Are immigrants at risk of heart disease in Australia? A systematic review. *Australian Health Review* 2009;33(3):479–91.

252 Bo A, Zinckernagel L, Krasnik A, et al. Coronary heart disease incidence among non-Western immigrants compared to Danish-born people: effect of country of birth, migrant status, and income. *Eur J Prev Cardiol* 2015;22(10):1281–89. doi:10.1177/2047487314551538.

253 Hargreaves S, Rustage K, Nellums LB, et al. Occupational health outcomes among international migrant workers: a systematic review and meta-analysis. *The Lancet Global Health* 2019;7(7):e872-e882.

254 Agudelo-Suarez AA, Ronda-Perez E, Benavides FG. Occupational health. In: Rechel B, Mladovsky P, Devillé W, et al., eds. Migration and health in the European Union. Maidenhead, Berkshire: McGraw-Hill Open Univ. Press 2011:155–68.

255 Bischoff A, Schneider M, Denhaerynck K, et al. Health and ill health of asylum seekers in Switzerland: an epidemiological study. *Eur J Public Health* 2009;19(1):59–64.

256 Tsai AJ. Disparities in osteoporosis by race/ethnicity, education, work status, immigrant status, and economic status in the United States. *Eur J Intern Med* 2019;64:85–89. doi:10.1016/j.ejim.2019.04.011.

257 Wändell P, Li X, Carlsson AC, et al. Osteoporotic fractures among foreign-born individuals: a national Swedish study. *Osteoporos Int* 2021;32(2):343–52. doi:10.1007/s00198-020-05597-5.

258 Wändell P, Li X, Carlsson AC, et al. Osteoporotic fractures in second-generation immigrants and Swedish natives. *Osteoporos Int* 2021;32(7):1343–50. doi:10.1007/s00198-020-05776-4.

259 Wang PP, Elsbett-Koeppen R, Geng G, et al. Arthritis prevalence and place of birth: findings from the 1994 Canadian National Population Health Survey. *Am J Epidemiol* 2000;152(5):442–45.

260 Rotermann M. The impact of considering birthplace in analyses of immigrant health: Statistics Canada Catalogue no. 82-003-X. *Health Reports* 2011;22(4):1–7.

261 Li X, Sundquist J, Sundquist K. Risks of rheumatic diseases in first- and second-generation immigrants in Sweden: a nationwide followup study. *Arthritis Rheum* 2009;60(6):1588–96.

262 Parkin DM, Khlat M. Studies of cancer in migrants: Rationale and methodology. *European Journal of Cancer* 1996;32(5):761–71.

263 McDonald JT, Farnworth M, Liu Z. Cancer and the healthy immigrant effect: a statistical analysis of cancer diagnosis using a linked Census-cancer registry administrative database. *BMC Public Health* 2017;17(1):296. doi:10.1186/s12889-017-4190-2.

264 Hemminki K, Försti A, Khyatti M, et al. Cancer in immigrants as a pointer to the causes of cancer. *Eur J Public Health* 2014;24 Suppl 1:64–71.

265 Siegel RL, Miller KD, Jemal A. Cancer statistics, 2015. *CA Cancer J Clin* 2015;65(1):5–29. doi:10.3322/caac.21254.

266 Montesi L, Caletti MT, Marchesini G. Diabetes in migrants and ethnic minorities in a changing World. *World J Diabetes* 2016;7(3):34–44.

267 Commodore-Mensah Y, Selvin E, Aboagye J, et al. Hypertension, overweight/obesity, and diabetes among immigrants in the United States: an analysis of the 2010-2016 National Health Interview Survey. *BMC Public Health* 2018;18(1):773. doi:10.1186/s12889-018-5683-3.

268 Alidu L, Grunfeld EA. A systematic review of acculturation, obesity and health behaviours among migrants to high-income countries. *Psychology & Health* 2018;33(6):724–45. doi:10.1080/08870446.2017.1398327.

269 Popovic-Lipovac A, Strasser B. A review on changes in food habits among immigrant women and implications for health. *J Immigr Minor Health* 2015;17(2):582–90.
270 Gerber M, Barker D, Pühse U. Acculturation and physical activity among immigrants: a systematic review. *J Public Health* 2012;20(3):313–41.
271 Delavari M, Sønderlund AL, Swinburn B, et al. Acculturation and obesity among migrant populations in high income countries--a systematic review. *BMC Public Health* 2013;13:458. doi:10.1186/1471-2458-13-458.
272 Federal Ministry of Justice and Consumer Protection (Bundesministerium für Justiz und Verbraucherschutz). Gesetz über die Statistik der Bevölkerungsbewegung und die Fortschreibung des Bevölkerungsstandes: BevStatG.
273 Federal Ministry of Justice and Consumer Protection (Bundesministerium für Justiz und Verbraucherschutz). Gesetz über das Ausländerzentralregister.
274 Dyck M, Wenner J, Wengler A, et al. Migration und Gesundheit in Deutschland – eine Bestandsaufnahme der Datenquellen. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2019;62(8):935–42.
275 University of Bielefeld. RefuDat - Vergleichsdatenbank für quantitative Forschung zu Gesundheit und gesundheitlicher Versorgung Geflüchteter 2021. Available at: http://projekt-refudat.uni-bielefeld.de/search/type/dataset.
276 Statistisches Bundesamt (Destatis). Mikrozensus - Fragen zur Gesundheit 2009. Wiesbaden 2010.
277 SOEP Group. SOEP-Core v35 - HEALTH. Berlin 2020.
278 Kroh M, Kühne S, Jacobsen J, et al. Sampling, nonresponse, and integrated weighting of the 2016 IAB-BAMF-SOEP Survey of Refugees (M3/M4). Berlin 2017.
279 Schupp J, Brücker H, Kroh M, et al. IAB-BAMF-SOEP-Befragung Geflüchteter 2016: SOEP Socio-Economic Panel Study 2018.
280 Kurth B-M, Razum O. Editorial: Gesundheitsmonitoring muss die Vielfalt der Bevölkerung berücksichtigen: Robert Koch-Institut 2019.
281 Allen J, Born S, Damerow S, et al. Gesundheit in Deutschland aktuell (GEDA 2019/2020-EHIS) - Hintergrund und Methodik: Robert Koch-Institut 2021.
282 Wirz J, Schenk L, eds. Kinder- und Jugendgesundheitssurvey (KiGGS) 2003 - 2006: Kinder und Jugendliche mit Migrationshintergrund in Deutschland: Bericht im Auftrag des Bundesministeriums für Gesundheit. Berlin: Robert-Koch-Institut 2008.
283 Robert Koch-Institut. Maßnahmen zur verbesserten Einbindung und Beteiligung von Kindern und Jugendlichen mit Migrationshintergrund in KiGGS Welle 2: RKI-Bib1 (Robert Koch-Institut) 2018.
284 Deutsches Jugendinstitut M, Technische Universität Chemnitz-Zwickau. DJI-Ausländersurvey - Jugendliche: GESIS Data Archive 2001.
285 Spallek J, Razum O. Erklärungsmodelle für die gesundheitliche Situation von Migrantinnen und Migranten. In: Bauer U, ed. Health Inequalities: Gesundheit und Gesellschaft Determinanten und Mechanismen gesundheitlicher Ungleichheit. Wiesbaden: VS Verlag für Sozialwissenschaften 2008:271–90.
286 Landesvereinigung für Gesundheitsförderung Mecklenburg-Vorpommern e.V. Betrachtung der gesundheitlichen Situation vulnerabler Zielgruppen in Mecklenburg-Vorpommern. Schwerin 2017.
287 Brodhun B, Altmann D, Hauer B, et al. Bericht zur Epidemiologie der Tuberkulose in Deutschland für 2019: Robert Koch-Institut 2020.
288 Kuehne A, Fiebig L, Jansen K, et al. Migrationshintergrund in der infektionsepidemiologischen Surveillance in Deutschland: Analysen am Beispiel Tuberkulose, HIV und Syphilis. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2015;58(6):560–68.
289 Milewski N, Peters F. Too Low or Too High? On Birthweight Differentials of Immigrants in Germany. *CPoS* 2014;39(1).
290 Icks A, Kulzer B, Razum O. Diabetes bei Migranten. In: diabetesDE, ed. Deutscher Gesundheitsbericht Diabetes 2011. Mainz: Kirchheim + Co GmbH 2011:148–54.
291 Milewski N, Doblhammer G. Mental health among immigrants: Is there a disadvantage in later life? In: Doblhammer G, ed. Health among the elderly in Germany: New evidence on disease, disability and care need. Opladen, Berlin, Toronto: Barbara Budrich Publishers 2015:191–212.

292 Santos-Hövener C, Kuntz B, Frank L, et al. Ausgewählte Gesundheitsaspekte von Kindern und Jugendlichen mit Migrationshintergrund in Deutschland. Ergebnisse aus KiGGS Welle 2 (2014 – 2017). In: Gemeinsame Jahrestagung der Deutschen Gesellschaft für Medizinische Soziologie (DGMS) und der Deutschen Gesellschaft für Sozialmedizin und Prävention (DGSMP): Georg Thieme Verlag KG 2019.

293 Kuhnt A-K, Wengler A. Das soziale Wohlbefinden von Personen mit Migrationshintergrund in Deutschland. In: Lübke C, Delhey J, eds. Diagnose Angstgesellschaft?: transcript Verlag 2019:193–222.

294 Arnold M, Razum O, Coebergh J-W. Cancer risk diversity in non-western migrants to Europe: An overview of the literature. *Eur J Cancer* 2010;46(14):2647–59.

295 Glaesmer H, Wittig U, Brähler E, et al. Sind Migranten häufiger von psychischen Störungen betroffen? *Psychiatr Prax* 2009;36(1):16–22. doi:10.1055/s-2008-1067566.

296 Lindert J, Brähler E, Wittig U, et al. Depressivität, Angst und posttraumatische Belastungsstörung bei Arbeitsmigranten, Asylbewerbern und Flüchtlingen. Systematische Ubersichtsarbeit zu Originalstudien. *Psychother Psychosom Med Psychol* 2008;58(3-4):109–22.

297 Clauss S, Nauck B. Immigrant and Native Children in Germany. *Child Ind Res* 2010;3(4):477–501.

298 Hoebel J, Rommel A, Schröder SL, et al. Socioeconomic Inequalities in Health and Perceived Unmet Needs for Healthcare among the Elderly in Germany. *Int J Environ Res Public Health* 2017;14(10). doi:10.3390/ijerph14101127.

299 Kotwal AA. Physical and psychological health of first and second generation Turkish immigrants in Germany. *Am J Hum Biol* 2010;22(4):538–45.

300 Kuehne A, Huschke S, Bullinger M. Subjective health of undocumented migrants in Germany - a mixed methods approach. *BMC Public Health* 2015;15:926. doi:10.1186/s12889-015-2268-2.

301 Sahyazici F, Huxhold O. Depressive Symptome bei älteren türkischen Migrantinnen und Migranten. In: Baykara-Krumme H, Schimany P, Motel-Klingebiel A, eds. Viele Welten des Alterns. Wiesbaden: VS Verlag für Sozialwissenschaften 2012:181–200.

302 Carnein M, Milewski N, Doblhammer G, et al. Health inequalities of immigrants: Patterns and determinants of health expectancies of Turkish migrants living in Germany. In: Doblhammer G, ed. Health among the elderly in Germany: New evidence on disease, disability and care need. Opladen, Berlin, Toronto: Barbara Budrich Publishers 2015:157–90.

303 Porsch-Oezçueruemez M. Prevalence of risk factors of coronary heart disease in Turks living in Germany: The Giessen Study. *Atherosclerosis* 1999;144(1):185–98.

304 Reeske A, Zeeb H, Razum O, et al. Differences in the Incidence of Gestational Diabetes between Women of Turkish and German Origin: An Analysis of Health Insurance Data From a Statutory Health Insurance in Berlin, Germany (AOK), 2005-2007. *Geburtshilfe Frauenheilkd* 2012;72(4):305–10.

305 Spallek J, Arnold M, Hentschel S, et al. Cancer incidence rate ratios of Turkish immigrants in Hamburg, Germany: A registry based study. *Cancer Epidemiol* 2009;33(6):413–18. doi:10.1016/j.canep.2009.10.006.

306 Wittig U, Merbach M, Siefen RG, et al. Beschwerden und Inanspruchnahme des Gesundheitswesens von Spätaussiedlern bei Einreise nach Deutschland. *Gesundheitswesen* 2004;66(2):85–92.

307 Wittig U, Lindert J, Merbach M, et al. Mental health of patients from different cultures in Germany. *European Psychiatry* 2008;23:28–35.

308 Kreft D, Doblhammer G. Contextual and individual determinants of health among Aussiedler and native Germans. *Health Place* 2012;18(5):1046–55.

309 Stolpe S, Ouma M, Winkler V, et al. Self-rated health among migrants from the former Soviet Union in Germany: a cross-sectional study. *BMJ Open* 2018;8(10):e022947. doi:10.1136/bmjopen-2018-022947.

310 Winkler V, Ott JJ, Holleczek B, et al. Cancer profile of migrants from the Former Soviet Union in Germany: incidence and mortality. *Cancer Causes Control* 2009;20(10):1873–79.

311 Volodina A, Bertsche T, Kostev K, et al. Drug utilization patterns and reported health status in ethnic German migrants (Aussiedler) in Germany: a cross-sectional study. *BMC Public Health* 2011;11:509. doi:10.1186/1471-2458-11-509.

312 Deckert A, Winkler V, Meisinger C, et al. Myocardial infarction incidence and ischemic heart disease mortality: overall and trend results in repatriates, Germany. *Eur J Public Health* 2014;24(1):127–33. doi:10.1093/eurpub/ckt058.

313 Kornischka J, Assion H-J, Ziegenbein M, et al. Psychosoziale Belastungsfaktoren und psychische Erkrankungen bei Spätaussiedlern. *Psychiatr Prax* 2008;35(2):60–66. doi:10.1055/s-2007-971023.

314 Ronellenfitsch U, Kyobutungi C, Becher H, et al. All-cause and cardiovascular mortality among ethnic German immigrants from the Former Soviet Union: a cohort study. *BMC Public Health* 2006;6:16. doi:10.1186/1471-2458-6-16.

315 Kyobutungi C, Ronellenfitsch U, Razum O, et al. Mortality from external causes among ethnic German immigrants from former Soviet Union countries, in Germany. *Eur J Public Health* 2006;16(4):376–82. doi:10.1093/eurpub/ckl013.

316 Ronellenfitsch U, Razum O. Deteriorating health satisfaction among immigrants from Eastern Europe to Germany. *Int J Equity Health* 2004;3(1):4.

317 Bozorgmehr K, Mohsenpour A, Saure D, et al. Systematische Übersicht und "Mapping" empirischer Studien des Gesundheitszustands und der medizinischen Versorgung von Flüchtlingen und Asylsuchenden in Deutschland (1990-2014). *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2016;59(5):599–620.

318 Metzing M, Schacht D, Scherz A. Psychische und körperliche Gesundheit von Geflüchteten im Vergleich zu anderen Bevölkerungsgruppen: DIW - Deutsches Institut für Wirtschaftsforschung 2020.

319 Grochtdreis T, König H-H, Riedel-Heller SG, et al. Health-Related Quality of Life of Asylum Seekers and Refugees in Germany: a Cross-Sectional Study with Data from the German Socio-Economic Panel. *Applied Research Quality Life* 2020.

320 Jung F. Das Bremer Modell - Gesundheitsversorgung Asylsuchender: Kurzfassung 2011.

321 Führer A, Eichner F, Stang A. Morbidity of asylum seekers in a medium-sized German city. *European Journal of Epidemiology* 2016;31(7):703–06. doi:10.1007/s10654-016-0148-4.

322 Alberer M, Wendeborn M, Löscher T, et al. Erkrankungen bei Flüchtlingen und Asylbewerbern: Daten von drei verschiedenen medizinischen Einrichtungen im Raum München aus den Jahren 2014 und 2015. *Dtsch Med Wochenschr* 2016;141(1):e8-15. doi:10.1055/s-0041-106907.

323 Bogic M, Ajdukovic D, Bremner S, et al. Factors associated with mental disorders in long-settled war refugees: refugees from the former Yugoslavia in Germany, Italy and the UK. *Br J Psychiatry* 2012;200(3):216–23. doi:10.1192/bjp.bp.110.084764.

324 Lersner U von, Rieder H, Elbert T. Psychische Gesundheit und Rückkehrvorstellungen am Beispiel von Flüchtlingen aus dem ehemaligen Jugoslawien. *Zeitschrift für Klinische Psychologie und Psychotherapie* 2008;37(2):112–21.

325 Schröder H, Zok K, Faulbaum F. Gesundheit von Geflüchteten in Deutschland - Ergebnisse einer Befragung von Schutzsuchenden aus Syrien, Irak und Afghanistan 2018.

326 Renner A, Hoffmann R, Nagl M, et al. Syrian refugees in Germany: Perspectives on mental health and coping strategies. *J Psychosom Res* 2020;129:109906. doi:10.1016/j.jpsychores.2019.109906.

327 Tibubos AN, Kröger H. A cross-cultural comparison of the ultrabrief mental health screeners PHQ-4 and SF-12 in Germany. *Psychol Assess* 2020;32(7):690–97. doi:10.1037/pas0000814.

328 Schenk L, Anton V, Baer N-R, et al. Ernährungsmuster von Kindern und Jugendlichen mit Migrationshintergrund: Ergebnisse der KiGGS-Studie. *Public Health Forum* 2016;24(3):205–08.

329 Prüfer-Krämer L, Krämer A. Gesundheit von Migranten in Deutschland. *Public Health Forum* 2000;8(3):24–25.

330 Klein J, Knesebeck Ovd. Inequalities in health care utilization among migrants and non-migrants in Germany: a systematic review. *Int J Equity Health* 2018;17(1):160. doi:10.1186/s12939-018-0876-z.

331 Brause M, Reutin B, Razum O, et al. Rehabilitationserfolg bei Menschen mit türkischem Migrationshintergrund - Eine Auswertung von Routinedaten der Deutschen Rentenversicherungen Rheinland und Westfalen. *Rehabilitation (Stuttg)* 2012;51(5):282–88. doi:10.1055/s-0031-1295448.

332 Göbber J, Pfeiffer W, Winkler M, et al. Stationäre psychosomatische Rehabilitationsbehandlung von Patienten mit türkischem Migrationshintergrund. *Zeitschrift für Psychiatrie, Psychologie und Psychotherapie* 2010;58(3):181–87.

333 Niedermaier A, Freiberg A, Tiller D, et al. Outpatient health care utilization and health expenditures of asylum seekers in Halle (Saale), Germany - an analysis of claims data. *BMC Health Serv Res* 2020;20(1):961. doi:10.1186/s12913-020-05811-4.

334 Bozorgmehr K, Dieterich A, Offe J. UN concerned about the right to health for migrants in Germany. *The Lancet* 2019;393(10177):1202–03.

335 Borgschulte HS, Wiesmüller GA, Bunte A, et al. Health care provision for refugees in Germany - one-year evaluation of an outpatient clinic in an urban emergency accommodation. *BMC Health Serv Res* 2018;18(1):488. doi:10.1186/s12913-018-3174-y.

336 Kluth W. Die Gesundheitsversorgung von Migranten: ein systematischer problemorientierter Überblick. *Zeitschrift für medizinische Ethik* 2018;64(1):5–14.

337 Goreis A, Asbrock F, Nater UM, et al. What Mediates the Relationship Between Ethnic Discrimination and Stress? Coping Strategies and Perceived Social Support of Russian Immigrants in Germany. *Front Psychiatry* 2020;11:557148. doi:10.3389/fpsyt.2020.557148.

338 Statistisches Bundesamt (Destatis). Mikrozensus 2019.

339 Goebel J, Grabka MM, Liebig S, et al. The German Socio-Economic Panel (SOEP). *Jahrbücher für Nationalökonomie und Statistik* 2019;239(2):345–60.

340 Siegers R, Steinhauer HW, Dührsen L. SOEP-Core v36 - Documentation of Samples Sizes and Panel Attrition in the German Socio-Economic Panel (SOEP) (1984 until 2019). Berlin 2021.

341 Liebau E, Tucci I. Migrations- und Integrationsforschung mit dem SOEP von 1984 bis 2012: Erhebung, Indikatoren und Potenziale. Berlin 2015.

342 DIW Berlin. Living in Germany.

343 Bohlender A, Rathje M, Glemser A. SOEP-Core - 2018: Report of survey methodology and fieldwork. Berlin 2020.

344 Gramlich T. Analyse der Panelausfälle im Sozio-oekonomischen Panel SOEP. Berlin 2008.

345 Brücker H, Rother N, Schupp J, eds. IAB-BAMF-SOEP-Befragung von Geflüchteten 2016: Studiendesign, Feldergebnisse sowie Analysen zu schulischer wie beruflicher Qualifikation, Sprachkenntnissen sowie kognitiven Potenzialen. Nürnberg: Bundesamt für Migration und Flüchtlinge 2018.

346 Kuehne S. et al. Sampling in Times of High Immigration: The Survey Process of the IAB-BAMF-SOEP Survey of Refugees. *Surv Methods Insights Field* 2019.

347 Kohlenberger J. Refugee Health and Integration Survey (ReHIS) (SUF edition): AUSSDA Dataverse 2019.

348 Kohlenberger J, Buber-Ennser I, Rengs B, et al. Gesundheitszugang von syrischen, irakischen und afghanischen Geflüchteten in Österreich: Ergebnisse aus dem Refugee Health and Integration Survey. In: Czaika M, Rössl L, Altenburg F, et al., eds. Migration und Integration 7: Dialog zwischen Politik, Wissenschaft und Praxis. Reihe Dialogforum Integration. Krems: Edition Donau-University Krems 2019:239–59.

349 DiPrete TA, Forristal JD. Multilevel Models: Methods and Substance. *Annu. Rev. Sociol.* 1994;20:331–57.

350 Guo G, Zhao H. Multilevel Modeling for Binary Data. *Annu. Rev. Sociol.* 2000;26(1):441–62.

351 Windzio M. Regressionsmodelle für Zustände und Ereignisse: Eine Einführung. Wiesbaden: Springer VS 2013.

352 Ballinger GA. Using Generalized Estimating Equations for Longitudinal Data Analysis. *Organizational Research Methods* 2004;7(2):127–50.

353 Zeger SL, Liang K-Y. Longitudinal Data Analysis for Discrete and Continuous Outcomes. *Biometrics* 1986;42(1):121.

354 Carey G, ed. Quantitative Methods In Neuroscience. Boulder 2013.

355 Liang K-Y, Zeger SL. Longitudinal data analysis using generalized linear models. *Biometrika* 1986;73(1):13–22.

356 Zeger SL, Liang K-Y, Albert PS. Models for Longitudinal Data: A Generalized Estimating Equation Approach. *Biometrics* 1988;44(4):1049.

357 Szmaragd, Camille, Clarke, Paul, Steele, Fiona. Subject specific and population average models for binary longitudinal data: a tutorial. *Longitudinal and Life Course Studies* 2013;4(2):147–65.

358 Cui J. QIC Program and Model Selection in GEE Analyses. *The Stata Journal* 2007;7(2):209–20.

359 Aldrich JH, Nelson FD. Linear, Probability, Logit, and Probit Models. Newbury Park: Sage 1984.

360 Caliendo M, Kopeinig S. Some practical guidance for the implementation of propensity score matching. *J Economic Surveys* 2008;22(1):31–72.
361 Hirano K, Imbens GW. Estimation of causal effects using propensity score weighting: An application to data on right heart catheterization. *Health Serv Outcomes Res Methodol.* 2001;2(3/4):259–78.
362 Rosenbaum PR, Rubin DB. The central role of the propensity score in observational studies for causal effects. *Biometrika* 1983;70(1):41–55.
363 Imbens GW. Nonparametric Estimation of Average Treatment Effects Under Exogeneity: A Review. *Rev Econ Stat* 2004;86(1):4–29.
364 Rosenbaum PR, Rubin DB. Constructing a Control Group Using Multivariate Matched Sampling Methods That Incorporate the Propensity Score. *Am Stat* 1985;39(1):33–38.
365 DiPrete TA, Gangl M. 7. Assessing Bias in the Estimation of Causal Effects: Rosenbaum Bounds on Matching Estimators and Instrumental Variables Estimation with Imperfect Instruments. *Sociological Methodology* 2004;34(1):271–310.
366 Berman P, Kendall C, Bhattacharyya K. The household production of health: Integrating social science perspectives on micro-level health determinants. *Social Science & Medicine* 1994;38(2):205–15.
367 Hank K, Steinbach A. Families and Health: A Review. In: Doblhammer G, Gumà J, eds. A Demographic Perspective on Gender, Family and Health in Europe. Cham: Springer International Publishing 2018:23–39.
368 Keese M, Schmitz H. Broke, Ill, and Obese: Is There an Effect of Household Debt on Health? *Review of Income and Wealth* 2014;60(3):525–41.
369 Hughes M, Waite LJ. Health in Household Context: Living Arrangements and Health in Late Middle Age. *J Health Soc Behav.* 2002;43(1):1–21.
370 Joung IM, van de Mheen H, Stronks K, et al. Differences in self-reported morbidity by marital status and by living arrangement. *Int J Epidemiol* 1994;23(1):91–97.
371 Lippe E von der, Rattay P. Association of partner, parental, and employment statuses with self-rated health among German women and men. *SSM Popul Health* 2016;2:390–98. doi:10.1016/j.ssmph.2016.05.005.
372 Ingram E, Ledden S, Beardon S, et al. Household and area-level social determinants of multimorbidity: a systematic review. *J Epidemiol Community Health* 2021;75(3):232–41. doi:10.1136/jech-2020-214691.
373 McIlvane JM, Ajrouch KJ, Antonucci TC. Generational Structures and Social Ressources in Mid-Life: Influences on Health and Well-Being. *Journal of Social Issues* 2007;63(4):759–73.
374 Dunifon RE, Ziol-Guest KM, Kopko K. Grandparent Coresidence and Family Well-Being. *The ANNALS of the American Academy of Political and Social Science* 2014;654(1):110–26.
375 Muennig P, Jiao B, Singer E. Living with parents or grandparents increases social capital and survival: 2014 General Social Survey-National Death Index. *SSM Popul Health* 2018;4:71–75. doi:10.1016/j.ssmph.2017.11.001.
376 Masfety VK, Aarnink C, Otten R, et al. Three-generation households and child mental health in European countries. *Soc Psychiatry Psychiatr Epidemiol* 2019;54(4):427–36. doi:10.1007/s00127-018-1640-9.
377 Statistisches Bundesamt (Destatis). Zusammenleben von Generationen. Wiesbaden 2016.
378 Ryan AK, Willits FK. Family ties, physical health, and psychological well-being. *J Aging Health* 2007;19(6):907–20.
379 Ross CE, Mirowsky J, Goldsteen K. The Impact of the Family on Health: The Decade in Review. *Journal of Marriage and the Family* 1990;52(4):1059.
380 Nomaguchi K, Milkie MA. Parenthood and Well-Being: A Decade in Review. *J Marriage Fam* 2020;82(1):198–223. doi:10.1111/jomf.12646.
381 Carnein M, Baykara-Krumme H. Einstellungen zur familialen Solidarität im Alter: eine vergleichende Analyse mit türkischen Migranten und Deutschen. *Zeitschrift für Familienforschung* 2013;25(1):29–52. https://nbn-resolving.org/urn:nbn:de:0168-ssoar-386557.
382 Baykara-Krumme H, Klaus D, Steinbach A. Generationenbeziehungen in Deutschland. Ein Vergleich der Beziehungsqualität in einheimischen deutschen Familien, Familien mit türkischem Migrationshintergrund und Aussiedlerfamilien. In: Brüderl J, Castiglioni L, Schumann N, eds. Partnerschaft, Fertilität und

intergenerationale Beziehungen: Ergebnisse der ersten Welle des Beziehungs- und Familienpanels. Würzburg: Ergon-Verl. 2011:259–86.

383 Guner N, Kulikova Y, Llull J. Reprint of: Marriage and health: Selection, protection, and assortative mating. *European Economic Review* 2018;109:162–90.

384 Hilz R, Wagner M. Marital Status, Partnership and Health Behaviour: Findings from the German Ageing Survey (DEAS). *CPoS* 2018;43.

385 Windzio M, Aybek CM. Marriage, Norm Orientation and Leaving the Parental Home: Turkish Immigrant and Native Families in Germany 2015.

386 Bundesministerium für Familie, Senioren, Frauen und Jugend. Ehe, Familie, Werte - Migrantinnen und Migranten in Deutschland. Berlin 2010.

387 Gumà J, Solé-Auró A, Arpino B. Examining social determinants of health: the role of education, household arrangements and country groups by gender. *BMC Public Health* 2019;19(1):699. doi:10.1186/s12889-019-7054-0.

388 Gerstel N, Sarkisian N. Sociological Perspectives on Families and Work: The Import of Gender, Class, and Race. In: Pitt-Catsouphes M, Ernst Kossek E, Sweet S, eds. The Work and Family Handbook: Multi-Discliplinary Perspectives and Approaches. Mahwah, NJ 2006:237–66.

389 Christensen K, Doblhammer G, Rau R, et al. Ageing populations: the challenges ahead. *The Lancet* 2009;374(9696):1196–208.

390 Pfaff H. People in Need of Long-term Care: The Present and the Future. In: Doblhammer G, Scholz R, eds. Ageing, Care Need and Quality of Life: The Perspective of Care Givers and People in Need of Care. Wiesbaden: VS/GWV 2010:14–28.

391 Geyer J, Schulz E. Who cares?: Die Bedeutung der informallen Pflege durch Erwerbstätige in Deutschland 2014.

392 Eurostat. Immigration 2021. Available at: https://ec.europa.eu/eurostat/databrowser/view/tps00176/default/table Accessed June 22, 2021.

393 Thum M. Auswirkungen des demografischen Wandels im Einwanderungsland Deutschland: Studie im Auftrag der Abteilung Wirtschafts- und Sozialpolitik der Friedrich-Ebert-Stiftung, Gesprächskreis Migration und Integration. Bonn 2015.

394 Koch-Institut, Robert. Limitations in activities of daily living in old age in Germany and the EU – Results from the European Health Interview Survey (EHIS) 2 2019.

395 Roth DL, Perkins M, Wadley VG, et al. Family caregiving and emotional strain: associations with quality of life in a large national sample of middle-aged and older adults. *Qual Life Res* 2009;18(6):679–88. doi:10.1007/s11136-009-9482-2.

396 Schulz R, Sherwood PR. Physical and mental health effects of family caregiving. *Am J Nurs* 2008;108(9 Suppl):23-7; quiz 27.

397 Bom J, Bakx P, Schut F, et al. The Impact of Informal Caregiving for Older Adults on the Health of Various Types of Caregivers: A Systematic Review. *Gerontologist* 2019;59(5):e629-e642.

398 Pinquart M, Sörensen S. Correlates of physical health of informal caregivers: a meta-analysis. *J Gerontol B Psychol Sci Soc Sci* 2007;62(2):P126-37.

399 Zwar L, König H-H, Hajek A. Consequences of different types of informal caregiving for mental, self-rated, and physical health: longitudinal findings from the German Ageing Survey. *Qual Life Res* 2018;27(10):2667–79. doi:10.1007/s11136-018-1926-0.

400 Lazarus RS, Folkman S. Stress, appraisal, and coping, 11th edn. New York: Springer 2015.

401 Knight BG, Sayegh P. Cultural values and caregiving: the updated sociocultural stress and coping model. *J Gerontol B Psychol Sci Soc Sci* 2010;65B(1):5–13.

402 Aranda MP, Knight BG. The influence of ethnicity and culture on the caregiver stress and coping process: a sociocultural review and analysis. *Gerontologist* 1997;37(3):342–54.

403 Pinquart M, Sörensen S. Ethnic differences in stressors, resources, and psychological outcomes of family caregiving: a meta-analysis. *Gerontologist* 2005;45(1):90–106.

404 Tennstedt S, Chang BH. The relative contribution of ethnicity versus socioeconomic status in explaining differences in disability and receipt of informal care. *J Gerontol B Psychol Sci Soc Sci* 1998;53(2):S61-70.

405 Willert B, Minnotte KL. Informal Caregiving and Strains: Exploring the Impacts of Gender, Race, and Income. *Applied Research Quality Life* 2021;16(3):943–64.

406 Bundesministerium für Inneres. Asylstatistik 2020 2021.

407 Kaltenbach E, Härdtner E, Hermenau K, et al. Efficient identification of mental health problems in refugees in Germany: the Refugee Health Screener. *Eur J Psychotraumatol* 2017;8(sup2):1389205. doi:10.1080/20008198.2017.1389205.

408 Bozorgmehr K, Razum O. Refugees in Germany—untenable restrictions to health care. *The Lancet* 2016;388(10058):2351–52.

409 Mawani FN. Social Determinants of Refugee Mental Health. In: Simich L, Andermann L, eds. Refuge and Resilience. Dordrecht: Springer Netherlands 2014:27–50.

410 Bauer JM, Brand T, Zeeb H. Pre-migration socioeconomic status and post-migration health satisfaction among Syrian refugees in Germany: A cross-sectional analysis. *PLoS Med* 2020;17(3):e1003093. doi:10.1371/journal.pmed.1003093.

411 Hondius AJ, van Willigen LH, Kleijn WC, et al. Health problems among Latin-American and middle-eastern refugees in The Netherlands: relations with violence exposure and ongoing sociopsychological strain. *J Trauma Stress* 2000;13(4):619–34.

412 Laban CJ, Gernaat HB, Komproe IH, et al. Impact of a long asylum procedure on the prevalence of psychiatric disorders in Iraqi asylum seekers in The Netherlands. *J Nerv Ment Dis* 2004;192(12):843–51.

413 Kravdal Ø, Grundy E, Lyngstad TH, et al. Family Life History and Late Mid-Life Mortality in Norway. *Population and Development Review* 2012;38(2):237–57.

414 Zunzunegui MV, Béland F, Otero A. Support from children, living arrangements, self-rated health and depressive symptoms of older people in Spain. *Int J Epidemiol* 2001;30(5):1090–99.

415 van Hook J, Glick JE. Immigration and living arrangements: moving beyond economic need versus acculturation. *Demography* 2007;44(2):225–49.

416 Tran TV, Khatutsky G, Aroian K, et al. Living Arrangements, Depression, and Health Status Among Elderly Russian-Speaking Immigrants. *J Gerontol Soc Work* 2000;33(2):63–77.

417 Haug S. Interethnische Kontakte, Freundschaften, Partnerschaften und Ehen von Migranten in Deutschland. Nürnberg 2010.

418 Babka von Gostomski C. Türkische, griechische, italienische und polnische Personen sowie Personen aus den Nachfolgestaaten des ehemaligen Jugoslawien in Deutschland: erste Ergebnisse der Repräsentativbefragung "Ausgewählte Migrantengruppen in Deutschland 2006/2007" (RAM). Nürnberg 2008.

419 Carol S. Social Integration and Intermarriage in Europe: Routledge 2016.

420 Rother N. Better integrated due to a German partner?: an analysis of differences in the integration of foreigners in intra- and inter-ethnic partnerships in Germany. *Revista OBETS* 2008(1):21.

421 Tegegne MA. Linguistic Integration and Immigrant Health: The Longitudinal Effects of Interethnic Social Capital. *Journal of health and social behavior* 2018;59(2):215–30. doi:10.1177/0022146518757198.

422 Kuhnt A-K, Krapf S. Partnership Living Arrangements of Immigrants and Natives in Germany. *Front Sociol* 2020;5:538977. doi:10.3389/fsoc.2020.538977.

423 Chou K-L. Psychological distress in migrants in Australia over 50 years old: a longitudinal investigation. *J Affect Disord* 2007;98(1-2):99–108. doi:10.1016/j.jad.2006.07.002.

424 Kretschmer D. Explaining differences in gender role attitudes among migrant and native adolescents in Germany: intergenerational transmission, religiosity, and integration. *Journal of Ethnic and Migration Studies* 2018;44(13):2197–218.

425 Bardi A, Buchanan KE, Goodwin R, et al. Value stability and change during self-chosen life transitions: self-selection versus socialization effects. *J Pers Soc Psychol* 2014;106(1):131–47. doi:10.1037/a0034818.

426 Arends-Tóth J, van de Vijver FJR. Cultural differences in family, marital, and gender-role values among immigrants and majority members in the Netherlands. *Int J Psychol* 2009;44(3):161–69.

427 Becher I, Menouar Ye. Geschlechterrollen bei Deutschen und Zuwanderern christlicher und muslimischer Religionszugehörigkeit, 2013rd edn. Nürnberg: Bundesamt für Migration und Flüchtlinge 2014.

428 Lancee B. Job search methods and immigrant earnings: A longitudinal analysis of the role of bridging social capital. *Ethnicities* 2015;16(3):349–67.

429 Schaeffer M. Inter-Ethnic Neighbourhood Acquaintances of Migrants and Natives in Germany: On the Brokering Roles of Inter-Ethnic Partners and Children. *Journal of Ethnic and Migration Studies* 2013;39(8):1219–40.

430 Bauer JM, Sousa-Poza A. Impacts of Informal Caregiving on Caregiver Employment, Health, and Family. *Population Ageing* 2015;8(3):113–45.

431 Wingenfeld K. Studien zur Nutzerperspektive in der Pflege. Bielefeld 2003.

432 Dell'Orto G, Wetzstein I, eds. Refugee news, refugee politics: Journalism, public opinion and policymaking in Europe. New York, NY: Routledge 2018.

433 Malmusi D. Immigrants' health and health inequality by type of integration policies in European countries. *Eur J Public Health* 2015;25(2):293–99.

434 Giannoni M, Franzini L, Masiero G. Migrant integration policies and health inequalities in Europe. *BMC Public Health* 2016;16:463. doi:10.1186/s12889-016-3095-9.

435 Akresh IR, Frank R. Health selection among new immigrants. *Am J Public Health* 2008;98(11):2058–64.

436 Ware JE. SF-36 Health Survey. In: Maruish ME, ed. The use of psychological testing for treatment planning and outcomes assessment. Mahwah, NJ: Lawrence Erlbaum Associates Publishers 1999:1227–46.

437 Ware JE, Kosinski M, Keller SD. A 12-Item Short-Form Health Survey: Construction of Scales and Preliminary Tests of Reliability and Validity. *Medical Care* 1996;34(3):220–33. https://www.jstor.org/stable/3766749.

438 Chandola T, Jenkinson C. Validating self-rated health in different ethnic groups. *Ethn Health* 2000;5(2):151–59.

439 Layes A, Asada Y, Kepart G. Whiners and deniers - what does self-rated health measure? *Soc Sci Med* 2012;75(1):1–9. doi:10.1016/j.socscimed.2011.10.030.

440 Wiessner C, Keil T, Krist L, et al. Personen mit Migrationshintergrund in der NAKO Gesundheitsstudie – soziodemografische Merkmale und Vergleiche mit der autochthonen deutschen Bevölkerung. *Bundesgesundheitsblatt Gesundheitsforschung Gesundheitsschutz* 2020;63(3):279–89.

441 Vogt T, Pope C, Mullooly J, et al. Mental health status as a predictor of morbidity and mortality: a 15-year follow-up of members of a health maintenance organization. *Am J Public Health* 1994;84(2):227–31.

442 Ohrnberger J, Fichera E, Sutton M. The relationship between physical and mental health: A mediation analysis. *Soc Sci Med* 2017;195:42–49. doi:10.1016/j.socscimed.2017.11.008.

443 Schnell R. Survey-Interviews: Methoden standardisierter Befragungen, 2nd edn. Wiesbaden, Heidelberg: Springer VS 2019.

444 Søgaard AJ, Selmer R, Bjertness E, et al. The Oslo Health Study: The impact of self-selection in a large, population-based survey. *Int J Equity Health* 2004;3(1):3. doi:10.1186/1475-9276-3-3.

445 Groves RM, Fowler FJ, Couper M, et al. Survey methodology. Hoboken, New Jersey: Wiley 2009.

446 Groves RM, Couper M. Nonresponse in household interview surveys. New York, Chichester, Weinheim: Wiley 1998.

447 Bloch A. Survey research with refugees. *Policy Studies* 2004;25(2):139–51.

448 Röder A. Methodische Herausforderungen quantitativer Befragungen von Geflüchteten am Beispiel einer Vorstudie in Sachsen. *Z'Flucht* 2018;2(2):313–29.

449 Jylhä M, Guralnik JM, Ferrucci L, et al. Is self-rated health comparable across cultures and genders? *J Gerontol B Psychol Sci Soc Sci* 1998;53(3):S144-52.

450 Detollenaere J, Baert S, Willems S. Association between cultural distance and migrant self-rated health. *Eur J Health Econ* 2018;19(2):257–66. doi:10.1007/s10198-017-0881-y.

451 Helman CG. Culture, health and illness, 5th edn. London, Boca Raton, FL: Hodder Arnold; CRC Press 2007.

452 Elkeles T, Seifert W. Immigrants and health: Unemployment and health-risks of labour migrants in the Federal Republic of Germany, 1984–1992. *Social Science & Medicine* 1996;43(7):1035–47.

453 Koopmans R, Veit S, Yemane R. Taste or statistics? A correspondence study of ethnic, racial and religious labour market discrimination in Germany. *Ethnic and Racial Studies* 2019;42(16):233–52.

454 Goldberg A, Mourinho D. The Occurence of Discrimination in Germany. In: Zegers de Beijl R, ed. Documenting discrimination against migrant workers in the labour market: A comparative study of four European countries. Geneva: International Labour Office 2000:53–64.

455 Kaas L, Manger C. Ethnic Discrimination in Germany's Labour Market: A Field Experiment. *German Economic Review* 2012;13(1):1–20.

456 Ünlü Ince B, Cuijpers P, van 't Hof E, et al. Internet-based, culturally sensitive, problem-solving therapy for Turkish migrants with depression: randomized controlled trial. *J Med Internet Res* 2013;15(10):e227. doi:10.2196/jmir.2853.

457 Schneider NF, Bujard M, Wolf C, et al. Family Research and Demographic Analysis (FReDA): Evolution, Framework, Objectives, and Design of "The German Family-Demographic Panel Study". *CPoS* 2021;46.

458 German National Cohort Consortium. The German National Cohort: aims, study design and organization. *European Journal of Epidemiology* 2014;29(5):371–82. doi:10.1007/s10654-014-9890-7.

459 Baykara-Krumme H, Platt L. Life satisfaction of migrants, stayers and returnees: reaping the fruits of migration in old age? *Ageing and Society* 2018;38(4):721–45.

460 Bartram D. Happiness and 'economic migration': A comparison of Eastern European migrants and stayers. *Migration Studies* 2013;1(2):156–75.

461 Billson JM. Keepers of the culture: The power of tradition in women's lives. New York: Lexington Books 1995.

462 Stronach M, Maxwell H, Taylor T. 'Sistas' and Aunties: sport, physical activity, and Indigenous Australian women. *Annals of Leisure Research* 2016;19(1):7–26.

463 Oksuzyan A, Brønnum-Hansen H, Jeune B. Gender gap in health expectancy. *Eur J Ageing* 2010;7(4):213–18. doi:10.1007/s10433-010-0170-4.

11. Original Publications

11.1 Study I

The Contextual and Household Contribution to Individual Health Status in Germany: What Is the Role of Gender and Migration Background?

Daniela Georges, Daniel Kreft and Gabriele Doblhammer

Introduction

As early as 1997 George Engel postulated the need to consider the multidimensionality of health in the contextual perspective on health, illness, and health care (Engel 1977), yet the meso-structural level of health is often neglected in research. The meso-level is located between state and individual actors and it describes influences of the direct environment, such as families and households. Theoretical approaches and empirical findings highlight that these characteristics are also important determinants of individual health.

It is well known that different types of households result in different morbidity and mortality risks (for a detailed overview, see Hank and Steinbach in this volume). Although, across the studies various indicators are used to reflect the household structure (usually marital status is taken into account, together with the life form, e.g. family structure, parenthood, presence and number of children, partnership status, cohabitation), this finding applies largely independent (Schneider et al. 2014). Our approach is to map this multidimensionality of living arrangements by examining several indicators together.

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Today private households and families are experiencing a differentiation and pluralisation, wherein the non-family sector (childless couples, living alone, living apart together) is growing and the family sector (couples with children, single parents) is shrinking (Meyer 2006). Meanwhile, in Germany less than half the population lives in a family, that is, with children. The proportion of households with at least three members has been declining for many years (1991: 35.6%, 2014: 24.8%), while 1-person and 2-person households are increasing. As a result, the average household size shrank from 2.27 in 1991 to 2.01 in 2014 (Statistisches Bundesamt 2015a). Life forms such as cohabitation, single parents, living alone, or childless couples do not completely repress the traditional family (married couples with children), but they are becoming increasingly common. We will analyze whether this development is accompanied by increasing health inequalities.

Gender is still a central determinant of health and health inequalities (Oksuzyan et al. 2014; Verbrugge 1989; see Oksuzyan et al. in this volume). Men and women show—at least partly—different mechanisms of health and illness, and they are vulnerable to different diseases (Denton et al. 2004). These differences are also apparent in the context of households and may even be exacerbated by household effects. Within households, social roles and gender norms are produced and reproduced, and usually the set of roles is different for men and women. To what extent this attribution of roles really has an effect on health and well-being, though, depends on the specific composition of the household, the type, strength and direction of relations, and other factors (McIlvane et al. 2007; Lowenstein et al. 2007), and is subject of our investigation.

Against the background of increasing global migration flows (Willekens 2015), the importance of the migration background as a determinant of (health) inequalities is increasing. Today, more than 200 million persons are living outside their country of birth, i.e. they migrated to another country (Willekens 2015). This raises a new cultural diversity within populations, which affects the health situation and demographic characteristics in the countries involved (both in the country of origin as well as in the host country) (Kohls 2012).

Germany has been an immigration country since World War II and is characterized by a large number of people with a migration background: About 20% (16.4 million) of the population in Germany has a migration background (Statistisches Bundesamt 2015a).[1] The largest groups among them are the Turks, who were recruited in the 1960s and 1970s as guest workers, and their descendants, and the Aussiedler,[2] who immigrated after the collapse of the Soviet Union (Statistisches Bundesamt 2015a). These two groups not only differ (more or less; see Section "Why Investigate the Health of Migrants and Distinguish Between

[1]"Migration background" includes all people who immigrated to Germany themselves or are descendants of persons who immigrated to Germany (Statistisches Bundesamt 2015b).

[2]This terms refers to foreign-born persons who hold German citizenship which was not acquired by an act of naturalization, who moved to Germany after 1949 [definition based on Statistisches Bundesamt (2011)].

Different Migration Backgrounds?") from the German host society, but also among themselves. In a health context it can be shown that Turks have increased risks of infectious diseases (Neuhauser and Razum 2008) and lower mental health (Milewski and Doblhammer 2015). By implication, Turkish migrants have disadvantages in healthy life expectancy relative to the German population; especially Turkish women show great disadvantages in life expectancy and healthy life expectancy compared to German women (Carnein et al. 2015). Aussiedler have higher rates of non-natural deaths but lower overall mortality than native Germans (Becher et al. 2007). While it is less common for Aussiedler to have severe diseases, they do suffer more frequently from mental disorders (Becher et al. 2007; Knipper and Bilgin 2009). At the household level, we find that the size and structure of a household depends on the migration background, where households of migrants are more frequently familial, larger, and have more children (Friedrich 2008; Worbs et al. 2013; Wittig et al. 2004; Woellert and Klingholz 2014). Both the household structure and health are therefore subject to a cultural imprint. Against the backdrop that once young migrants also age and are currently reaching ages associated with increasing health risks, the necessity to scrutinize integration and health inequalities in the context of migration background arises.

The direction and intensity of these connections have yet not been examined for Germany. We try to close this gap by analyzing the effects of household structure, namely the generational structure, on individual health. Due to the expected differences between men and women and between different migration backgrounds mentioned, we contextualize this by gender and migration background. Our main research questions are therefore: What is the influence of the household on health? What are the differences between men and women and which of these depend on the migration background? In addition, we conduct a mediator and moderator analysis to answer these questions: What is the impact of economic resources on the household effects? What influence do different characteristics of the household structure have on health in the context of migration background? The results can contribute to a better understanding of meso-level influences on health. They allow us to estimate the impact of changes in the family sector and contribute to a better understanding of health inequalities among migrants. Additionally, they can help identify vulnerable groups and exploit intervention as well as prevention measures in the German case.

Theoretical Perspectives and Findings

Health as an Outcome of Household Production

As George Engel's biopsychosocial model illustrates, illness and health cannot be understood as only individual characteristics, but rather they must be explored in a multilevel context (Engel 1977). This is why it is not effective to consider only

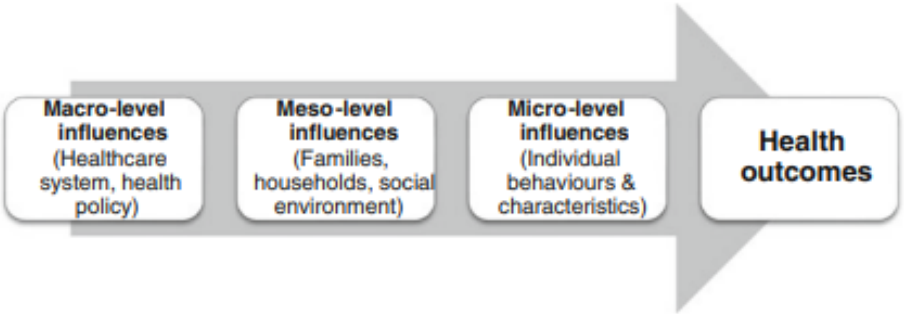

Fig. 1 Multidimensionality of health factors and health outcomes

effects on the individual level; a consideration of other contexts is also required when investigating determinants of health. In addition to individual characteristics, it is necessary to include families and other social organisations as well as healthcare facilities and health policy in order to gain a holistic understanding of health and disease (Holmes et al. 2008). Health outcomes are the result of factors at different levels, as we illustrate in Fig. 1.

Because they yield daily influences, households represent a crucial determinant of health. They set resources and demands and represent a special form of social networks, which are characterised by emotional ties, a specific role allocation, and permanent exchange relations. As a result, household members have similar resources and needs, and thus they show similar health outcomes (Hughes and Waite 2002; Berman et al. 1994). Currently, investigating the household as a determinant of health disparities appears to be particularly exciting, because households, household types, and household structures are becoming increasingly diverse. With increasing life expectancy, intergenerational relationships can last much longer, resulting in new (generational and familial) relationship potentials, e.g. long-term relations between grandparents and their grandchildren and multigenerational households[3] (Arránz Becker and Steinbach 2012). These supposedly positive developments might even so be problematic: particularly the middle ages are in a "sandwich position" between their children and their parents, and are therefore faced with both a double burden as well as competing social role attributions (McIlvane et al. 2007).

In addition to this (partially) unequal distribution of roles, households fulfil the function as an instance of socialisation. They impart values, norms, duties and behaviour patterns, which are also reflected in health aspects. Within households and families, all members are producers of their own and the other members' health (Jacobson 2000), and as a result of exchange relationships, health knowledge is shared, health behaviours are adopted, and a similar perception of health is configured (Jacobson 2000; Settertobulte and Palentien 1996).

[3]Despite the new potential, multigenerational households are rather atypical and tend to be less important; e.g. in Germany the proportion of all households with three or more generations declined from 1.2% in 1991 to 0.4% in 2012 (Hammes 2013).

One of the first conceptual frameworks, developed for the connection between households and health outcomes, is the Household Production of Health (HHPH) approach. The HHPH implies that households are the locus of health production, as they strive to maintain or restore their members' health. In a dynamic process, within households, internal resources (e.g. knowledge about health, health-related behaviours) are linked to external resources (e.g. information, resources, health services), so there is an allocation and adaption of health care strategies. This combination makes households more efficient than individuals and allows short-term responses and interventions, which have a quicker impact than contextual effects. Because health behaviour within a household is thus influenced by both the household itself and external factors, it can be assumed that different households and different types of households react differently given identical conditions, and that they would thus show different health outcomes (Berman et al. 1994). Economic theories, such as the approach of the New Household economics (NHE), expand the HHPH approach through economic aspects. This approach posits that the objectives of households are utility maximization and satisfaction, whereby health outcomes represent one possible source of satisfaction, which competes with other outcomes. Households are assumed to know how to produce health and strive to achieve a maximum of outcomes using available resources. The consideration, which and how many resources are used for which outcome, is a dynamic process. On the one hand, different combinations can result in the same outcomes, and on the other hand, similarly available resources do not necessarily result in equal outcomes (Berman et al. 1994). According to the NHE, health is subject to a large variance and depends heavily on intra-household choices. Statistical multilevel models are suitable and necessary to regard this variance when one investigates the effects of household and individual characteristics (DiPrete and Forristal 1994).

Findings consequently indicate that different types of households and living arrangements are linked to differences in health. In research, the aspect of the household is usually displayed by family demographic parameters, such as marital status (Hughes and Waite 2009). Being married is positively associated with good health outcomes (Joung et al. 1994; Schneider et al. 2014; Williams and Umberson 2004). This protective effect of marriage is largely explained by a better economic position and higher social support, but may as well—at least partially—be driven by differences in living arrangements. It has to be assumed that the living arrangements have an additional, but separate effect on health outcomes (Joung et al. 1994). While living alone is associated with health risks (Manderbacka et al. 2014; Cramer 1993), both partnership and parenthood are protective factors for health (Helbig et al. 2006; Koskinen et al. 2007; Zunzunegui et al. 2001; Kravdal et al. 2012).

According to Ferrer et al. (2005), the magnitude of household influences on health differences itself is dependent on the household composition. For married people without children, this effect of household and family is very pronounced; in this group, 22% of health differences are explained by the family-level effect (Ferrer et al. 2005). Soons and Kalmijn (2009) examined health differences between marriage and cohabitation and found that this effect is explained by the level of

institutionalization of cohabitation: In countries where the proportion of cohabitants is higher, the difference is smaller than in countries with a low proportion (Soons and Kalmijn 2009). With regard to the household composition, in Finland it was found that for those living alone, lone parents and cohabitants have a higher amenable mortality, which is attributed to economic disadvantages (Manderbacka et al. 2014). McIlvane et al. (2007) performed an analysis of the impact of the generational composition on self-rated health and found that single parents show low self-rated health. In contrast, living with parents has positive effects and may compensate for other, otherwise unfavourable characteristics, such as a low level of education or being unmarried (McIlvane et al. 2007). A longitudinal analysis of the relationship between living arrangement and different health outcomes was carried out by Hughes and Waite (2002). They state health variances across different living arrangements, where members of married couples living alone or with children show the best health and single mothers have the greatest health disadvantages (Hughes and Waite 2002).

To summarize, the household has a double significance in the production of health. On the one hand, different arrangements are associated with different health risks and health outcomes. On the other hand, further outcomes (e.g. gender roles, distribution of responsibilities, perception of health) are determined within households, which are associated with health differences. However, households are not independent, but are embedded in social conditions, so it should be considered that both the welfare state configuration and cultural norms influence this nexus.

Migration Background and Health in a Household Context

Migrants are people who change their main place of residence for a longer time or permanently to another country in the course of a migration process. They have in common that they have gone through this migration process, which is a phase of disruption and reorientation associated with stress and integration challenges (Neuhauser and Razum 2008). This process characterizes both their own situation and the family development over several generations (Neuhauser and Razum 2008). Due to often precarious employment and income situations as well as lower levels of non-transferable economic and educational assets, migrants more frequently belong to socially disadvantaged classes in the host country. This social deprivation is associated with additional health risks and often also has negative effects on the educational success of children with migration background (Schenk 2007). In addition to socio-economic disadvantages and downward social mobility (Constant and Massey 2005; Schenk 2007), problems such as language barriers, processes of integration, and cultural adaptation can affect migrants negatively, e.g. in terms of health (Neuhauser and Razum 2008). Language barriers, differences in health perception, and a lack of knowledge about the health care system in the host society often results in a limited access of migrants to the formal health care system and a

lower utilization of health services[4] (Dias et al. 2008; Helman 2007). The stressful experiences associated with immigration and integration as well as social stigmatization and marginalization enhance this effect (Derose, Escarce and Lurie 2007; Neuhauser and Razum 2008). The health of migrants is thus determined by three aspects: the conditions in the country of origin, the conditions of the migration process, and the conditions in the host country (Spallek and Razum 2007).

However, migrants represent a heterogeneous group and differ in their origin, their cultural backgrounds, their motives to migrate, their duration of stay in the host country, their legal status, their degree of integration, their demographic behaviour, and many other characteristics (Lindert et al. 2008; Norredam 2011; Neuhauser and Razum 2008). They differ both among themselves as well as from the society of origin and the host society. Their decision to migrate is subject to a selection process, and in most cases driven by a positive selection mechanism: compared to non-migrants of the country of origin, migrants are mostly young, educated, and relatively healthy[5] (Ghatak et al. 1996; Razum and Rohrmann 2002). Due to this combination of characteristics, migrants also differ positively from the host society, particularly in their work performance (Ghatak et al. 1996).

Migrants with their own migration experiences (i.e. first generation migrants) underwent their socialisation in their country of origin, which often differs from the host society, and therefore have incorporated different cultural ideas, behaviours, norms, and values. Because migrants often maintain ties with their countries of origin (Haas 2010), these patterns usually persist for a longer time after immigration. Gender norms, family ideals, health related behaviours, and health perception therefore are supposedly strongly influenced by the culture of origin and social policies in the home country. Consequently, it can be assumed, that migrants differ in their health outcomes and in household patterns from the host society, whereby the extent of these differences depends on the magnitude of cultural differences as well as the individual degree of integration.

Although social networks (in the potential host society and the society of origin) are an important aspect in the decision to migrate, migrants often experience a temporary loss of social ties and social capital (Haug 2007). The social capital affects the social embedding and the integration. As a source of control (Coleman 1990), social capital enables access to the labour market and thus affects economic and social outcomes. Using the example of Turks in Germany, Lancee and Hartung (2012) demonstrate that, among migrants, being embedded in inter-ethnic contacts results in advantages in the labour market (Lancee and Hartung 2012). The high importance of social networks among migrants can be inferred from the so-called "Latino Health Paradox". Despite a worse socio-economic profile, Latinos in the US have better health outcomes and lower mortality rates than do Whites, which is

[4]Studies have found that the differences in health risks and health care utilization between immigrants and non-immigrants are equalized with increasing duration of stay (Leclere et al. 1994; Kreft and Doblhammer 2012).

[5]This selection is called the "Healthy-Migrant-Effect" (Kohls 2008).

due to social factors, such as social networks and emotional ties (Viruell-Fuentes and Schulz 2009; Abraído-Lanza et al. 1999). Although this effect of social ties probably has a cultural component and depends on the legal status of migrants in the host country, we suspect transferability to other contexts, for example to the German case. Other studies also show that the family situation and the household structure might have a substituting function for external social ties: If the external social capital is low, the household and family act as a central compensating resource (Haug 2007). Burt's "Closure-Argument" highlights the importance of social networks in the creation of social capital (Burt 2001), whereby a dense family network also increases social capital (Haug 2007).

Thus, there are strong ties between the household context and the migration status. Both are strongly embedded in the cultural context and contribute to the formation of social norms (e.g. gender roles, family ideals, health perception). We therefore follow the assumption that the impact of the household on health is different between migrants and non-migrants.

Gender Differences in Health and Household Context

"The embeddedness of gender in all social relationships may make it impossible to separate gender from the very life circumstances that we examine in order to understand gender patterns in health. (Walters et al. 2002)"

Gender inequalities in health are reported frequently. Men and women not only differ in general in their morbidity and mortality, but also have different determinants for health and illness. For a detailed overview, see Oksuzyan et al. in this volume. This diversity is also reflected in the household context.

In the household context additional gender differences become apparent. The previously presented studies consistently illustrate—as far as they performed gender-specific analyses—a difference of determinants and effect sizes between men and women (Manderbackaet al. 2014; Williams and Umberson 2004; Soons and Kalmijn 2009; Hughes and Waite 2002). The underlying mechanism is that men's health shows a higher dependency on behavioural determinants, while for women social structural and psychosocial determinants are more important. It has to be assumed that household factors have a stronger impact on women's health than on men's health. Gender-based health inequalities thus reflect (among other things) social factors and an unequal distribution of family demands (Denton et al. 2004; Artazcoz 2001), which goes together with the social roles and role allocation within households already described (see Section "Health as an Outcome of Household Production"). Gender or gender-specific role assignments are crucial determinants of health, as they have an influence on how people behave and how they access health services (UN 2010; World Health Organization 2010).

Household and care work are still rather female domains (Oláh et al. 2014). Together with the increasing involvement of women in the labour market, additional burdens arise for women (Geulen 2004). The understanding of gender roles

and division of tasks is strongly influenced by social-political standards and cultural norms. Especially in conservative welfare states, the value of the family is quite high and there is a traditional division of tasks, due to which men and women are attributed different roles. Conservative welfare states have low levels of egalitarian participation on the labour market and shared household tasks (Hook 2006; Huschek et al. 2011; Batalova and Cohen 2002). This ideal of the traditional family image is maintained by social policies and thus can promote gender differences in the context of households and health (Esping-Andersen 1990).

Why Investigate the Health of Migrants and Distinguish Between Different Migration Backgrounds?

The need for migration background-specific analyses of health in Germany arises from the special composition of the German population. In 2014, one of every five people in Germany (16.4 million) had a migration background, i.e. they immigrated themselves or are descendants of migrants (Statistisches Bundesamt 2015a). Thus, the number of migrants in Germany is currently at a record high and a growing ethnic and cultural diversity is emerging. Against this backdrop, and due to the close ties between health and migration background, migrants must be considered as a group that is exposed to additional health risks. We carry out an internal differentiation of the migrant population in Germany and consider the two largest groups of migrants—Turkish migrants and Aussiedler—separately, because they differ in many characteristics and health outcomes. In the following analysis, we measure the migration background according to the definition of the German Federal Statistical Office (Statistisches Bundesamt) and consider both the (current and former) nationality and/or country of birth as well as the parents' ancestry. People with a migration background thus are all those who migrated to Germany themselves (first generation migrants), who were born as a foreigner in Germany, or who have at least one parent who immigrated or was born as a foreigner in Germany (second generation migrants) (Statistisches Bundesamt 2011).

Turkish migrants and Aussiedler are the two largest groups of people with a migration background in Germany. In 2014, approximately 3 million Turks lived in Germany, of which about 1.4 million were first generation migrants (Statistisches Bundesamt 2015b). The high number of Turks in Germany is explained by the recruitment of guest workers between the 1950s and the 1970s and subsequent family reunification. Aussiedler are the second large migrant group in Germany, comprising approximately 3 million people. Aussiedler, sometimes called "In-Migrating Ethnic Germans", are descendants of emigrants who moved from Germany to Eastern Europe before the 20th century or persons of German origin who stayed in the former German regions after the 2nd World War (Kreft and Doblhammer 2012). Aussiedler differ from other migrant groups especially in their cultural background and motives to migrate. In their home countries, Aussiedler

were a minority and they emigrated to live as Germans among Germans. For Aussiedler, Germany is their cultural home (Janikowski 1999). Due to this German origin, Aussiedler are in the unique situation that they are legally recognized as "Germans by status" and can directly acquire citizenship, which entitles them to participate in the health and welfare system. Aussiedler immigrated from different countries, the majority come from the former Soviet Union (1.4 million), Poland (570,000), Kazakhstan (568,000), and the Russian Federation (555,000) (Statistisches Bundesamt 2015b).

Studies demonstrate significant differences between the host population, Turks, Aussiedler, and other migrant groups in Germany. Regarding health, non-Germans generally are exposed to other and higher health risks; while chronic diseases and cancers are less common among migrants compared to Germans without migration background, they have higher risks of suffering from musculoskeletal disorders, cardiovascular diseases, diabetes, respiratory diseases, and infectious diseases (Neuhauser and Razum 2008). These differences are at least partly explained by poor working and living conditions of non-Germans, and also reflect the relatively high medical standard in Germany[6] (Neuhauser and Razum 2008). More detailed analyses reveal that Turks in Germany have increased morbidity, and especially higher risks for cardiovascular diseases, diabetes, and viral hepatitis (Knipper and Bilgin 2009). This is particularly attributed to an inactive lifestyle and other eating habits (Knipper and Bilgin 2009). Among Turks, eating has a high priority (Rehaag et al. 2012); a bountiful table is a sign of hospitality and although traditional Turkish cuisine is based primarily on vegetables, they are often prepared with copious amounts of oil (Zwick 2007). Aussiedler, on the other hand, exhibit increased risk factors for cardiovascular diseases (e.g. alcohol consumption, obesity, drugs), but seldom have severe diseases. Despite the pooling of risk factors, Aussiedler have surprisingly low rates of mortality (Becher et al. 2007; Wittig et al. 2004; Knipper and Bilgin 2009). Generally, these differences (between the groups of migrants and non-migrants) are more pronounced in women than in men (Worbs et al. 2013). The causes are mainly due to socioeconomic differences, but also cultural differences contribute to this (Neuhauser and Razum 2008).

Turkish migrants in Germany have a low social status on average, e.g. low levels of education and a poor economic situation (Statistisches Bundesamt 2015a; Woellert and Klingholz 2014), and thus bundle characteristics that are associated with health disadvantages (Mielck 2008). On the contrary, the Aussiedler have an advantageous structure in their educational and professional qualification, are usually employed, and thus have a high similarity to the German middle class (Worbs et al. 2013). The proportion of people with a higher education entrance qualification is 43% among Germans,[7] 31% among Aussiedler, and 20% among

[6]E.g., infectious diseases have become very rare in Germany due to medical processes and are now rather diseases of less developed countries (Omran 2005).

[7]In the following descriptions, "Germans" means the German population without a migration background in first or second generation.

Turks; the unemployment rate is 6% among Germans, 9% among Aussiedler, and 16% among Turks (Woellert and Klingholz 2014). The deviating proportions of the Turks are particularly due to the low integration of Turkish women in the education system and the labour market (Woellert and Klingholz 2014; Neuhauser and Razum 2008). Consequently, the housewife ratio, which reflects the proportion of women who stay at home, is markedly higher—49% of Turkish women stay at home but only 17% of Germans and 20% of Aussiedler (Woellert and Klingholz 2014). This demonstrates a still persisting classic distribution of tasks and traditional gender roles among Turks.

The majority of Turks in Germany are very religious, whereas the religious faith is rather understood as a norm than as an individual decision (Wetzels and Brettfeld 2007). Turks are usually Muslims (Haug et al. 2009), and in Islam roles tend to be non-interchangeable and the traditional family ideal is of great importance (Predelli 2004). Aussiedler are usually Christian (83%), and thus have the same confession as the majority of the German population without migration background (Worbs et al. 2013).

Marriage and family life forms have a higher importance among Turks (Sachverständigenkommission 6. Familienbericht 2000), and Turkish migrants show different patterns in their family-formation processes, e.g. marry at an earlier age and have more children (Milewski 2011). Aussiedler, as well, are more likely to be married and to share a household with children than Germans (Worbs et al. 2013). Again, this might be an indicator of the gender roles and family norms of their countries of origin, which are more conservative and traditional than in Germany, especially among Turkish migrants (Huschek et al. 2011; Diehl et al. 2009; de Valk 2008). As a result, the average household size and structure differs between Germans, Turks, and Aussiedler. While Germans live in rather small households (Ø 2.0 persons per household), the household size is larger among Aussiedler (2.3) and especially among Turks (3.1) (Woellert and Klingholz 2014). Familial forms of life, households with many children, and multi-generational households are more common among Turks and Aussiedler (Woellert and Klingholz 2014).

To summarize, there are several differences in many aspects of life between Turks, Aussiedler, and Germans. While Turks differ strongly from Germans—mainly due to their traditional norms—Aussiedler are quite similar to the German population. Aussiedler show—in comparison with Turks—a high degree of integration, which can be attributed to their legal status and their cultural similarity (Woellert and Klingholz 2014). We assume that the decision for or against a specific arrangement is culturally influenced and driven by deviating motivations and thus results in different health-outcomes.

Summary and Hypotheses

The descriptions above illustrate the importance of the household as a determinant of health, whereas the underlying mechanisms are not clear, but embedded in a strong network of individual values, cultural background, and socio-political

frameworks. What becomes clear is that the impact of household structures differs across the contexts, for example with regard to gender and migration background. We aim to discover and explain these various mechanisms.

Our analysis is designed to test four hypotheses deduced from the conceptual framework discussed above. First, we test the *family segregation-hypothesis*. There are different patterns in the household formation and different types of households are associated with disparate tasks and resources and finally result in different health risks. Because living in a one generation household, i.e. living alone or living without children, is accompanied by lower levels of family ties, we assume that people in one generation households show health disadvantages. These disadvantages are based particularly on the lack of social support when living alone, the lack of integration into a dense family network, and the positive selection mechanisms into parenthood. We expect, however, a variance according to migration background, resulting from different cultural backgrounds. Because traditional family households are more common among migrants and one generation households tend to contradict the cultural norm, we suspect that living without children is the result of disadvantageous selection among migrants and thus acts more detrimentally among migrants than among non-migrant Germans. Our second hypothesis—*the gender hypothesis*—states that the effect of the household structure is strongly gendered. Due to an allocation of multiple social roles and a high embedding in the household, women's health is stronger and affected by the household composition in a different way than men's health. Due to more traditional gender roles in migrant households we expect this effect to be amplified among migrants. Based on the *mediator hypothesis*, we test whether and how additional characteristics, especially the economic situation, explain health differences by household composition, gender, and migration background. Finally, the *partner hypothesis* hypothesises a positive effect of a partner in the household on health, which is driven by positive health selection into partnership. Due to a higher importance of the traditional family ideal among migrants, we assume that the absence of a partner is more disadvantageous for migrants than for Germans without a migration background. In addition, health related selection forces into partnership may also differ by migration background.

Data and Methods

Data and Variables

Dataset and Analytical Basis: The German Microcensuses 2005 and 2009

We used data from the German Microcensuses 2005 and 2009 (hereafter referred to as Microcensus 2005/2009) which is an annual multi-purpose household survey with a representative sample of one percent of the German population (about 830,000 persons per year). Due to the obligation to provide information to the

majority of questions and the presence of information for each member of the household, the Microcensus is highly representative of the German population. The data provide detailed information on the German demographic and labour market structure, including socio-demographic, economic, and household aspects (Statistisches Bundesamt 2015c).

Because the Microcensus is designed as a rotating panel, in which each selected household is annually interviewed over a period of four years, we used two survey years with a distance of four years to ensure that each person is included in the dataset only once. We used the survey years 2005 and 2009 because these combine information about individuals' health status, household context, and migratory background. Pooling the data of the two years increases the number of individuals with a migration background.

Variables

Health Outcomes

The Microcensuses 2005 and 2009 include a health module in addition to the standard programme with a limited set of indicators. In the following analysis, the general health status is measured by the following question: "Have you been ill or had an accidental injury within the last four weeks (before the interview)?" and "How long does/did your illness or your injury last?". In this study all persons with an illness that lasts (lasted) at least four weeks are defined as unhealthy. The time frame of four weeks was chosen in order to exclude persons with short-term illnesses (e.g., the flu or other infections). Because answering the question is optional, the number of cases with missing information is higher than for most of the other variables. Due to missing information in the health variable 69,144 cases [57,053 native Germans (12.64% of the total sample) and 12,091 persons with migration background (2.68%)] have to be excluded from the analysis. In total, 382,113 persons [323,577 native Germans (84.68% of the final sample) and 58,536 migrants (15.32%)] remain in the sample under study.

Variables at the Individual Level

When analysing contextual effects on individual health outcomes, the effects of personal characteristics are controlled for. These individual level variables are sex, age (4 age groups: 30 to <40, 40 to <50, 50 to <60 and 60 to <65 years), family status (single, married, divorced, widowed), presence of a partner in the household, education (low degree = graduation after a maximum of nine classes, medium = ten-class general educational school, high = university entrance qualification), and occupational status [self-employed without employees; self-employed with employees; unpaid family worker; official or judge; employed or soldier; full- and

part-time worker (skilled, semi-skilled, and unskilled); non-active population]. One of the key characteristics is the migration background, which includes migration history and ethnic background for first and second generation and thus follows the definition of the Federal Statistical Office (Statistisches Bundesamt 2011). Based on this information, we distinguish between native born Germans, Turks, Aussiedler, and people with a migration background from other countries ("other"). As "native born Germans", we mean all who have no migration background in the first or second generation, i.e. persons who have neither migrated themselves nor have parents who are immigrants in Germany. Turks are identified by current and former nationality: all who have themselves or whose parent(s) had or have Turkish nationality belong to this group. Aussiedler are measured by legal status and represent the group of those whose parent(s) or who themselves is/are registered as Aussiedler. The identification of Aussiedler in the data of the Microcensus is possible on the basis of officially generated information. "Other" includes all persons who have a migration background but are not Turkish or Aussiedler.[8]

Because behavioural factors are strongly linked to health (see e.g. Sturm 2002; World Health Organization 2002), BMI [classified into underweight (BMI < 18.5), normal weight ($18.5 \leq$ BMI ≥ 25), overweight ($25 <$ BMI ≥ 30), obese (BMI > 30), missing information], and smoking habits (never smoked, ex-smoker, smoker, missing) will be controlled for. Additionally, the year of the interview (2005 or 2009) will be included in the models to control for period effects.

Household and Contextual Variables

At the second level, we focus on the household structure and take the number and composition of generations into account: One generation households (1G-HH) comprise persons living alone or as a couple (without children or with children who do not/no longer live in the same household). Two generation households combine a parent and a child generation; we make distinctions for two generations (2G-HH) with one or two children, 2G-HH with three or more children, 2G-HH with (grand)parents. We also created a category for households with three or more generations (3+G-HH). Additionally, we control for the net equivalent income [less than 930 € per month (lowest 20% in the sample); 930 to less than 1400 € (20–50%); 1400 to less than 2110 € (50–80%); more than 2110 € (top 20%)], and analyze the migration background of the household. In contrast to the individual migration background, the migration background of the household provides information about the presence of persons without a migration background. We define three types of households: no migration background (i.e. all persons are non-migrants), mixed households (i.e. households with migrants and non-migrant Germans), and migrant households (all persons with migration background).

[8] A detailed differentiation is not possible and useful due to statistical and definitional problems.

Table 1 Variance inflation factors of the sample, men and women

	Sample	Men	Women
Generation composition	1.18	1.19	1.19
Year of interview	1.01	1.02	1.01
Sex	1.06		
Age group	1.24	1.21	1.32
Family status	1.09	1.07	1.14
Presence of a partner in the same HH	1.13	1.16	1.19
Migration background	2.61	2.60	2.63
Education	1.16	1.15	1.19
Occupational status	1.20	1.22	1.18
BMI	1.03	1.03	1.03
Smoking habits	1.07	1.06	1.05
Equivalent income group	1.24	1.26	1.25
Migration background of the household	2.73	2.72	2.75
Place of residence	1.06	1.06	1.06
Mean VIF	1.34	1.34	1.36
n	382,113	188,108	194,005

Source German Microcensus 2005/2009

Finally, we control for the size of the place of residence (rural with fewer than 20,000 inhabitants; urban with 20,000 inhabitants or more) as an indicator of the contextual embedding and access to health care (Hartley et al. 1994; Bennett et al. 2008).

Pre-regression Diagnostics

The bivariate analysis shows significant statistical correlations between all characteristics and longstanding illness. Covariates are generally not correlated, with the exception of the individual migration background and the household's migration background (Table 1).

Statistical Methods

We modelled the association between health and the observed characteristics by applying multilevel regression models for both sexes combined to account for the dependency of observations on the household-level. Logistic regression models were used to calculate sex specific models. The estimations were performed using the "xtlogit" and "logit" routine in Stata version 14.1.

Sample Under Study

The analyses were restricted to 451,257 individuals between the ages of 30 and 64 living in private households. This specific age groups was chosen because people in this range display a diversity in living arrangements and are typically of an age in which (own) children already or still live at home. Of these, 69,144 individuals were excluded due to missing information about their health status. The two-level regression analysis for both sexes combined were therefore conducted based on 382,113 people at level 1 (individual level), nested within 247,360 households at level 2 (household level). Of these, 323,577 were native born Germans (84.68%), 10,043 were Turkish (2.63%), 13,147 were Aussiedler (3.44%), and 35,346 had a different migration background (9.25%).

The sex specific models included 194,005 women and 188,108 men. The proportion of the migrant groups is similar for both sexes.

Results

Descriptive Statistics

A detailed overview of the sample's composition is given in Table 2.

Longstanding illness is a rather rare phenomenon in our study population. Only 5.47% of the sample have a longstanding illness, where the proportion among women (5.60%) is slightly higher than men (5.34%). People who live in a one generation household (1G-HH) or in a two generation household (2G-HH) with their (grand)parents have worse health than those in other household structures; the proportion of ill persons is 7.30% for both groups. The quota is 3.79% in 2G-HH with one or two children, 3.23% in 2G-HH with three or more children, and 5.28% in households with 3 or more generations (3+G-HH). Turkish people have worst health of all migration backgrounds (8.01% vs. 5.40–5.49%).

In terms of household structure there are differences by migration background and sex. While the majority of native Germans live in 1G-HH (50.08%) followed by 42.68% in 2G-HH with one or two children, 2G-HH with one or two children are the most common composition among the other migrant groups. It is also striking that Turks live in different household structures than Germans, i.e. with three or more children (24.76%) or in 3+G-HH (2.41%). Furthermore, the absence of a partner in the same household is more common among native Germans (26.16%) and least common among Turks (16.17%); the share of persons without a partner among Aussiedler is located between these two groups (20.44%).

We find gender differences to the extent that men live in an 1G-HH (49.22% vs. 46.80%) slightly more frequently than women and slightly less frequently with

Table 2 Characteristics of the sample, men and women

	Sample		Men		Women	
	n	%	n	%	n	%
Longstanding illness						
No	361,199	94.53	178,057	94.66	183,142	94.40
Yes	20,914	5.47	10,051	5.34	10,863	5.60
Generation composition						
1G-HH	183,382	47.99	92,594	49.22	90,788	46.80
2G-HH with one or two children	166,224	43.50	79,792	42.42	86,432	44.55
2G-HH with three or more children	24,914	6.52	12,057	6.41	12,857	6.63
2G-HH with (grand)parents	3524	0.92	1819	0.97	1705	0.88
3+G-HH	4069	1.06	1846	0.98	2223	1.15
Year of interview						
2005	195,681	51.21	96,671	51.39	99,010	51.03
2009	186,432	48.79	91,437	48.61	94,995	48.97
Sex						
Females	194,005	50.77				
Males	188,108	49.23				
Age group						
30 to <40 years	97,679	25.56	48,164	25.60	49,515	25.52
40 to <50 years	127,163	33.28	63,311	33.66	63,852	32.91
50 to <60 years	108,437	28.38	52,925	28.14	55,512	28.61
60 to <65 years	48,834	12.78	23,708	12.60	25,126	12.95
Family status						
Single	68,609	17.96	41,452	22.04	27,157	14.00
Married	264,441	69.20	128,375	68.25	136,066	70.14
Widowed	10,422	2.73	1969	1.05	8453	4.36
Divorced	38,641	10.11	16,312	8.67	22,329	11.51
Presence of a partner in the same HH						
Yes	285,178	74.63	140,130	74.49	145,048	74.77
No	96,935	25.37	47,978	25.51	48,957	25.23
Migration background						
Native Germans	323,577	84.68	159,525	84.81	164,052	84.56
Turkish	10,043	2.63	5172	2.75	4871	2.51
Aussiedler	13,147	3.44	6402	3.40	6745	3.48
Other	35,346	9.25	17,009	9.04	18,337	9.45
Education						
Low	150,914	39.49	77,036	40.95	73,878	38.08
Medium	129,477	33.88	55,996	29.77	73,481	37.88
High	100,718	26.36	54,558	29.00	46,160	23.79

(continued)

Table 2 (continued)

	Sample		Men		Women	
	n	%	n	%	n	%
Missing information	1004	0.26	518	0.28	486	0.25
Occupational status						
Self-employed without employees	17,528	4.59	11,161	5.93	6367	3.28
Self-employed with employees	14,927	3.91	11,259	5.99	3668	1.89
Unpaid family worker	1330	0.35	154	0.08	1176	0.61
Official or judge	15,773	4.13	9270	4.93	6503	3.35
Employed or soldier	139,659	36.55	62,187	33.06	77,472	39.93
Full- or part-time worker	69,372	18.15	46,928	24.95	22,444	11.57
Non-active population	123,524	32.33	47,149	25.06	76,375	39.37
BMI						
Underweight (BMI < 18.5)	5585	1.46	686	0.36	4899	2.53
Normal weight (18.5 $\leq$ BMI $\geq$ 25)	160,046	41.88	63,410	33.71	96,636	49.81
Overweight (25 < BMI $\geq$ 30)	125,677	32.89	79,641	42.34	46,036	23.73
Obese (BMI > 30)	49,465	12.95	27,673	14.71	21,792	11.23
Missing information	41,340	10.82	16,698	8.88	24,642	12.70
Smoking habits						
Never	173,768	45.48	70,836	37.66	102,932	53.06
Ex-smoker	78,825	20.63	45,359	24.11	33,466	17.25
Smoker	116,285	30.43	65,335	34.73	50,950	26.26
Missing information	13,235	3.46	6578	3.50	6657	3.43
Equivalent income group						
<930 € (lowest 20%)	68,371	17.89	32,019	17.02	36,352	18.74
930 to <1400 € (20–50%)	109,822	28.74	52,511	27.92	57,311	29.54
1400 to <2110 € (50–80%)	107,153	28.04	53,413	28.39	53,740	27.70
>2110 € (top 20%)	71,760	18.78	37,655	20.02	34,105	17.58
Missing information	25,007	6.54	12,510	6.65	12,497	6.44
Migration background of the household						
No migration background	310,811	81.34	152,745	81.20	158,066	81.48
Mixed household	24,534	6.42	12,153	6.46	12,381	6.38
All persons with migration background	46,768	12.24	23,210	12.34	23,558	12.14

(continued)

Table 2 (continued)

	Sample		Men		Women	
	n	%	n	%	n	%
Place of residence						
Rural (fewer than 20,000 inhabitants)	166,103	43.47	82,457	43.83	83,646	43.12
Urban (20,000 inhabitants and more)	216,010	56.53	105,651	56.17	110,359	56.88
Total	382,113	100.00	188,108	100.00	194,005	100.00

Source German Microcensus 2005/2009

children (49.81% vs. 52.33%[9]). Regarding the absence or presence of a partner, there are no striking gender differences.

There are sufficient numbers of cases for all characteristics and the main combinations of characteristics to perform a multilevel regression model and sex-specific logistic regression models.

Gender Differences in Health— Results of Logistic Regression

The results of the logistic regression models are shown in Table 3.

Living in a 1G-HH is accompanied by health disadvantages. This effect applies to both men and women, but is more pronounced for women. Women in 2G-HH with one or two children respectively three or more children and women in 3 +G-HH have significantly lower health risks than women in 1G-HH. These group differences exist almost independently of other characteristics, but are reinforced after control for socio-economic characteristics. Women in 2G-HH with three or more children have the best health (OR = 0.45–0.61; $p < 0.001$), followed by women in 3+G-HH (OR = 0.60–0.74; $p = 0.000$–0.002) and women in 2G-HH with one or two children (OR = 0.68–0.71; $p < 0.001$) (Table 3). Among men, health advantages by generation composition appear for those in 2G-HH with children. Those with three or more children have the best health with a reduced risk of illness by 17% ($p = 0.001$), followed by men with one or two children, who have a 13% lower risk ($p < 0.001$). 2G-HH with (grand)parents and 3G-HH do not differ from 1G-HH (Table 3).

When controlling for other characteristics, it became clear that health differences according to migration background exist for women but not for men. Female Aussiedler and women with other migration backgrounds reveal better health than German women: Their risk of poor health is 24% ($p = 0.012$) resp. 20%

[9]The remaining ~1% of men and women live in 2G-HH with (grand)parents.

Table 3 Odds of longstanding illness for men and women: odds ratio and *p*-values from logistic regression

Covariates	Men		Women	
	OR	*p*	OR	*p*
Generation composition (ref. 1G-HH)				
2G-HH with one or two children	0.87	0.000	0.69	0.000
2G-HH with three or more children	0.82	0.001	0.45	0.000
2G-HH with (grand)parents	0.95	0.609	0.88	0.188
3+G-HH	1.04	0.741	0.62	0.000
Year of interview (ref. 2005)				
2009	1.11	0.000	1.15	0.000
Age group (ref. 30 to <40 years)				
40 to <50 years	1.62	0.000	1.72	0.000
50 to <60 years	2.53	0.000	2.39	0.000
60 to <65 years	1.78	0.000	1.77	0.000
Family status (ref. single)				
Married	1.07	0.109	0.84	0.000
Widowed	0.96	0.658	0.81	0.000
Divorced	1.03	0.449	1.11	0.009
Presence of a partner in the same HH (ref. yes)				
No	1.31	0.000	1.42	0.000
Migration background (ref. native Germans)				
Turkish	1.19	0.124	1.01	0.938
Aussiedler	0.93	0.481	0.76	0.012
Other	0.96	0.690	0.80	0.020
Education (ref. low)				
Medium	0.76	0.000	0.87	0.000
High	0.67	0.000	0.73	0.000
Missing information	0.95	0.799	0.90	0.624
Occupational status (ref. employed or soldier)				
Self-employed without employees	1.03	0.686	1.11	0.239
Self-employed with employees	1.01	0.938	1.00	0.970
Unpaid family worker	1.55	0.337	1.89	0.000
Official or judge	1.53	0.000	1.25	0.020
Full- or part-time worker	1.08	0.094	1.21	0.000
Non-active population	6.68	0.000	4.73	0.000
BMI (ref. normal weight; 18.5 $\leq$ BMI $\geq$ 25)				
Underweight (BMI < 18.5)	2.59	0.000	1.70	0.000
Overweight (25 < BMI $\geq$ 30)	0.97	0.178	1.21	0.000
Obese (BMI > 30)	1.29	0.000	1.76	0.000
Missing information	0.79	0.000	0.94	0.147
Smoking habits (ref. never)				
Ex-smoker	1.47	0.000	1.39	0.000

(continued)

Table 3 (continued)

Covariates	Men		Women	
	OR	*p*	OR	*p*
Smoker	1.15	0.000	1.28	0.000
Missing information	0.70	0.000	0.60	0.000
Equivalent income group (ref. < 930 €; lowest 20%)				
930 to < 1400 € (20–50%)	0.92	0.003	0.84	0.000
1400 to < 2110 € (50–80%)	0.78	0.000	0.78	0.000
>2110 € (top 20%)	0.63	0.000	0.68	0.000
Missing information	0.88	0.008	0.83	0.000
Migration background household (ref. no m.b.)				
Mixed household	1.02	0.799	0.98	0.794
All persons with migration background	1.02	0.851	1.38	0.001
Place of residence (ref. rural; fewer than 20,000 inhabitants)				
Urban (20,000 inhabitants and more)	0.95	0.019	0.99	0.743
Constant	0.01	0.000	0.02	0.000
R^2	0.16		0.12	
Log likelihood	−33,074		−36,731	
n	188,108		194,005	

Source German Microcensus 2005/2009

($p = 0.020$) lower (Table 3). The opposite is true for Turkish women: Health disadvantages of Turkish women compared to German women are driven mainly by social status and do remain after controlling for these characteristics (OR = 1.01; $p = 0.938$). Among men, without controlling for individual socio-economic status, lifestyle factors and contextual/household factors, both migrant groups considered have worse health than do German men. In the model without controlling for these factors, the risk of longstanding illness is 114% higher among Turks ($p < 0.001$) and 14% higher among Aussiedler ($p = 0.022$). These health differences are fully explained by compositional and structural factors and are attenuated, once controlled for other characteristics (Table 3).

The legal status of a partnership (family status) affects health, but only among women. Living as a female divorcee increases the risk of longstanding illness by 11% ($p = 0.009$) whereas the health advantage of married women is 16% (p 0.001) and those of the widowed 19% ($p < 0.001$) (Table 3). The effect of a partner in the household is stronger and more consistent than the effect of family status: the absence of a partner increases the risk of poor health both among women (by 42%; $p < 0.001$) and men (by 30%; $p < 0.001$) (Table 3). This partner effect is partly explained by individual socioeconomic differences among men and by contextual characteristics among women, as our stepwise models (results not shown) illustrate.

Finally, we find that women who live in a household consisting of only migrants have worse health. Their risk of illness is increased by 38% ($p = 0.001$) compared to households with no migration background. For men, this relationship cannot be found.

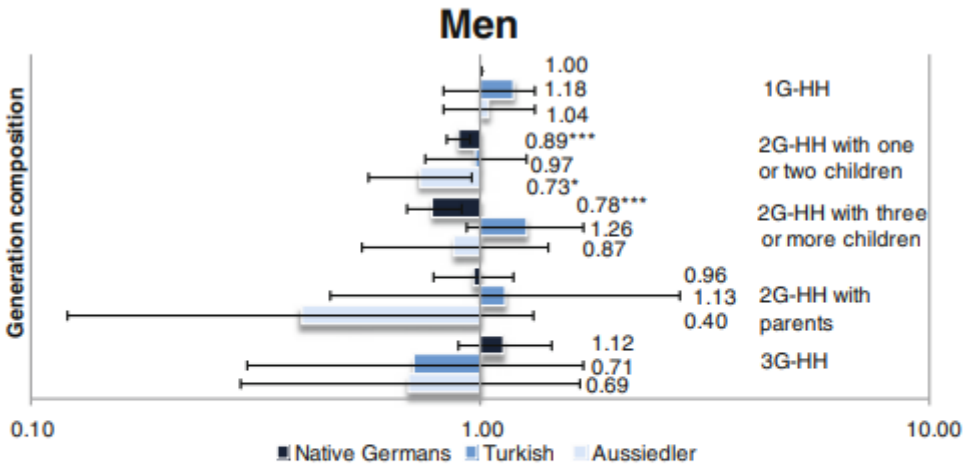

Fig. 2 Household effect according to migration background: odds and 95% confidence intervals of longstanding illness for men.
Note Reference = Native Germans in 1G-HH; logarithmic scale; controlled for all covariates.
Source German Microcensus 2005/2009; n = 188,108; ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

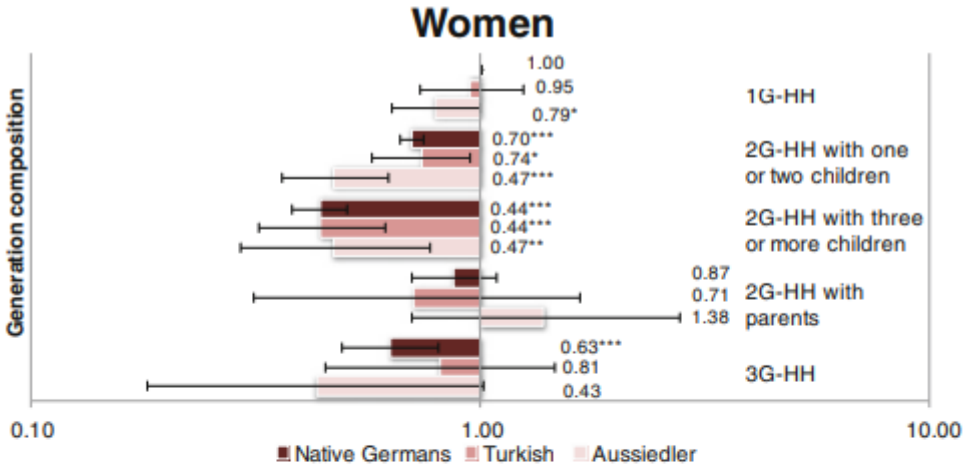

Fig. 3 Household effect according to migration background: odds and 95% confidence intervals of longstanding illness for women.
Note Reference = Native Germans in 1G-HH; logarithmic scale: controlled for all covariates.
Source German Microcensus 2005/2009; n = 194,005; ***$p < 0.001$, **$p < 0.01$,*$p < 0.05$

Our hypotheses suggest that most mechanisms act differently upon migrants and non-migrants. To test this assumption, interaction effects were estimated. Interaction effects indicate an estimation of non-additive effects of (at least) two independent variables on the outcome, assuming that the effect of one variable is influenced by the other variable. We examine the effect of the generation composition and the partner effect and assume that these effects vary among native Germans, Turks, and Aussiedler. Our results do not support this assumption. Among men and women, the effect of the

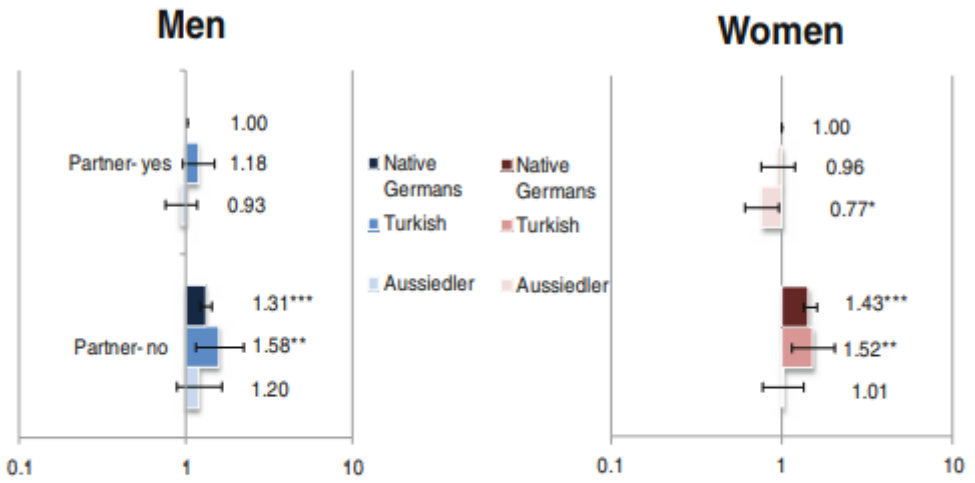

Fig. 4 Partner effect according to migration background: odds and 95% confidence intervals of longstanding illness for men and women.
Note Reference = Native Germans with partner; logarithmic scale; controlled for all covariates.
Source German Microcensus 2005/2009; men: n = 188,108; women: n = 194,005; ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

generation composition within the household on longstanding illness is the same for all subgroups considered. The generation composition generally causes a shift in health risks and follows—in particular among women—largely the same tendency for Germans, Turks, and Aussiedler (Figs. 2 and 3). However, two exceptions can be found: female Aussiedler in 1G-HH have lower risks of illness compared to German women in 1G-HH (OR = 0.79; $p = 0.043$). Thus, the absence of children or other persons of other generation are less disadvantageous for female Aussiedler than for female Germans (Fig. 3). Turkish men in 2G-HH with three or more children have higher risks of illness (OR = 1.26; 95% CI: 0.93; 1.69) than their German counterparts (OR = 0.78; 95% CI: 0.68; 0.90). Concerning the partner effect, again the same trend applies for all migrant-groups: the absence of a partner results in increased risks of illness. Among women, however, we find that the strength of this negative effect differs between the migrant groups, whereas especially female Aussiedler show a different pattern. Female Aussiedler with a partner have significantly lower risks of illness than German women with a partner (OR = 0.77; $p = 0.019$), and the absence of a partner is not associated with health disadvantages (OR = 1.01; $p = 0.917$) (Fig. 4).

Effects of Household Structure, Migration Background, and Individual Characteristics on Health—Results of Multilevel Regression

The results presented so far are based on gendered logistic regression models. To highlight and understand the variance across households, multilevel regression

Table 4 Odds of longstanding illness: odds ratio and *p*-values from multilevel regression

Covariates	Model 1		Model 2		Model 3		Model 4		Model 5	
	OR	*p*	OR	*p*	OR	*p*	OR	*p*	OR	*p*
Generation composition (ref. 1G-HH)										
2G-HH with one or two children	0.63	0.000	0.72	0.000	0.77	0.000	0.78	0.000	0.75	0.000
2G-HH with three or more children	0.59	0.000	0.67	0.000	0.58	0.000	0.60	0.000	0.55	0.000
2G-HH with (grand)parents	0.95	0.535	0.92	0.342	0.86	0.082	0.87	0.106	0.89	0.198
3+G-HH	0.79	0.010	0.83	0.033	0.76	0.003	0.78	0.008	0.77	0.004
Year of interview (ref. 2005)										
2009	1.14	0.000	1.12	0.000	1.14	0.000	1.12	0.000	1.16	0.000
Sex (ref. Females)										
Males	0.96	0.009	0.97	0.037	1.25	0.000	1.13	0.000	1.12	0.000
Age group (ref. 30 to <40 years)										
40 to <50 years	1.78	0.000	1.85	0.000	1.86	0.000	1.82	0.000	1.84	0.000
50 to <60 years	3.48	0.000	3.87	0.000	3.05	0.000	2.93	0.000	3.01	0.000
60 to <65 years	4.58	0.000	5.33	0.000	2.08	0.000	2.03	0.000	2.13	0.000
Family status (ref. single)										
Married			1.02	0.608	0.98	0.582	0.96	0.233	0.95	0.142
Widowed			0.98	0.734	0.91	0.057	0.86	0.003	0.89	0.021
Divorced			1.22	0.000	1.23	0.000	1.16	0.000	1.14	0.000
Presence of a partner in the same HH (ref. yes)										
No			1.75	0.000	1.60	0.000	1.60	0.000	1.44	0.000
Migration background (ref. native Germans)										
Turkish			2.57	0.000	1.46	0.000	1.48	0.000	1.12	0.232
Aussiedler			1.11	0.039	1.02	0.658	1.03	0.497	0.83	0.028
Other			1.23	0.000	1.02	0.464	1.05	0.117	0.84	0.024

(continued)

Table 4 (continued)

Covariates	Model 1		Model 2		Model 3		Model 4		Model 5	
	OR	*p*	OR	*p*	OR	*p*	OR	*p*	OR	*p*
Education (ref. low)										
Medium					0.76	0.000	0.77	0.000	0.79	0.000
High					0.56	0.000	0.60	0.000	0.67	0.000
Missing information					0.76	0.117	0.90	0.539	0.92	0.639
Occupational status (ref. employed or soldier)										
Self-employed without employees					1.01	0.901	1.01	0.856	0.98	0.750
Self-employed with employees					0.89	0.100	0.90	0.139	0.93	0.293
Unpaid family worker					1.89	0.000	1.99	0.000	1.88	0.000
Official or judge					1.32	0.000	1.32	0.000	1.44	0.000
Full- or part-time worker					1.12	0.001	1.09	0.011	1.02	0.495
Non-active population					7.96	0.000	7.67	0.000	6.78	0.000
BMI (ref. normal weight; 18.5 $\leq$ BMI $\geq$ 25)										
Underweight (BMI < 18.5)							2.05	0.000	2.04	0.000
Overweight (25 < BMI $\geq$ 30)							1.13	0.000	1.11	0.000
Obese (BMI > 30)							1.73	0.000	1.67	0.000
Missing information							0.87	0.000	0.86	0.000
Smoking habits (ref. never)										
Ex-smoker							1.55	0.000	1.58	0.000
Smoker							1.29	0.000	1.27	0.000
Missing information							0.60	0.000	0.59	0.000
Equivalent income group (ref. < 930 €; lowest 20%)										
930 to <1400 € (20–50%)									0.82	0.000
1400 to <2110 € (50–80%)									0.70	0.000

(continued)

Table 4 (continued)

Covariates	Model 1		Model 2		Model 3		Model 4		Model 5	
	OR	*p*	OR	*p*	OR	*p*	OR	*p*	OR	*p*
>2110 € (top 20%)									0.56	0.000
Missing information									0.78	0.000
Migration background household (ref. no m.b.)										
Mixed household									1.00	0.959
All persons with migration background									1.24	0.008
Place of residence (ref. rural; fewer than 20,000 inhabitants)										
Urban (20,000 inhabitants and more)									0.97	0.125
Constant	0.01	0.000	0.01	0.000	0.00	0.000	0.00	0.000	0.01	0.000
lnsig2u	0.88		0.81		0.79		0.76		0.76	
sigma_u	1.55		1.50		1.48		1.46		1.46	
Rho	0.422		0.406		0.400		0.394		0.395	
Log likelihood	−77,299		−76,629		−70,243		−69,612		−69,453	
n	382,113		382,113		382,113		382,113		382,113	

Source German Microcensus 2005/2009

models using pooled data (men and women together) were calculated. Interestingly, the results of the sample reflect mainly the effects among women. We use the results to reveal model changes when stepwise including the covariates and thus to explore possible underlying mechanisms, where the analysis consists of five nested models. The detailed results are shown in Table 4.

The gross effect of the migration background is partly explained and superimposed by other characteristics. Without consideration of socioeconomic characteristics, lifestyle, and contextual factors, native Germans have (only slightly but significantly) better health than Aussiedler (OR = 1.11; $p = 0.039$). The poor health of the Turkish subgroup is particularly striking, as they show a more than 2.5-fold increased risk of illness (OR = 2.57; $p < 0.001$) (Model 2, Table 4). Our full models reveal that the health disadvantage among Turks is primarily explained by worse socioeconomic status and contextual embedding. Considering the socioeconomic status, the risk of illness among Turks is reduced to 1.5-fold of the risk of native Germans (OR = 1.48; $p < 0.001$; Model 4, Table 4), and considering the contextual embedding, there remain no significant health differences between these two groups (OR = 1.12, $p = 0.232$; Model 5, Table 4). Controlling for contextual factors, Aussiedler (OR = 0.83; $p = 0.028$) even have health advantages over native Germans (Model 5, Table 4). The effect of the migration background does not superimpose the effect of the generation composition and is thus an additional risk factor for health outcomes. It also applies to the pooled multilevel model that the effect of the generation structure does not vary according to migration background.

The generation composition of the household is an independent determinant of health outcomes, which is remarkably stable in the model comparison. Persons living in a 1G-HH have worse health compared to the other subgroups. The risk is almost halved among 2G-HH with three or more children (OR = 0.55; $p < 0.001$) and about a quarter lower for 2G-HH with one or two children (OR = 0.75; $p < 0.001$) and for 3+G-HH (OR = 0.77; $p = 0.004$).

Gender effects in terms of long-standing illness vary. As shown in the previous section, men's and women's health is affected by different protective and pathogenic mechanisms. In our baseline model men show slightly better health than women (OR = 0.96; $p = 0.009$; Model 1, Table 4) This health advantage is mainly driven by a conducive socio-economic status; after controlling for this the gender effect is reversed and women show better health (OR = 1.25, $p < 0.001$; Model 3, Table 4). Differences in lifestyle explain some of the gender differences. Taking the lifestyle factors in account, women have a 12–13% lower risk of longstanding illness ($p < 0.001$; Models 4 and 5, Table 4).

The absence of a partner in the same household is a strong and largely independent pathogenic factor associated with an increased risk of illness. Those without a partner in the same household have from a 44% up to a 75% higher risk of longstanding illness ($p < 0.001$; Table 4). This effect is the same across all migrant groups. The risk of divorced people compared to singles is increased by 14% ($p < 0.001$) and that of the widowed is decreased by 11% ($p = 0.021$).

Finally, it is detrimental if all persons in the household have a migration background. This situation results in a 24% increased risk of longstanding illness ($p = 0.008$; Model 5, Table 4).

Discussion

To our knowledge, our study is one of the first to investigate the influence of the generational composition—a measure of the household structure—on health and to integrate the results in the context of gender and migration background. Not only family characteristics such as marital status and partnership status, which are frequently considered in research, but also the household structure is associated with health. This finding is particularly consistent and robust among women. For women, it applies to all migration backgrounds that living in a one generation household (1G-HH) results in exposure to greater health risks. Living in a two generation household (2G-HH) with three or more children is constantly beneficial and associated with lowest risks of illness. As well, living in a 2G-HH with one or two children is more advantageous than living in a 1G-HH. Our results suggest that this generational structure even results in additional health benefits among female Aussiedler (compared to German women). This link between household structure and health is not explained or offset by other factors and it applies to men as well. However, because men's health is generally less dependent on household characteristics and economic resources than women's health, less robust correlations arise among men. Without controlling for further health related characteristics, health inequalities by migration background are immense, but our analyses indicate that they are mainly driven by socio-economic differences.

Interpretation

Our *family segregation-hypothesis* states that living in a 1G-HH is accompanied by situations of relatively weak family ties—at least within the household—and thus results in health disadvantages. This hypothesis can largely be confirmed, but our assumption, that native Germans and migrants differ in this effect, is not conferred. Our models showed health disadvantages among persons in 1G-HH. Compared to all the other considered subgroups, they constantly have the highest risk of long-standing illness. Among men, the extent of differences between the groups decreases slightly when controlling for other characteristics, among women it even increases. The result, that persons in households with many children (2G-HH with three or more children) have the best health, illustrates the importance of emotional ties and social support within households. This conclusion is consistent with other findings (Zunzunegui et al. 2001; Kravdal et al. 2012), but contradicts those approaches which consider child care a burden and focus the multiple burdens of middle-aged persons (McIlvane et al. 2007; Oláh et al. 2014). Our findings instead indicate that

children are a helpful resource. This parenthood-health-interaction, as well as the decision for a specific household type, might be driven by selection effects: in particular, when healthy adults decide to have (many) children and consciously take care of children or other relatives. A detailed analysis of the quality of relationships could be included in subsequent studies. Furthermore, it is conceivable that the effect of the parenthood depends on the age of the children in the household and is different between those with younger and those with older children. As Kravdal et al. (2012) stated, it is likely that parenting and the responsibility for a large household have a positive impact on individual lifestyle and thus result in better health outcomes. However, it should be noted that the group of persons in 1G-HH is composed of three subgroups: those living alone, couples without children, and couples with children that have already moved out of the parental household. 64% of the persons in 1G-HH in our sample live together with a partner. As we controlled for partnership status, we determine the net effect for this group. Our model reference category includes persons in a 1G-HH without a partner in the household. Thus, our findings are consistent with other studies that find that living alone is associated with additional health risks, e.g. due to a higher consumption of alcohol in this group (Cramer 1993) or to differences in access to healthcare providers (Manderbacka et al. 2014). Health disadvantages of couples without children can also be inferred from other studies (e.g. Hughes and Gove 1981). Johnson and Catalano (1981) note that childless married are partly socially isolated and therefore vulnerable to illness; van Balen and Trimbos-Kemper (1993) observe lower levels of well-being among infertile adults. Parents, especially mothers, whose children leave the parental home, sometimes experience a phase of reorientation which is accompanied by feelings of loneliness (Liu and Guo 2007) and negatively affects mental health (Radloff 1980). Persons in 1G-HH thus group unfavourable circumstances and characteristics that may adversely affect health. Considering that persons in 1G-HH partly even have economic benefits (e.g. no costs for child maintenance, couples with "double income and no kids"), our results illustrate the importance of social components and affirm the Social Support Theory (Lakey and Cohen 2000). Furthermore, our results may demonstrate reverse causality, i.e. health selection into childlessness (Gibney 2012).

The *gender hypothesis* states a gendered effect of the household structure, which is greater among people with migration backgrounds. A gender-gradient is evident in the strength of the influence of different household compositions. Among women, the effect is greater and more stable, which was also shown in other studies (Manderbacka et al. 2014; Williams and Umberson 2004; Soons and Kalmijn 2009; Hughes and Waite 2002; Denton et al. 2004; Artazcoz 2001). A higher dependence of women on household characteristics can thus be detected. The result, that living in solely migrant households is disadvantageous only among women, illustrates this effect additionally and is in line with earlier studies (e.g. Haug 2004, 2007). That this effect cannot be proven for men might also represent their greater integration into the labour market, due to which the household is only one of several resources of social capital. The gender hypothesis can be accepted, but there are no differences in the context of migration background. Among migrants the effect of the household structure on health is not any more gendered than among non-migrants.

According to our *mediator hypothesis* additional characteristics, especially the economic situation, are expected to explain health differences by household composition, gender, and migration background. This hypothesis must be rejected in large parts. Our results demonstrate that the socio-economic status is of high importance in the perspective of the migration background; here it explains many of the differences between the groups. However, differences by household composition are generally not explained by structural differences. The socio-economic status itself determines health inequalities, but does not mediate the effect of the generation composition. Of particular importance is how someone positions himself in society, i.e. with regard to education and occupational status. The household's economic situation acts as an additional compensation effect.

Our *partner hypothesis* states a positive effect of a partner in the household, which differs according to migration background. In all considerations the presence of a partner is associated with health benefits and leads to a general shift in health risks, which is in line with existing research (e.g. Koskinen et al. 2007; Joung et al. 1994; Manderbacka et al. 2014). This result may also demonstrate the health-related selection into partnership (Hughes and Gove 1981).

Our hypotheses can largely be confirmed. However, the expected fundamental differences between native Germans and migrants cannot be found. An exception is found for female Aussiedler, for whom living in a 1G-HH as well as the absence of a partner are less disadvantageous than for German women. Supposedly adverse effects are less influential among female Aussiedler. This result especially reflects the generally lower risk of illness among female Aussiedler. Despite this, the basic mechanisms in the production of health, respectively the influence of the household structure on health, are the same for native Germans, Turks, and (male) Aussiedler. One reason for this might be the composition of our sample under study. The migrants in our sample generally have been in Germany for a long time already. Among the Turks, more than 90% have been in Germany for more than 10 years and 70% more than 30 years. Among the Aussiedler, 85% have a duration of stay of longer than 10 years and 25% of longer than 30 years. Our results show that—as explained in Section "Why Investigate the Health of Migrants and Distinguish Between Different Migration Backgrounds?"—Aussiedler have many similarities to the German majority population. Additionally, the results suggest that Aussiedler and Turkish migrants in Germany have strongly adopted values and behaviours of the majority population, which is consistent with Kreft and Doblhammer (2012). We have analyzed whether these findings are also driven by our wide definition of "migration background" (migrants in first and second generation); the differentiated regression models for migrants in first generation largely repeat the previously described findings and underline the robustness of our results.

Our results may reflect selection processes among migrants. The "healthy migrant effect" (Kohls 2008) assumes a positive selection effect, i.e. especially young and healthy persons are likely to migrate.[10] Together with the

[10]However, it is assumed that the health benefits of migrants appear especially shortly after migration and decrease over time (Razum and Rohrmann 2002; Schenk 2007).

"unhealthy-remigration effect" (Razum et al. 1998)—unhealthy migrants are more likely to return to their home countries—the analysis of migrants is possibly biased. So it is conceivable that the migrants in our sample are subject to a positive selection mechanism and thus the effects are underestimated. It should also be kept in mind that Turkish migrants and Aussiedler in Germany are subject to an additional selection process. Due to their health checks in their recruitment as guest workers, at least the first generation of (male) Turkish migrants was selected by health, and Aussiedler are selected by their proximity to German culture. This may have direct and indirect impact on health factors and the integration into society.

Another explanation could be that migrants have greater social resources. In addition to stable family structures, they might be emotionally supported by extended families, social networks, and ethnic communities in times of shortage (Razum and Spallek 2012; Wilkinson and Marmot 2003). Networks across households and/or outside households were not investigated in our study, but could provide further explanations. As Haug (2007) describes, external resources might—along with the household—act as sources of social embeddedness and it seems that this resource is equally compensatory among migrants and non-migrants. The finding that women who live in households without any non-migrants have increased health risks suggests that networks, in particular social contacts with Germans, might counteract health risks and is in line with existing studies (Haug 2004; Lancee and Hartung 2012).

Finally, it should also be questioned whether in fact there are immense differences in value systems, family ideals, and the motivation for the formation of a specific household type between non-migrant Germans and migrants, particularly against the background of a long duration of stay. According to Haas (2010) and Haug (2004), migrants often maintain ties with their countries of origin, which exist and are formative long after migration. Among Turkish migrants, this social capital is rather family-based and kinship based (Haug 2005), which could be detrimental for the social integration and health care utilization and thus might establish an intra-ethnic segmentation (Lue Kessing et al. 2013; Esser 2001). Bearing in mind that Turks and Aussiedler often migrated to reunite their family or—in the case of Aussiedler—to live in their cultural home, this assumption must be questioned. It is conceivable—and supported by our results—that there is a gradual appropriation of cultural peculiarities, which goes together with an adaption of norms and values as well as health risks in the course of stay (Schenk 2007). As in other studies, we conclude that migrants who have been in Germany for a long time adapt behaviours (Milewski 2010, 2011; Berry 1992).

Our results also indicate that there are social structures which compensate for differences at the household level. There are differences in the health structure between Turkish migrants, Aussiedler, and Germans, but these generally do not explain health differences by migration background. One exception are (female) Aussiedler, where it remains partly unclear why they have better health and why their dependence on the household structure follows a different pattern.

Strengths and Restrictions

This study and our results have some restrictions. First of all, the health indicator used must be questioned. Illness is operationalized by longstanding illness. In the questionnaire of the Microcensus, neither a definition of illness is given nor is the severity of illness requested. The time frame of four weeks, which was set as the minimum duration of illness to define a person as ill, is intended to compensate for this weakness. The relatively high item non-response in the health variable might be problematic, as it has to be assumed that non-respondents are in poor health (Goldberg et al. 2001). The consideration of persons living in private households only might lead to an underestimation of ill people, as especially serious illness is often associated with a stay in a health institution and these people are not included in our study.

It should also be questioned whether our indicator reflects the health status for all persons equally or is more relevant to those who are active in the labour market. Because employment rates differ partially between Germans and migrants in Germany, this could cause a bias. Additionally, it should be kept in mind that migrants have fewer chronic diseases and more infectious diseases (see Section "Why Investigate the Health of Migrants and Distinguish Between Different Migration Backgrounds?"), thus this indicator may not completely cover the spectrum of diseases among migrants. Finally, the definitions of health and illness are culturally shaped (Helman 2007) so it is conceivable that Germans, Turkish migrants, and Aussiedler differ in their perception of health and illness and have different patterns in the utilization of health care services and consult physicians more or less frequently. Language barriers among migrants may reinforce this effect and might contribute to a lower awareness of health status among migrants. The fact that the proportion of nonresponse is slightly higher among the migrant groups (18.43% among Turks and 16.05% among Aussiedler) than among the German group (14.99%) indicates uncertainty in answering this question among migrants, but might also reflect a sponsorship-effect (the Microcensus is carried out on behalf of the Federal Statistic Office and this official character could help that respondents answer in the sense of the sponsor or to avoid undesirable answers). Misunderstandings and misinterpretation due to language problems in the interviews with migrants/non-German speakers could be an additional bias.

Second, there are further restrictions on the contextual level. A generalisation of our findings should be verified. Health outcomes, motives for a specific household type, levels of integration, family ideals, and norms are strongly shaped by cultural beliefs, social policies, and other macro structural influences, which means that a transmission of the results, e.g. to other countries, should be part of subsequent studies. Our results reflect the mechanisms in the conservative welfare state of Germany, as well as the cultural values and perceptions of the sub groups analyzed (native Germans, Turks, and Aussiedler in Germany).

Third, with our study design, causality cannot be found, as we carried out a cross-sectional study. We assume that household structures affect health outcomes. This assumption is in line with theoretical approaches (Berman et al. 1994) and

longitudinal analyses (Hughes and Waite 2002). However, reverse causality is also conceivable: specific households and generation compositions are formed due to health characteristics. Children and parents might act as a helpful resource, so that living together is chosen more or less deliberately. Likewise, living with parents and/or children might also be driven by economic or health needs and might go together with additional burdens (McIlvane et al. 2007). Overall, the motivations and reasons for a specific living arrangement are quite heterogeneous, so the arrangement-specific impact may be heterogeneous as well. An analysis of the structure of relationships, the quality of relationships, and the exchanges within households appears to be necessary and useful, but this was not initially targeted in our analysis. The necessity to capture the high complexity, multidimensionality, and heterogeneity of health, illness, households, family ties, etc. in a more detailed way is revealed by our gender-specific models and might yield further research suggestions.

Fourth, the classification of generation structures in our analyses is partly imprecise. In particular, the group of the one generation households is rather heterogeneous, as it includes singles and couples who either are childless or whose children have already left the parental home. When using the data of the German Microcensus there is no reliable way to differentiate between these groups, so this is a data problem.

The main strengths of our study are the consideration of different levels that affect health and the modelling of the effect of the generation composition within households on health. The multilevel approach allows us to consider a second level —the household level—and thus to meet the variance across households in health matters, which are postulated by the approaches of the Household Production of Health and the New Household Economics. Our results illustrate this variance and the need for multilevel models. By considering the generation composition, we focus a measurement of the household structure, which will probably gain ground in the future. Already today, we find numerous changes in family and household structures (e.g. the trend towards smaller households, the possibility of coexistence of several generations), which are associated with different health risks and opportunities. This differentiation will also continue in the coming decades, resulting in the need for household to be a level of consideration. By using several household-related characteristics, we can prove that many of these characteristics act independently. Some of the indicators measure similar issues, however, they are not perfectly multicollinear and have an additional effect on health inequalities (e.g. there is a significant correlation between partnership status and the family status ($p < 0.001$), but we find all combinations of characteristics; the proportion of partnerless is 3% among married, 85% among widowed, 76% among divorced, and 73% among singles). What is surprising is the effect of the generation composition, which is stronger and more robust than the effect of the family status, which traditionally is examined as the main indicator for household characteristics. The comparison of men and women as well of the migrant groups shows that this is a largely global effect.

Another major strength of our study lies in the use of a broad database. First, the German Microcensus enables us to identify the household level and to perform stratified analyses. Second, considering the heterogeneity of the migrant population points to an internal differentiation of this group. With our differentiation between the two groups (Turks and Aussiedler) we meet this requirement and thus can make differentiated conclusions for a larger portion of the population in Germany. Finally, due to the obligation to provide information and the sampling, the data of the Microcensus and our analyses are highly representative for the target population examined (the non-institutionalised population in Germany between ages 30 and 64) and provide high accuracy.

Conclusion and Implications

This study provides new insights into the household effect on health and helps to identify health inequalities by migration background and gender. Native Germans, Turks, and Aussiedler differ in their health status, however, these differences are for the most part not due to differences in household composition. Our results indicate that there are effects on the macro level and individual level, which can compensate or superimpose meso-structural disadvantages or differences. Also, we assume that the migrant groups considered, which generally have already been in Germany for a longer time, are well integrated into social structures and have adopted norms, ideals, and health behaviours.

The household structure is significantly associated with health outcomes, whereas persons in 1G-HH (singles, couples without children, those living apart from their families) show health disadvantages. Thus, this group can be identified as particularly vulnerable. Because the influence of the household structure is largely the same for men and women who are Germans, Turks, and Aussiedler, the implication of interventions at the household level appears to reduce health inequalities globally. However, interactions at the family level and household level (e.g. childbearing, health behaviours, allocation of roles, and division of tasks) are a private matter, so connecting factors are difficult to discern. Our analysis clearly shows that women in particular are the beneficiaries of such interventions, as they have a greater dependence on household characteristics and because the household is still a female domain. An establishment of modern role models, a social policy adjustment, and a relief of women in the household could weaken these mechanisms and dependence prospectively.

Additionally, our analysis emphasises the socio-economic situation as a crucial determinant of health, which becomes especially clear in the context of migration background. At first glance, Turks have great health disadvantages and Aussiedler slight disadvantages. These health inequalities among migrants in Germany are mainly driven by their worse economic status. Intervention measures should act on this level as well. The example of Aussiedler in Germany elucidates that a high

level of integration into society, the education system, and the labour market also leads to an approximation in individual health outcomes.

References

Abraído-Lanza, A. F., Dohrenwend, B. P., Ng-Mak, D. S., & Turner, J. B. (1999). The Latino mortality paradox: A test of the "salmon bias" and healthy migrant hypotheses. *American Journal of Public Health*. https://doi.org/10.2105/AJPH.89.10.1543.

Arránz Becker, O., & Steinbach, A. (2012). Relations between Grandparents and Grandchildren in the Context of the Family System. *Zeitschrift für Bevölkerungswissenschaft, 37*(3–4), 543–566.

Artazcoz, L. (2001). Gender inequalities in health among workers: The relation with family demands. *Journal of Epidemiology and Community Health*. https://doi.org/10.1136/jech.55.9.639.

Batalova, J. A., & Cohen, P. N. (2002). Premarital cohabitation and housework: Couples in cross-national perspective. *Journal of Marriage and Family*. https://doi.org/10.1111/j.1741-3737.2002.00743.x.

Becher, H., Razum, O., Kyobutungi, C., Laki, J., Ott, J. J., Ronellenfitsch, U., et al. (2007). Mortalität von Aussiedlern aus der ehemaligen Sowjetunion: Ergebnisse einer Kohortenstudie. *Deutsches Ärzteblatt, 104*(23), 1655–1661.

Bennett, K. J., Olatosi, B., & Probst, J. C. (2008). *Health disparities: A rural-urban chartbook*. http://www.cabi.org/cabdirect/FullTextPDF/2009/20093189673.pdf.

Berman, P., Kendall, C., & Bhattacharyya, K. (1994). The household production of health: Integrating social science perspectives on micro-level health determinants. *Social Science and Medicine, 38*(2), 205–215.

Berry, J. W. (1992). Acculturation and adaptation in a new society. *International Migration*. https://doi.org/10.1111/j.1468-2435.1992.tb00776.x.

Burt, R. S. (2001). Structural holes versus network closure as social capital. In N. Lin, K. Cook, & R. S. Burt (Eds.), *Social capital: Theory and research* (pp. 31–56). New York: De Gruyter.

Carnein, M., Milewski, N., Doblhammer, G., & Nusselder, W. J. (2015). Health inequalities of immigrants: Patterns and determinants of health expectancies of Turkish migrants living in Germany. In G. Doblhammer (Ed.), *Health among the elderly in Germany: New evidence on disease, disability and care need* (Beiträge zur Bevölkerungswissenschaft, Vol. 46). Leverkusen: Opladen [u.a.].

Coleman, J. S. (1990). *Foundations of social theory*. Cambridge, MA: Belknap Press of Harvard University Press.

Constant, A. F., & Massey, D. S. (2005). Labor market segmentation and the earnings of German guestworkers. *Population Research and Policy Review* (24), 489–512.

Cramer, D. (1993). Living alone, marital status, gender and health. *Journal of Community & Applied Social Psychology*. https://doi.org/10.1002/casp.2450030102.

de Haas, H. (2010). Migration and development: A theoretical perspective 1. *International Migration Review*. https://doi.org/10.1111/j.1747-7379.2009.00804.x.

de Valk, H. A. G. (2008). Parental influence on work and family plans of adolescents of different ethnic backgrounds in the Netherlands. *Sex Roles*. https://doi.org/10.1007/s11199-008-9464-9.

Denton, M., Prus, S., & Walters, V. (2004). Gender differences in health: A Canadian study of the psychosocial, structural and behavioural determinants of health. *Social Science and Medicine*. https://doi.org/10.1016/j.socscimed.2003.09.008.

Derose, K. P., Escarce, J. J., & Lurie, N. (2007). Immigrants and health care: Sources of vulnerability. *Health Affairs (Project Hope)*. https://doi.org/10.1377/hlthaff.26.5.1258.

Dias, S. F., Severo, M., & Barros, H. (2008). Determinants of health care utilization by immigrants in Portugal. *BMC Health Services Research*. https://doi.org/10.1186/1472-6963-8-207.

Diehl, C., Koenig, M., & Ruckdeschel, K. (2009). Religiosity and gender equality: Comparing natives and Muslim migrants in Germany. *Ethnic and Racial Studies*. https://doi.org/10.1080/01419870802298454.

DiPrete, T. A., & Forristal, J. D. (1994). Multilevel models: Methods and substance. *Annual Review of Sociology, 20,* 331–357.

Engel, G. L. (1977). The Need for a new medical model: A challenge for biomedicine. *Science, 196*(4286), 129–136.

Esping-Andersen, G. (1990). *The three worlds of welfare capitalism*. Princeton, NJ: Princeton University Press.

Esser, H. (2001). *Integration und ethnische Schichtung*. Mannheim. http://edoc.vifapol.de/opus/volltexte/2014/5134/pdf/wp_40.pdf.

Ferrer, R. L., Palmer, R., & Burge, S. (2005). The family contribution to health status: A population-level estimate. *Annals of Family Medicine*. https://doi.org/10.1370/afm.266.

Friedrich, L. (2008). *Wohnen und innerstädtische Segregation von Migranten in Deutschland: Integrationsreport*. Nürnberg.

Geulen, D. (2004). *Sozialisationstheorie interdisziplinär: Aktuelle Perspektiven* (Der Mensch als soziales und personales Wesen, Vol. 20). Stuttgart: Lucius & Lucius.

Ghatak, S., Levine, P., & Price, S. W. (1996). Migration theories and evidence: An assessment. *Journal of Economic Surveys*. https://doi.org/10.1111/j.1467-6419.1996.tb00008.x.

Gibney, S. (2012). OP18 childlessness in Europe: Implications for wellbeing in later life. *Journal of Epidemiology and Community Health*. https://doi.org/10.1136/jech-2012-201753.018.

Goldberg, M., Chastang, J. F., Leclerc, A., Zins, M., Bonenfant, S., Bugel, I., et al. (2001). Socioeconomic, demographic, occupational, and health factors associated with participation in a long-term epidemiologic survey: A prospective study of the French GAZEL cohort and its target population. *American Journal of Epidemiology*. https://doi.org/10.1093/aje/154.4.373.

Hammes, W. (2013). Haushalte und Lebensformen der Bevölkerung: Ergebnisse des Mikrozensus 2012. *Wirtschaft und Statistik*, 782–794.

Hartley, D., Quam, L., & Lurie, N. (1994). Urban and rural differences in health insurance and access to care. *The Journal of Rural Health*. https://doi.org/10.1111/j.1748-0361.1994.tb00216.x.

Haug, S. (2004). Soziale Integration durch soziale Einbettung in Familie. *Verwandtschafts- und Freundesnetzwerke. Zeitschrift für Bevölkerungswissenschaft, 29*(2), 163–192.

Haug, S. (Ed.) (2005). *Aspekte der Integration: Eingliederungsmuster und Lebenssituation italienisch- und türkischstämmiger junger Erwachsener in Deutschland* (1st edn, Schriftenreihe des Bundesinstituts für Bevölkerungsforschung, Bd. 35). Wiesbaden: VS, Verl. für Sozialwiss.

Haug, S. (2007). Soziales Kapital als Ressource im Kontext von Migration und Integration. In J. Lüdicke & M. Diewald (Eds.), *Soziale Netzwerke und soziale Ungleichheit* (pp. 85–111). Wiesbaden: VS Verlag für Sozialwissenschaften.

Haug, S., Müssig, S., & Stichs, A. (2009). *Muslimisches Leben in Deutschland* (1st edn, Forschungsbericht/Bundesamt für Migration und Flüchtlinge, Vol. 6). Nürnberg: Bundesamt für Migration und Flüchtlinge.

Helbig, S., Lampert, T., Klose, M., & Jacobi, F. (2006). Is parenthood associated with mental health? Findings from an epidemiological community survey. *Social psychiatry and psychiatric epidemiology*, https://doi.org/10.1007/s00127-006-0113-8.

Helman, C. (2007). *Culture, health, and illness* (5th ed.). London, New York, NY: Hodder Arnold; Distributed in the United States of America by Oxford University Press.

Holmes, J. H., Lehman, A., Hade, E., Ferketich, A. K., Gehlert, S., Rauscher, G. H., et al. (2008). Challenges for multilevel health disparities research in a transdisciplinary environment. *American Journal of Preventive Medicine*. https://doi.org/10.1016/j.amepre.2008.05.019.

Hook, J. L. (2006). Care in context: Men's unpaid work in 20 countries, 1965–2003. *American Sociological Review*. https://doi.org/10.1177/000312240607100406.

Hughes, M., & Gove, W. R. (1981). Living alone, social integration, and mental health. *American Journal of Sociology, 87*(1), 48–74.

Hughes, M. E., & Waite, L. J. (2002). Health in household context: Living arrangements and health in late middle age. *Journal of Health and Social Behavior, 43*(1), 1–21.

Hughes, M. E., & Waite, L. J. (2009). Marital biography and health at mid-life. *Journal of Health and Social Behavior*. https://doi.org/10.1177/002214650905000307.

Huschek, D., de Valk, H. A., & Liefbroer, A. C. (2011). Gender-role behavior of second-generation Turks: The role of partner choice, gender ideology and societal context. *Advances in Life Course Research*. https://doi.org/10.1016/j.alcr.2011.09.005.

Jacobson, L. (2000). The family as producer of health—An extended grossman model. *Journal of Health Economics*. https://doi.org/10.1016/S0167-6296(99)00041-7.

Janikowski, A. (1999). Berufliche Integration der Aussiedler und Aussiedlerinnen. In R. K. Silbereisen, E.-D. Lantermann, & E. Schmitt-Rodermund (Eds.), *Aussiedler in Deutschland* (pp. 113–142). Wiesbaden: VS Verlag für Sozialwissenschaften.

Johnson, C. L., & Catalano, D. J. (1981). Childless elderly and their family supports. *The Gerontologist*. https://doi.org/10.1093/geront/21.6.610.

Joung, I., van de Mheen, H., Stronks, K., Van Poppel, F. W. A., & Mackenbach, J. P. (1994). Differences in self-reported morbidity by marital status and by living arrangement. *International Journal of Epidemiology*. https://doi.org/10.1093/ije/23.1.91.

Knipper, M., & Bilgin, Y. (2009). *Migration und Gesundheit* (Eine Veröffentlichung der Konrad-Adenauer-Stiftung e.V. und der Türkisch-Deutschen Gesundheitsstiftung e.V). Sankt Augustin, Berlin: Konrad-Adenauer-Stiftung.

Kohls, M. (2008). *Healthy-Migrant-Effect*. Erfassungsfehler und andere Schwierigkeiten bei der Analyse der Mortalität von Migranten: Eine Bestandsaufnahme. Nürnberg.

Kohls, M. (2012). *Demographie von Migranten in Deutschland* (Challenges in public health, Bd. 63). Frankfurt am Main, New York: Lang.

Koskinen, S., Joutsenniemi, K., Martelin, T., & Martikainen, P. (2007). Mortality differences according to living arrangements. *International Journal of Epidemiology*. https://doi.org/10.1093/ije/dym212.

Kravdal, Ø., Grundy, E., Lyngstad, T. H., & Wiik, K. A. (2012). Family life history and late mid-life mortality in Norway. *Population and Development Review*. https://doi.org/10.1111/j.1728-4457.2012.00491.x.

Kreft, D., & Doblhammer, G. (2012). Contextual and individual determinants of health among Aussiedler and native Germans. *Health & Place*. https://doi.org/10.1016/j.healthplace.2012.05.008.

Lakey, B., & Cohen, S. (2000). Social support theory and measurement. In S. Cohen, L. G. Underwood, & B. H. Gottlieb (Eds.), *Social support measurement and intervention: A guide for health and social scientists*. Oxford, New York: Oxford University Press.

Lancee, B., & Hartung, A. (2012). Turkish migrants and native germans compared: The effects of inter-ethnic and intra-ethnic friendships on the transition from unemployment to work. *International Migration*. https://doi.org/10.1111/j.1468-2435.2011.00736.x.

Leclere, F. B., Jensen, L., & Biddlecom, A. E. (1994). Health care utilization, family context, and adaptation among immigrants to the United States. *Journal of Health and Social Behavior, 35*(4), 370–384.

Lindert, J., Schouler-Ocak, M., Heinz, A., & Priebe, S. (2008). Mental health, health care utilisation of migrants in Europe. *European Psychiatry*. https://doi.org/10.1016/S0924-9338(08)70057-9.

Liu, L.-J., & Guo, Q. (2007). Loneliness and health-related quality of life for the empty nest elderly in the rural area of a mountainous county in China. *Quality of Life Research: An international Journal of Quality of Life Aspects of Treatment, Care and Rehabilitation*. https://doi.org/10.1007/s11136-007-9250-0.

Lowenstein, A., Katz, R., & Gur-Yaish, N. (2007). Reciprocity in Parent-child exchange and life satisfaction among the elderly: A cross-national perspective. *Journal of Social Issues*. https://doi.org/10.1111/j.1540-4560.2007.00541.x.

Lue Kessing, L., Norredam, M., Kvernrod, A.-B., Mygind, A., & Kristiansen, M. (2013). Contextualising migrants' health behaviour—A qualitative study of transnational ties and their

implications for participation in mammography screening. *BMC Public Health*. https://doi.org/10.1186/1471-2458-13-431.

Manderbacka, K., Peltonen, R., & Martikainen, P. (2014). Amenable mortality by household income and living arrangements: A linked register-based study of Finnish men and women in 2000–2007. *Journal of Epidemiology and Community Health*. https://doi.org/10.1136/jech-2014-204272.

McIlvane, J. M., Ajrouch, K. J., & Antonucci, T. C. (2007). Generational structure and social resources in mid-life: Influences on health and well-being. *Journal of Social Issues*. https://doi.org/10.1111/j.1540-4560.2007.00535.x.

Meyer, T. (2006). Private Lebensformen im Wandel. In Die Sozialstruktur (Ed.), *Deutschlands* (pp. 331–357). Wiesbaden: VS Verlag für Sozialwissenschaften.

Mielck, A. (2008). Soziale Ungleichheit und Gesundheit in Deutschland. *Bundesgesundheitsblatt - Gesundheitsforschung - Gesundheitsschutz*. https://doi.org/10.1007/s00103-008-0465-1.

Milewski, N. (2010). *Fertility of immigrants*. Berlin, Heidelberg: Springer.

Milewski, N. (2011). Transition to a first birth among Turkish second-generation migrants in Western Europe. *Advances in Life Course Research*. https://doi.org/10.1016/j.alcr.2011.09.002.

Milewski, N., & Doblhammer, G. (2015). Mental health among immigrants: Is there a disadvantage in later life? In G. Doblhammer (Ed.), *Health among the elderly in Germany: New evidence on disease, disability and care need* (Beiträge zur Bevölkerungswissenschaft, Vol. 46). Leverkusen: Opladen [u.a.].

Neuhauser, H., & Razum, O. (2008). *Migration und Gesundheit: Schwerpunktbericht der Gesundheitsberichterstattung des Bundes (Gesundheitsberichterstattung des Bundes)*. Berlin: Robert-Koch-Inst.

Norredam, M. (2011). Migrants' access to healthcare. *Danish Medical Bulletin, 58*(10), B4339.

Oksuzyan, A., Shkolnikova, M., Vaupel, J. W., Christensen, K., & Shkolnikov, V. M. (2014). Sex differences in health and mortality in Moscow and Denmark. *European Journal of Epidemiology*. https://doi.org/10.1007/s10654-014-9893-4.

Oláh, L. S., Richter, R., & Kotowska, I. E. (2014). *State-of-the-art report. The new roles of men and women and implications for families and societies. State-of-the-art report* (Families And Societies 11/2014). http://www.familiesandsocieties.eu/wp-content/uploads/2014/12/WP11OlahEtAl2014.pdf.

Omran, A. R. (2005). The epidemiologic transition: A theory of the epidemiology of population change. *Milbank Quarterly*. https://doi.org/10.1111/j.1468-0009.2005.00398.x.

Predelli, L. N. (2004). Interpreting gender in Islam: A case study of immigrant Muslim women in Oslo, Norway. *Gender & Society*. https://doi.org/10.1177/0891243204265138.

Radloff, L. S. (1980). Depression and the empty nest. *Sex Roles*. https://doi.org/10.1007/BF00287233.

Razum, O., & Rohrmann, S. (2002). Der Healthy-migrant-Effekt: Bedeutung von Auswahlprozessen bei der Migration und Late-entry-Bias. *Das Gesundheitswesen*. https://doi.org/10.1055/s-2002-20271.

Razum, O., & Spallek, J. (2012). Erklärungsmodelle zum Zusammenhang zwischen Migration und Gesundheit im Alter. In H. Baykara-Krumme, P. Schimany, & A. Motel-Klingebiel (Eds.), *Viele Welten des Alterns* (pp. 161–180). Wiesbaden: VS Verlag für Sozialwissenschaften.

Razum, O., Zeeb, H., Akgun, H. S., & Yilmaz, S. (1998). Low overall mortality of Turkish residents in Germany persists and extends into a second generation: Merely a healthy migrant effect?*. *Tropical Medicine & International Health*. https://doi.org/10.1046/j.1365-3156.1998.00233.x.

Rehaag, R., Uslucan, H.-H., & Aydin-Canpolat, G. (2012). Kulinarische Praxen als Medium der Identitätsdarstellung deutscher und türkischer Jugendlicher. *Gender*(2), 28–47.

Sachverständigenkommission 6. Familienbericht (2000). *Familien ausländischer Herkunft in Deutschland: Empirische Beiträge zur Familienentwicklung und Akkulturation*. Opladen: Vs Verlag Fur Sozialwisse.

Schenk, L. (2007). Migration und Gesundheit-Entwicklung eines Erklärungs- und Analysemodells für epidemiologische Studien. *International Journal of Public Health*. https://doi.org/10.1007/s00038-007-6002-4.

Schneider, B., Rapp, I., Klein, T., & Eckhard, J. (2014). Relationship status and health: Does the use of different relationship indicators matter? *Global Public Health*. https://doi.org/10.1080/17441692.2014.904917.

Settertobulte, W., & Palentien, C. (1996). Gesundheitserziehung in der Familie. In J. Mansel (Ed.), *Glückliche Kindheit — Schwierige Zeit?* (pp. 102–112). Wiesbaden: VS Verlag für Sozialwissenschaften.

Soons, J. P., & Kalmijn, M. (2009). Is marriage more than cohabitation? Well-being differences in 30 European countries. *Journal of Marriage and Family*(71), 1141–1157.

Spallek, J., & Razum, O. (2007). Gesundheit von Migranten: Defizite im Bereich der Prävention. *Medizinische Klinik (Munich, Germany: 1983)*. https://doi.org/10.1007/s00063-007-1058-8.

Statistisches Bundesamt. (2011). *Fachserie 1 Reihe 2.2 Bevölkerung und Erwerbstätigkeit: Bevölkerung mit Migrationshintergrund. Ergebnisse des Mikrozensus 2009*. Wiesbaden.

Statistisches Bundesamt. (2015a). *Bevölkerung und Erwerbstätigkeit: Haushalte und Familien. Ergebnisse des Mikrozensus 2014*. Wiesbaden.

Statistisches Bundesamt. (2015b). *Bevölkerung und Erwerbstätigkeit. Bevölkerung mit Migrationshintergrund.: Ergebnisse des Mikrozensus*. Wiesbaden.

Statistisches Bundesamt. (2015c). *Erläuterungen zum Mikrozensus*. https://www.destatis.de/DE/ZahlenFakten/GesellschaftStaat/Bevoelkerung/Methoden/Mikrozensus.html. Accessed June 9, 2015.

Sturm, R. (2002). The effects of obesity, smoking, and drinking on medical problems and costs. *Health Affairs*, https://doi.org/10.1377/hlthaff.21.2.245.

UN. (2010). *Global strategy for women's and children's health*. New York.

van Balen, F., & Trimbos-Kemper, T. C. (1993). Long-term infertile couples: a study of their well-being. *Journal of Psychosomatic Obstetrics and Gynaecology, 14*(Suppl), 53–60.

Viruell-Fuentes, E. A., & Schulz, A. J. (2009). Toward a dynamic conceptualization of social ties and context: implications for understanding immigrant and Latino health. *American Journal of Public Health*. https://doi.org/10.2105/AJPH.2008.158956.

Verbrugge, L. M. (1989). The twain meet: Empirical explanations of sex differences in health and mortality. *Journal of Health and Social Behavior*, *30*(3), 282–304.

Walters, V., McDonough, P., & Strohschein, L. (2002). The influence of work, household structure, and social personal and material resources on gender differences in health: an analysis of the 1994 Canadian National Population Health Survey. *Social Science and Medicine, 54*, 677–692.

Wetzels, P., & Brettfeld, K. (2007). *Muslime in Deutschland: Integration, Integrationsbarrieren, Religion und Einstellungen zu Demokrtie*. Berlin: Rechtsstaat und politisch-religiös motivierter Gewalt.

Wilkinson, R. G., & Marmot, M. G. (2003). *Social determinants of health: The solid facts*. Copenhagen: World Health Organization, Regional Office for Europe.

Willekens, F. (2015). Demographic transitions in Europe and the world. In K. Matthijs (Ed.), *Population change in Europe, the Middle-East and North Africa*: *Beyond the demographic divide* (pp. 13–44, International Population Studies). Burlington: Ashgate Publishing.

Williams, K., & Umberson, D. (2004). Marital status, marital transitions, and health: A gendered life course perspective. *Journal of Health and Social Behavior*. https://doi.org/10.1177/002214650404500106.

Wittig, U., Merbach, M., Siefen, R. G., & Brähler, E. (2004). Beschwerden und Inanspruchnahme des Gesundheitswesens von Spätaussiedlern bei Einreise nach Deutschland. *Das Gesundheitswesen*. https://doi.org/10.1055/s-2004-812799.

Woellert, F., & Klingholz, R. (2014). *Neue Potenziale: Zur Lage der Integration in Deutschland*. Berlin: Berlin Institut f. Bevölkerung u. Entwicklung/Berlin Institute for Population and Development.

Worbs, S., Bund, E., Kohls, M., & Babka von Gostomski, C. (2013). *(Spät-)Aussiedler in Deutschland: Eine Analyse aktueller Daten und Forschungsergebnisse* (Forschungsbericht/

Bundesamt für Migration und Flüchtlinge, Vol. 20). Nürnberg: Bundesamt für Migration und Flüchtlinge.
World Health Organization. (2002). *The world health report 2002—Reducing risks, promoting healthy life*.
World Health Organization. (2010). *Gender, women and primary health care renewal: A discussion paper*. Geneva: World Health Organisation.
Zunzunegui, M. V., Béland, F., & Otero, A. (2001). Support from children, living arrangements, self-rated health and depressive symptoms of older people in Spain. *International Journal of Epidemiology, 30*(5), 1090–1099.
Zwick, M. M. (2007). Migration, Ernährung und Körper - das Beispiel türkischer MigrantInnen in Deutschland. *SIETAR*(2), 13–17.

11.2 Study II

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RESEARCH Open Access

The effect of informal caregiving on physical health among non-migrants and Ethnic German Immigrants in Germany: a cohort analysis based on the GSOEP 2000–2018

Daniela Georges*

Abstract

Background: The number of people in need of care in Germany has been rising since decades, which is related to an increasing need and relevance of informal caregiving. Likewise, the number of people with a migration background has been increasing. This study aims to analyse the impact of informal caregiving on physical health in comparative perspective for Ethnic German Immigrants (EGI) – the largest and oldest immigrant group in Germany – and non-migrant Germans (NMG).

Methods: The sample was drawn from the years 2000–2018 of the German Socio-Economic Panel ($n = 26{,}354$). NMG ($n = 24{,}634$) and EGI ($n = 1{,}720$) were categorized into non-caregivers ($n = 24{,}379$) and caregivers ($n = 1{,}975$), where the latter were distinguished by 1) their caregiving status and history (current, former, and never caregiver) and 2) the number of years in the caregiver role. Generalized Estimating Equations were applied to examine main effects and the interaction effects of caregiving status and migration background for changes in physical health ($n = 102{,}066$ observations).

Results: Adjusting for socioeconomic, household related, and individual characteristics, NMG and EGI had similar caregiving patterns and physical health. However, the interaction between migration background and caregiving revealed significantly higher declines in physical health for currently caregiving EGI. Sensitivity analyses indicated that particularly socioeconomic resources moderated this effect.

Conclusions: Findings suggest that caregiving is associated with declines in physical health, particularly in the long term and for EGI. This implies that care-related disadvantages accumulate over time and that the association of caregiving, health and associated determinants are culturally diverse and shaped by migration background. Both the health disadvantages of caregivers and EGI might be mitigated by a positive social and socioeconomic setting, which highlights the relevance of supporting structures and benefits for these subgroups.

Keywords: Health disparities, Longitudinal analysis, Long-term care, Immigrant health, Panel Analysis

Background

Ageing societies and the associated increase in the number of people requiring long-term care (LTC) coincidently increase the number of individuals providing care for the spouse, for relatives, friends, neighbours, or other loved ones [1–3]. Providing such (usually unpaid)

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informal care can be demanding and research reports a negative impact of caregiving on the caregiver's physical and psychological health [4–6]. Another current demographic development concerns the growing number of people with migrant status in many European countries [7, 8], who gradually will also reach care-relevant ages and will require LTC. This article analyses the impact of informal caregiving on physical health and its difference between migrants and non-migrants in Germany.

LTC in Germany: demand, LTC insurance and supply

Approximately 14% of the population in Germany (~ 11.6 million persons) have lasting limitations in instrumental activities of daily living [9]. Of these, 4.1 million have a recognized need for LTC ("care level"). In Germany, a "care level" expresses the degree of need for care of a person, which is officially assessed and determined by the LTC insurance funds, and is linked to benefits from the statutory social care insurance [10]. Eligibility for benefits is based on an assessment of individual daily living abilities; it depends on the amount and intensity of support needed and includes care benefits (for inpatient or outpatient professional care) and/or care allowance (financial benefits if the care is provided informally). In contrast, the majority of people with limitations do not receive state benefits, i.e. irrespective of disability no care level has been requested or approved. Both groups usually live and are cared for at home, thus informal home care is a central pillar of the German care system [10, 11]. This informal care is provided by 9% of the adult German population [12], 61% of which within households, usually by close relatives, particularly by children (37%) or partners (32%) [13].

Caregivers' health

So far, the majority of studies on the impact of (informal) care on health has focussed on psychological health, while research on physical health is much less available [14, 15]. The impact of caregiving on physical health has been reported ambiguously in previous studies [16, 17], but tends to be negative [17–19] due to three mechanisms. First, there are health spillovers within families and household members, i.e. the illness – such as care need – of one member induces health decreases of the others [20, 21]. Second, transition into caregiving is accompanied by occupational, social, and organizational strains [22, 23]. And third, caregiving is physically demanding and induces physical stress [24]. Vitaliano et al. (2003) derived the caregiving-health-association as a path from the onset of caregiving through distress and physiological responses to illness. Psychological reactions therefore precede physical reactions [25]. This model has been proven in terms of psychological and physical health [26, 27], and path dependency [28]. The spillovers and the adverse effects of care were particularly pronounced in couples [27, 29].

Considering Stress and Coping Models [30, 31], the intensity and speed of caregiving effects on health are determined by needs and resources. "Needs" include both requirements of the care recipient, such as type/cause of care need, scope of limitations, amount of care need, and other obligations, such as employment or (further) family responsibilities, while "resources" cover economic, emotional, social, and personality characteristics. Higher needs and lower resources elevate the negative effects of care and enhance coping strategies. Thus, for example, long-term caregivers, persons with higher stress levels, carers with multiple caregiving roles, and ethnic minorities are more affected by caregiving [16, 32–34].

Caregiving, health and ethnic differences

Culturally diverse aspects, such as family and role models, perceptions of illness, the acceptance of external care provisions, and motives to provide care, shape need-resource-patterns and the impact of caregiving on health [35]. Cultural differences are linked to different health care utilization patterns and behaviours in the case of care need [36, 37], and they have a complex effect on coping strategies [38]. Referring to Stress and Coping Models, ethnic differences in terms of socioeconomic status, family responsibilities, and individual resources must be assumed [39]. Additionally, temporal and situational differences, i.e. the timing of caregiving in the life course and the care patient's characteristics, might contribute to ethnic differences [40]. Regarding physical health, studies have found greater health disadvantages among caregiving immigrants [35, 41, 42].

This study covered Ethnic German Immigrants (EGI), who are the oldest and largest group of persons with an immigrant background in Germany. In the year 2020, approximately 2.5 million EGI lived in Germany [43], with high levels of EGI immigration taking place in the 1990s [44]. EGI are descendants of people who emigrated from Germany before the 20th Century or who stayed in former German regions after the Second World War. This means they are "Germans by status", and they can acquire German citizenship directly [45]. Usually, EGI have migrated to Germany voluntarily and have unrestricted access to social welfare benefits and health services [46]. EGI have a greater cultural proximity to the autochthonous population, higher educational levels, lower return migration rates, and an older age structure than other immigrant groups [46]. However, EGI differ from the autochthonous population in Germany because they (or their descendants) have witnessed minority experiences abroad, have a history of migration including integration

processes, have a lower socioeconomic status, live in rather traditional family structures, have more traditional attitudes, claim most health services less often, and are more likely to receive informal care [35, 46–48].

Thus, while there are differences in terms of needs and resources, no temporal and situational care-related differences between EGI and NMG have been identified thus far [49]. Hence, considering EGI are motivated by two gainful characteristics: firstly, they are currently one of the few immigrant populations that have already reached care-relevant ages. Considering that both EGI and other immigrant groups are united by the migration experience itself, findings for EGI might provide important insights for (yet) younger immigrant populations, e.g. Muslims or refugees. Secondly, the cultural, structural and legal proximity of EGI and NMG enables to examine the direct and indirect effects of migration background and minority status on the caregiving-health association, which is less influenced by further heterogeneity. EGI may undergo a higher stress level when becoming a caregiver due to different reasons, for example higher expectations to provide care informally within the family, lower rates of utilization of state and professional services, and lower social and economic resources. Therefore it was hypothesized that caregiving is more detrimental for the health of EGI than for NMG. It was further hypothesized that particularly in the long-term care is associated with worse health among EGI, when health-, care- and migration-related disadvantages accumulate.

Methods

Sample

This study used longitudinal data from the German Socio-Economic Panel covering the years 2000 to 2018 (GSOEP 2000–2018). The GSOEP is the largest and longest-running multidisciplinary, representative yearly household panel in Germany [50]. Due to its high annual response rates (e.g. 85.3% in 2018 [51]), and the relatively low panel attrition [52], the GSOEP was particularly suitable for this cohort study. A detailed health questionnaire has been included every two years since 2002. The years 2000 and 2001 were used to identify characteristics related to informal caregiving prior to the earliest possible baseline (in 2002) which are necessary to identify non-caregiving individuals in the year 2002. At baseline, the sample was restricted to NMG and EGI with at least one non-caregiving physical health measurement for a period of at least one year prior to the interview, i.e. in order to identify individuals with a valid baseline measurement in the year 2002, it was necessary to include information from the years 2000 and 2001. Excluding prevalent caregivers at baseline permits the study of the impact of the current caregiving status and the (observed) duration of caregiving. Moreover, individuals who have a need of care themselves were excluded to avoid interference. In the follow-up they needed to have at least one subsequent physical health measurement with or without caregiving. A large proportion of the observations of the data set from the years 2000 to 2018 had to be excluded due to an insufficient number of physical health measurements. Less than 2 physical health measurements were available for 41,015 individuals in the temporary data set (of which one measurement for 22,853 individuals, and no measurement at all for 18,162 individuals). This large proportion is driven by the fact that some of the individuals were surveyed for the last time prior to 2004 (7,796 individuals) respectively for the first time after 2016 (10,337 individuals), and thus per se could not achieve two health measurements. Panel attrition and mortality additionally contributed to a loss of analysable observations. The final analyses covered 26,354 individuals with a total of 102,066 observations of health changes. (see Fig. 1).

Measures

Physical health changes

Physical health was measured using the Physical Component Summary (PCS), which is one of the two main dimensions of the Short-Form 12 Survey and subsumes six items: one on general health, one on physical pain, two on physical limitations, and two on physical health problems. PCS provided a metric scale from 0 to 100. Higher PCS scores indicated better health, where for each year the values were transformed and mean-centred to 50 (SD = 10) [53]. The observed outcomes were absolute changes in physical health from baseline onwards (Δpcs), calculated by $\Delta pcs_j = pcs_{it+j} - pcs_{it=0}$, where $pcs_{it=0}$ denotes the physical health at baseline t = 0 and pcs_{it+j} the physical health of each subject (i) in the next following valid year after baseline (t + j). Negative values indicated physical health deterioration and positive values health improvements since baseline. The number of health changes per subject (j) was between 1 and 8.

Caregiving

"Caregiving" referred to informal caregiving and was measured twofold: if either at least one person within the household mentioned being in need of care and/or if a person mentioned that s/he provided care for at least two hours on average weekdays. Both information referred to self-disclosure, whereby the granting of the need of care is based on a standardized medical assessment of the individual autonomy and functional limitations. The average duration of caregiving covered only subjective assessments and no information on the tasks associated with caregiving. All persons to whom at least

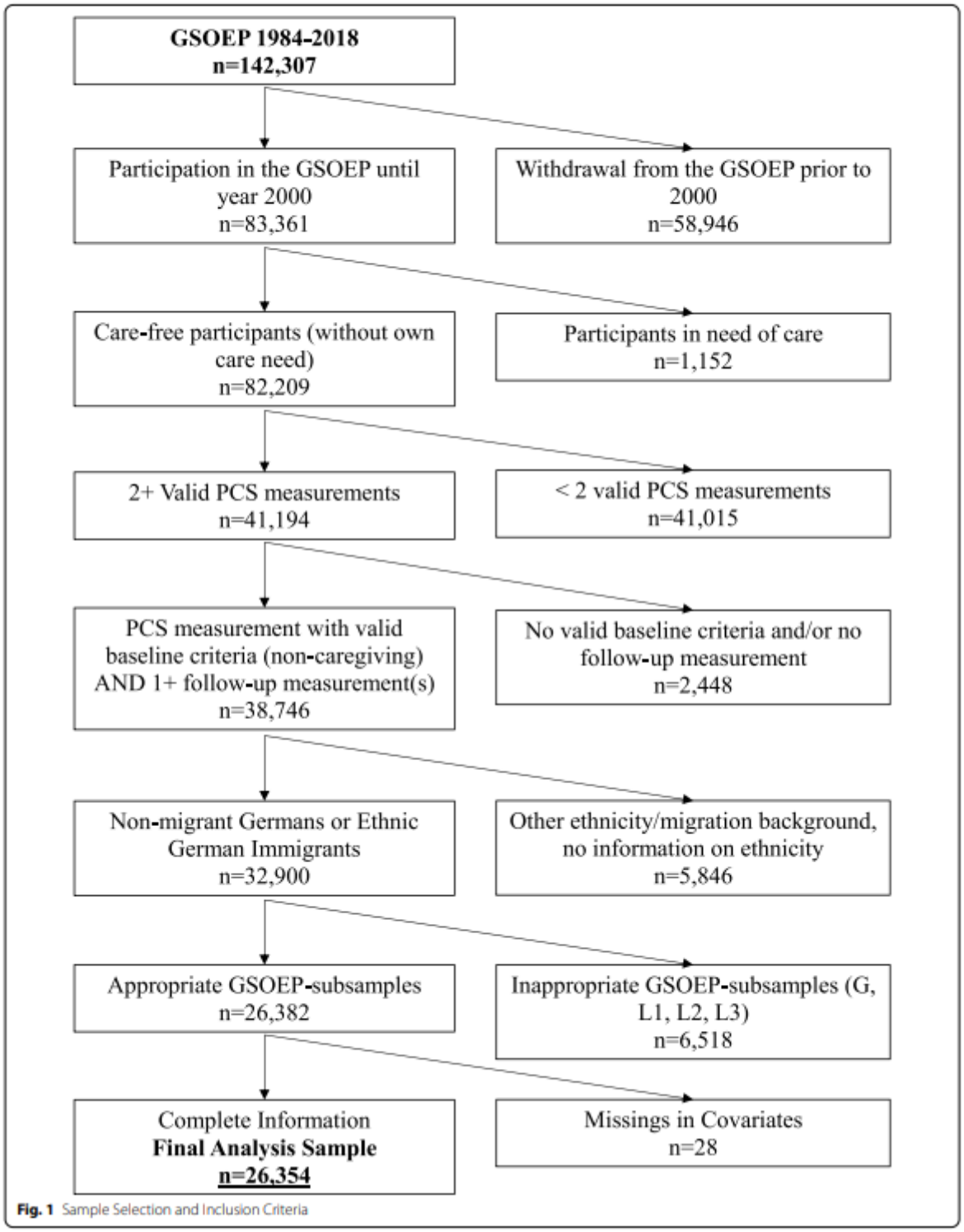

Fig. 1 Sample Selection and Inclusion Criteria

one of these characteristics applied were categorised as "Caregivers", all the other as "Non-Caregivers". The incidence of the caregiver status was identified by a period of at least one non-caregiving year prior to the baseline. To analyse path dependencies, the group of caregivers is differentiated by the caregiving history and the current caregiving status from incident caregiving onwards (current caregivers, former caregivers). For the sensitivity analysis, the number of years in the caregiver role from incident caregiving onwards was included (metric and categorized into: 1–2 years; 3–4 years; 5 + years).

Migration background

Non-migrant Germans (NMG) and Ethnic German Immigrants (EGI) were provided two separate categories. All subjects for whom none of the characteristics included in the GSOEP (own/parental migrant history, country of birth, country of origin, nationality, immigrant group, and sample group) indicated an immigrant background were defined as NMG. The status of belonging to the immigrant group of EGI was asked directly ("Which of the following immigrant categories did you belong to when you moved to Germany?" […] "Person of German descent from Eastern Europe") and was used as a classification criterion.

Covariates

The set of covariates covered socio-economic and household-related health determinants that particularly reflected the "resource" dimension of the above-mentioned Stress and Coping Models and that have been identified as essential in earlier studies [6, 54], and included time-constant and time-variant characteristics. Time-constant characteristics referred to the baseline year and included age (< 50 years; 50–59; 60–69; 70–79; 80 +), sex (male; female), family status (unmarried; married-living together; married-not living together; divorced; widowed), education (based on the International Standard Classification of Education (ISCED) 1997: lower than middle vocational (i.e. in school, inadequately, general elementary (ISCED levels 0–2)); middle vocational (ISCED level 3); vocational + Abitur (ISCED level 4); higher vocational (ISCED level 5); higher (ISCED level 6)), and baseline physical health (PCS, metric, mean centred). Time-variant characteristics were changes from baseline onwards in employment status (status at baseline (full time; part time; marginally employed; non-working)*change in working hours (more; less; constant)) and household income (income quartiles at baseline*change (decrease (> -10%); increase (> + 10%); constant)), mental health (Mental Component Summary, metric, mean centred), and household composition (single household; couple household (without children); single parents; couple with underage children (< 16 years); couple with adult children (age 16 + years); multigenerational household; others/missing). In addition, two design variables were accounted for: the GSOEP-subsample (time-constant; at baseline), and the distance between follow-up PCS measurement and baseline (in years, metric, time-variant). The study design is illustrated in Fig. 2.

Data analysis

Descriptive analyses were performed to report background characteristics of the sample and compositional differences by migration background and caregiving status. Bivariate analyses by chi-square tests and t-tests were performed to determine bivariate associations between caregiving status and covariates respectively migration background and covariates. Multivariate analyses for PCS changes were based on Generalized Estimating Equations (GEE) [55]. The models were specified with the identity link function for normally distributed outcomes, and with an independent within-person residual covariance matrix which proved to be the best covariance structure using the qic routine in Stata [56, 57]. Analyses comprised GEE models for the whole sample, and GEE models with interaction effects. Three step-wise models with subsequently added mediators and covariates were estimated: Model 1 included migration background and caregiving status, age, sex, baseline physical health and mental health as covariates, and accounts for the two design variables (distance to baseline; GSOEP-subsample). Household characteristics were added in Model 2, and socioeconomic characteristics were added in Model 3. Sensitivity analyses included tests for different thresholds of caregiving hours to distinguish caregivers and non-caregivers, analyses including the number of (observed) years a person provided care, models including care-related characteristics (i.e. information on the number of caregiving hours, the presence of a person in need of care within the household) for the total sample and the caregiver-subsample, models without adjustment for mental health, and models stratified by migration background.

Results

Descriptives

The sample comprised 102,066 observations, with an average physical health decline of -2.01 scale points. Of these observations, 6,992 (6.85%) referred to the period since initial caregiving and 5,254 (5.15%) were from EGI (Table 1).

Compared to non-caregivers, caregivers had higher physical health declines (-2.63 vs. -1.96) and lower physical health at baseline (48.66 vs. 51.43) (Table 1). Within

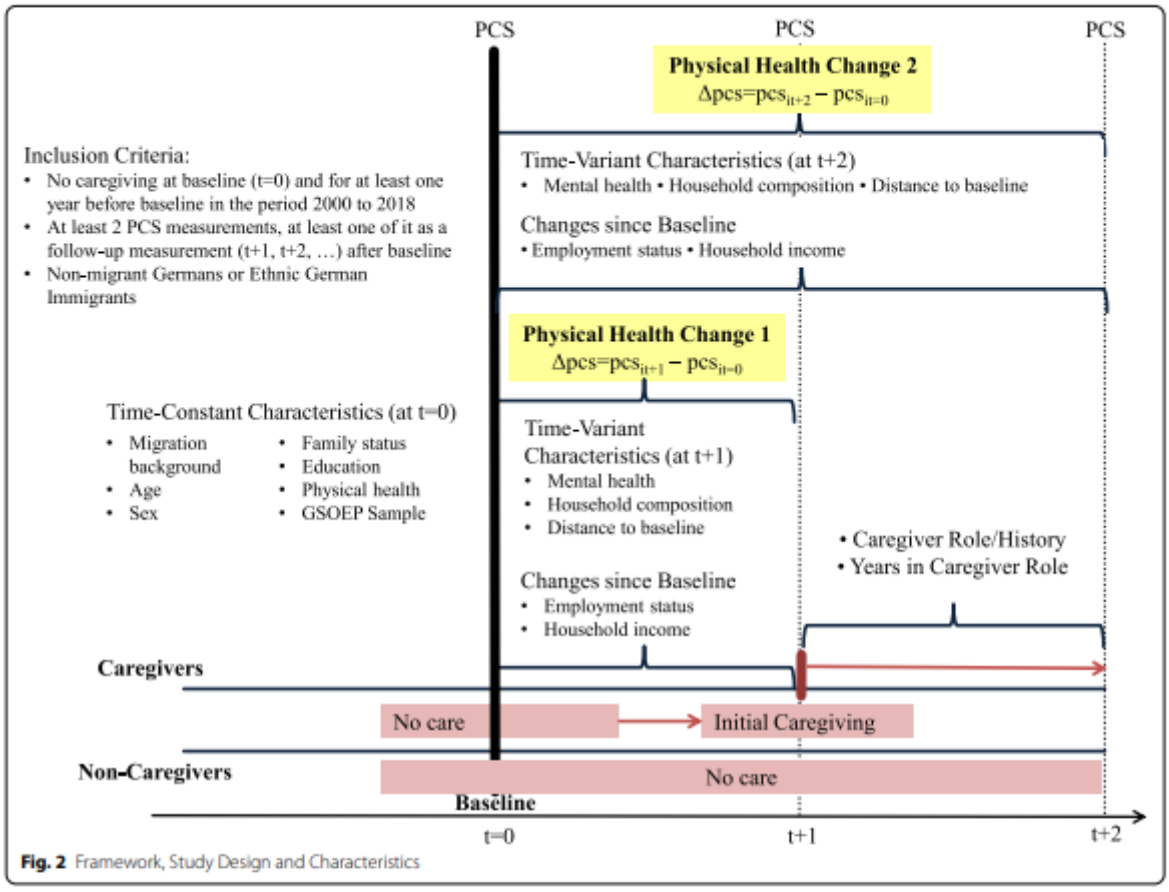

Fig. 2 Framework, Study Design and Characteristics

the group of caregivers, physical health declines were remarkably lower for current caregivers than for former caregivers (-2.38 vs. -2.78). There were mixed results when comparing NMG and EGI. Non-caring EGI had lower physical health at baseline than NMG (50.36 vs. 51.49), but lower physical health declines over time (-1.60 vs. -1.98). Currently caregiving EGI had remarkably higher physical health declines (-3.89 vs. -2.29) and former caregiving EGI had remarkably lower physical health declines (-0.91 vs. -2.86) than did NMG counterparts. However, the lower physical health at baseline of caregiving EGI compared to caregiving NMG is noticeable (current caregivers: 46.64 vs. 48.27; former caregivers: 46.53 vs. 49.07) (Table 1).

In the sample, the majority was younger than 50 years (62.50%), female (52.06%), married and living together at baseline (58.28%), lived in a couple household without children (37.45%) or with (underage or adult) children (37.93%), had a middle vocational degree (52.14%), and worked full time at baseline (46.27%). While household income generally increased over the time period (47.04%), the employment status and the working hours did not change that much (no change: 70.40%). Both physical health at baseline (PCS = 51.24) and mental health (MCS = 50.67) were slightly above the population average.

Considering differences by migration background, EGI were more frequently never or currently caregiving, were slightly more frequently in the middle age groups (ages 50 to 79), were more frequently married and living together or living in couple households with children (particularly underage children), had slightly more frequently educational degrees up to "middle vocational", had lower household incomes, and were more frequently working part-time or constantly non-working (each $p < 0.05$). While physical health at baseline and physical health declines over time were significantly lower for EGI, mental health (MCS) was significantly higher. The physical health change over time and rates of caregiving did not differ significantly between EGI and NMG. (Table 2; detailed results upon request).

Table 1 PCS and ΔPCS by Caregiving Status and Migration Background ($n = 26,354$; $N = 102,066$)

Groups (individuals/observations)	PCS at baseline (sd)	ΔPCS (sd)
Sample ($n = 26,354/102,066$)	51.24 (9.22)	-2.01 (8.62)
NMG ($n = 24,634/96,812$)	51.30 (9.19)	-2.03 (8.60)
EGI ($n = 1,720/5,254$)	50.14 (9.79)	-1.65 (8.89)
Non-Caregivers ($n = 24,379/95,074$)	51.43 (9.18)	-1.96 (8.55)
NMG ($n = 22,723/90,136$)	51.49 (9.15)	-1.98 (8.53)
EGI ($n = 1,616/4,938$)	50.36 (9.73)	-1.60 (8.86)
Caregivers ($n = 1,975/6,992$)	48.66 (9.40)	-2.63 (9.46)
Current caregivers ($n = 1,881/2,724$)	48.18 (9.47)	-2.38 (9.41)
NMG ($n = 1,784/2,569$)	48.27 (9.44)	-2.29 (9.35)
EGI ($n = 97/155$)	46.64 (9.86)	-3.89 (10.28)
Former caregivers ($n = 1,495/4,268$)	48.97 (9.35)	-2.78 (9.49)
NMG ($n = 1,430/4,107$)	49.07 (9.30)	-2.86 (9.53)
EGI ($n = 65/161$)	46.53 (10.23)	-0.91 (8.29)

Calculations based on GSOEP 2000–2018

All 'Caregivers' have at least one observation as 'Current caregivers' or as 'Former caregivers'

Considering differences by caregiving status, physical health at baseline was highest among non-caregivers and differed significantly across the groups. Physical health declines over time were significantly lower for non-caregivers than for caregivers but did not differ significantly within the group of caregivers. Moreover, caregivers were more frequently females, had more frequently low or medium education levels, more frequently reduced the number of hours worked, and were older than non-caregivers. The latter was particularly true for current caregivers, who moreover were more frequently married and lived without children. Finally, a decrease of the household income was most frequently among former caregivers. (see Additional File 1).

GEE models

GEE models were estimated to adjust for additional covariates and to adjust for structural differences by migration background and caregiving status as above-mentioned described. Model 1 was the basic model, and included migration background and caregiving status as the main explanatory variables, and some covariates. Caregiving and migration background significantly affected physical health changes (Table 3, Model 1). Caregivers had significantly higher physical health declines, which were more pronounced for current caregivers (-0.73, 95% CI: -1.02,-0.44) than for former caregivers (-0.54, 95% CI: -0.78, -0.30). Additionally, among EGI health declined significantly faster (-0.56, 95% CI: -0.79, -0.34) than among NMG (Additional File 2, Model 1). Adjusting for household characteristics in Model 2, care-related health disadvantages (former caregivers: -0.45, 95% CI: -0.69, -0.22; current caregivers: -0.63, 95% CI: -0.92, -0.34) were reduced, but remained significant, and differences by migration background were almost the same (EGI: -0.55; 95% CI: -0.77, -0.32) (Table 3, Model 2; Additional File 2, Model 2). Socio-economic characteristics, included in Model 3, largely mediated the main effects. Both, the health of former caregivers (-0.32; 95% CI: -0.55, -0.09) and the physical health of current caregivers (-0.44; 95% CI: -0.72, -0.15) deteriorated significantly faster than that of non-caregivers. Moreover, among EGI physical health declines were significantly more pronounced than for NMG (-0.32; 95% CI: -0.55, -0.10) (Table 3, Model 2; Additional File 2, Model 2). Regarding the control variables, applying the Wald test, it can be shown that (apart from sex) each characteristic was associated with physical health changes (each $p < 0.01$) (Table 3, Model 3). Adjusted for migration background, caregiving, and the respective other covariates, physical health declined faster at older ages, among divorced, widowed or separately living married individuals, for all household compositions compared to couples with underage children, for persons with non-middle vocational or higher vocational education levels, for those with income decrease and the first three income quartiles at baseline, and for those who reduced their working hours or were constantly non-working. Physical health declines were additionally higher for individuals with better physical health at baseline and with higher mental health (Additional File 2, Model 3).

Interaction effects between caregiving and migration background

To examine migration-related mechanisms and differences in physical health changes and the association of caregiving and physical health changes, interaction effects were estimated. Again, the strategy was to apply three step-wise models, and subsequently add covariates. Overall, the interaction effect was significantly associated with physical health changes in all Models ($p < 0.001$), and thus, there were differences in the caregiving-health-association by migration background (Table 4; Fig. 3). Currently caregiving EGI had additional declines in physical health, and these significantly exceeded the declines of NMG (-1.28, 95% CI: -2.51, -0.06) (Table 4, Model 3). This tendency persisted across the three models, but was only significant adjusting for socio-economic characteristics.

Table 2 Characteristics of the Sample ($n = 26,354$), NMG ($n = 24,924$), and EGI ($n = 1,430$)

		Total		NMG		EGI		Difference NMG—EGI
Variable		**N**	**%**	**N**	**%**	**N**	**%**	***p*-value**
	Total	**102,066**	**100**	**96,812**	**100**	**5,254**	**100**	
Physical Health at baseline (PCS) (mean) (t-c)		51.24		51.30		51.03		***a
Change (compared to baseline) (t-v) (mean)		-2.01		-2.03		-1.65		*a
Caregiving (t-v)	Non-Caregivers	95,074	93.15	90,136	93.10	4,938	93.99	***
	Former caregivers	4,268	4.18	4,107	4.24	161	3.06	
	Current caregivers	2,724	2.67	2,569	2.65	155	2.95	
Years in caregiver role (t-v)	0 (non-caregivers)	95,074	93.15	90,136	93.10	4,938	93.99	*
	1–2 years	4,928	4.83	4,719	4.87	209	3.98	
	3–4 years	1,222	1.20	1,159	1.20	63	1.20	
	5 + years	842	0.82	798	0.82	44	0.84	
Years in caregiver role (mean) (t-v)		0.09		0.09		0.09		a
Migration back-ground (t-c)	Non-migrant Germans (NMG)	96,812	94.85	96,812	100.00			
	Ethnic German Immigrants (EGI)	5,254	5.15			5,254	100.00	
Age (years) (baseline) (t-c)	< 50 years	63,787	62.50	60,584	62.58	3,203	60.96	*
	50–59	16,110	15.78	15,227	15.73	883	16.81	
	60–69	14,785	14.49	14,018	14.48	767	14.60	
	70–79	6,338	6.21	5,982	6.18	356	6.78	
	80 +	1,046	1.02	1,001	1.03	45	0.86	
Age (years) (baseline) (mean) (t-c)		44.23		44.21		44.48		a
Sex (t-c)	Male	48,933	47.94	46,560	48.09	2,373	45.17	***
	Female	53,133	52.06	50,252	51.91	2,881	54.83	
Mental Health (MCS Scale) (mean) (t-v)		50.67		50.65		51.03		**a
Family status (baseline) (t-c)	Unmarried	28,233	27.66	27,293	28.19	940	17.89	***
	Married—living together	59,489	58.28	55,755	57.59	3,734	71.07	
	Divorced	7,681	7.53	7,381	7.62	300	5.71	
	Widowed	4,771	4.67	4,574	4.72	197	3.75	
	Married—not living together	1,892	1.85	1,809	1.87	83	1.58	
Household composition (t-v)	Single household	17,952	17.59	17,256	17.82	696	13.25	***
	Couple household (w.o. children)	38,222	37.45	36,388	37.59	1,834	34.91	
	Single parents	5,507	5.40	5,229	5.40	278	5.29	
	Couple w underage children	23,314	22.84	21,783	22.50	1,531	29.14	
	Couples w adult ch. (age 16 +)	15,404	15.09	14,603	15.08	801	15.25	
	Multigenerational household	855	0.84	791	0.82	64	1.22	
	Other composition/missing	812	0.80	762	0.79	50	0.95	
Education (t-c)	Lower than middle vocational	9,267	9.08	8,448	8.73	819	15.59	***
	Middle vocational	53,218	52.14	50,874	52.55	2,344	44.61	
	Vocational + Abitur	6,420	6.29	5,676	5.86	744	14.16	
	Higher vocational	8,551	8.38	8,175	8.44	376	7.16	
	Higher	24,610	24.11	23,639	24.42	971	18.48	

Table 2 (continued)

Variable		Total		NMG		EGI		Difference NMG—EGI
		N	%	N	%	N	%	*p*-value
	Total	**102,066**	**100**	**96,812**	**100**	**5,254**	**100**	
Household Income at baseline (quartiles Q1-Q4) * Change (t-v)	Q1, Decrease > -10%	4,713	4.62	4,392	4.54	321	6.11	***
	Q2, Decrease > -10%	6,889	6.75	6,447	6.66	442	8.41	
	Q3, Decrease > -10%	8,043	7.88	7,661	7.91	382	7.27	
	Q4, Decrease > -10%	8,139	7.97	7,911	8.17	228	4.34	
	Q1, Constant (± 10%)	7,108	6.96	6,659	6.88	449	8.55	
	Q2, Constant (± 10%)	7,432	7.28	6,992	7.22	440	8.37	
	Q3, Constant (± 10%)	7,212	7.07	6,870	7.10	342	6.51	
	Q4, Constant (± 10%)	4,518	4.43	4,392	4.54	126	2.40	
	Q1, Increase > + 10%	16,377	16.05	15,329	15.83	1,048	19.95	
	Q2, Increase > + 10%	13,792	13.51	12,935	13.36	857	16.31	
	Q3, Increase > + 10%	11,718	11.48	11,203	11.57	515	9.80	
	Q4, Increase > + 10%	6,125	6.00	6,021	6.22	104	1.98	
Employment Status at baseline * Change (t-v)	Full time—No Change	35,327	34.61	33,631	34.74	1,696	32.28	***
	Full time—Reduced	11,898	11.66	11,384	11.76	514	9.78	
	Part time—More	1,727	1.69	1,624	1.68	103	1.96	
	Part time—No Change	5,913	5.79	5,576	5.76	337	6.41	
	Part time—Reduced	3,062	3.00	2,914	3.01	148	2.82	
	Non-regular—More	1,828	1.79	1,729	1.79	99	1.88	
	Non-regular—No change	1,632	1.60	1,283	1.33	79	1.50	
	Non-regular—Reduced	1,382	1.35	1,320	1.36	62	1.18	
	Non-working—More	10,581	10.37	9,962	10.29	619	11.78	
	Non-working—No change	28,986	28.40	27,389	28.29	1,597	30.40	

Calculations based on GSOEP 2000–2018

p-value for categorical variables for difference between NMG and EGI is based on a chi-square test between migrant group and the independent variable, *p*-value for metric variables (a) is based on a t-test, *t-v* time-varying variables, *t-c* time-constant variables, $^{*}p < .05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Sensitivity analyses

Several sensitivity analyses were performed to evaluate the robustness of the results and potential third variables. Firstly, the main explanatory variable – caregiving – was checked. Caregivers were defined as all those who lived in a shared household with at least one person in need of care or who stated to care for others for at least two hours per day. This definition came close to definitions of previous studies [58, 59]. The results are largely robust, where lower thresholds predictably lead to slightly less distinct results, and higher thresholds are accompanied by higher statistically uncertainty due to the lower number of cases (20% of the caregiving observations referred to caregivers with two caregiving hours per day). Secondly, to model the care history more detailed, the number of years in the caregiver role since initial caregiving was used as the main explanatory variable (besides migration background). There is a negative association between the number of years and physical health (metric: -0.09, 95% CI: -0.15, -0.03; categorized: 0 years (ref.): 0; 1–2 years: -0.31, 95% CI: -0.53, -0.08; 3–4 years: -0.47, 95% CI: -0.90, -0.03; 5 + years: -0.52, 95% CI: -1.05, 0.00). Interacting with migration background, there were tendencies of worse physical health with increasing length of care among EGI, but these did not reach significance (each $p < 0.10$). Thirdly, to consider the burden associated with caregiving, a set of care-related characteristics was integrated. Both the number of daily caregiving hours and a shared household with a person in need of care ($N = 1{,}214$) had no distinct effect on physical health and did not interact with migration background. These characteristics were additionally tested on the caregiver-subsample ($N = 6{,}992$), but were not correlated with physical health and migration background. Additional characteristics related to the care recipient (care level, diseases, type of care need, external support) were considered and

Table 3 Linear Regression (GEE Models): Determinants of Physical Health Changes (overall *p*-values)

	Model 1	Model 2	Model 3
Variable	*p*	*p*	*p*
Caregiving (t-v)	< 0.001	< 0.001	< 0.001
Migration background (t-c)	< 0.001	< 0.001	0.005
Age (years) (baseline) (t-c)	< 0.001	< 0.001	< 0.001
Sex (t-c)	< 0.001	< 0.001	0.141
Physical Health at baseline (PCS) (mean) (t-c)	< 0.001	< 0.001	< 0.001
Mental Health (MCS Scale) (mean) (t-v)	< 0.001	< 0.001	< 0.001
Family status (baseline) (t-c)		< 0.001	< 0.001
Household composition (t-v)		< 0.001	< 0.001
Education (t-c)			< 0.001
Household Income at baseline (quartiles Q1-Q4) * Change (t-v)			< 0.001
Employment Status at baseline * Change (t-v)			< 0.001
Cons	< 0.001	< 0.001	< 0.001
N (obs.)	26,354	26,354	26,354
N (individuals)	102,066	102,066	102,066

Calculations based on GSOEP 2000–2018

Overall *p*-value for categorical variables based on Wald test; overall *p*-value for metric variables based on linear regression; all models were adjusted for design variables (distance to baseline, GSOEP-subsample), *t-v* time-varying variables, *t-c* time-constant variables, *NMG* Non-migrant Germans, *EGI* Ethnic German Immigrants

variable has been maintained. Finally, to evaluate migration-specific mechanisms, models stratified by migration background were estimated. Apart from economic characteristics and family status – family status at baseline, education, income, and occupational status/changes were largely irrelevant for EGI – the mechanisms were very similar for both groups. All analyses are available on request.

Discussion

In line with previous studies [17, 18] this study suggests physical health disadvantages among caregivers. These do both evolve directly with transition into caregiving and have a long-term effect beyond the care period. Although the impact of direct and indirect health spillovers [20, 21] could not be disentangled in this study, they might partly explain physical health disadvantages of caregivers. In addition, the occupational and social strains associated with incident caregiving [22, 23] seem to play a central role, as these characteristics moderated the health-care-relationship. Socioeconomic, household, and individual characteristics partially mediated the effect caregiving has on physical health, whereas older ages, lower levels of education, low incomes and income decreases, unemployment and leaving full-time occupation – and thus particularly socioeconomic characteristics – were associated with physical health declines. These findings are comparable to previous findings [27] and elucidate both

Table 4 Interaction effects Caregiving*Migration Background ($n = 26{,}354$; $N = 102{,}066$) (overall *p*-values, coefficients and corresponding *p*-values)

		Model 1			Model 2			Model 3		
EGI		Coeff	95% CI	*p*	Coeff	95% CI	*p*	Coeff	95% CI	*p*
Care-giving (t-v)	Overall[a]			< 0.001		< 0.001				< 0.001
	Non-caregivers (ref.)	0			0			0		
	Former caregivers	1.09	[-0.12,2.30]	0.077	1.23	[0.03,2.43]	0.044	0.90	[-0.29,2.10]	0.138
	Current caregivers	-1.12	[-2.37,0.12]	0.076	-1.13	[-2.37,0.10]	0.072	-1.28	[-2.51,-0.06]	0.040

Calculations based on GSOEP 2000–2018

[a] Overall *p*-value for the interaction effect based on Wald test; coefficients represent additional differences compared to NMG counterparts; M1 adjusted for migration background, caregiving status, age, sex, baseline physical health, mental health, distance to baseline, GSOEP-subsample, M2 additionally adjusted for family status at baseline, household composition, M3 additionally adjusted for education, household income at baseline*change, employment status at baseline*change, *t-v* time-varying variable, *ref.* reference category

examined exploratory, but could not be included meaningfully, and did not deliver reliable results due to many missing information. Fourthly, to recognize the interrelation between physical and mental health (MCS), models without MCS were estimated. This slightly reduced the physical health differences depending on the caregiving status, but had almost no effect on the association and interaction between migration background and physical health. As MCS improved the model substantially, this

the impact of economic changes associated with incidence of care [22, 23] and the mitigating effect of higher resources among caregivers [30]. Thus, interventions for the labour situation, e.g. a better reconciliation of care and employment, might reduce public health burdens and the health burden of caregivers [60, 61]. In addition, this study implies caregivers to have additional physical health disadvantages with increasing care duration over the life course [62]. This illustrates the accumulating

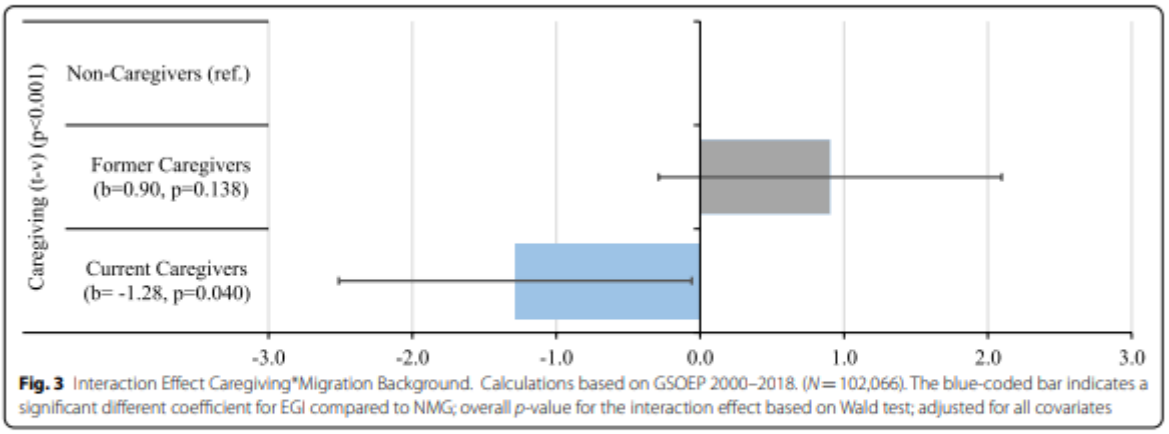

Fig. 3 Interaction Effect Caregiving*Migration Background. Calculations based on GSOEP 2000–2018. ($N = 102{,}066$). The blue-coded bar indicates a significant different coefficient for EGI compared to NMG; overall *p*-value for the interaction effect based on Wald test; adjusted for all covariates

negative impact caregiving has on physical health over time, and emphasizes the need to support caregivers in the long-term.

Differences in physical health changes between NMG and EGI were found across all models, indicating slightly higher health declines among EGI. Moreover, the results clarify that cultural differences shape the effect caregiving has on physical health [34], as the negative impact of caregiving is partly stronger among EGI. Currently caregiving EGI had additional physical health disadvantages over NMG by -1.28 points, which roughly equals the average (adjusted) difference between the age groups 60–69 and 70–79. Compared to the other coefficients, this was a noticeably strong effect. Neither socioeconomic, individual or household characteristics nor economic or employment changes explained these differences. However, socioeconomic resources were less important among EGI, while household characteristics appear to be more relevant and partly compensate for lower resources. The significant physical health advantages of caregiving EGI living in a couple household with underage children or living in a multigenerational household (results upon request) might indicate stronger intra-familial and intergenerational cohesion among EGI, which might reduce caregiver burdens [42]. Moreover, the transition into caregiving was culturally shaped. While the share of caregivers was similar for NMG and EGI, particularly EGI with poorer physical health at baseline transitioned into the caregiving role. However, while processing the data, it was noticeable that particularly EGI left the GSOEP after incidence of caregiving, thus their share was underestimated.

This study included main determinants of health, but could not fully cover the complex relationship between caregiving, physical health, and migration background. Thus, additional background characteristics and unobserved heterogeneity might be discussed. Considering stress and coping models, these cover sociocultural, interpersonal, and patient-related characteristics [32, 40]. While economic, organizational and psychological strains were integrated into the analyses, emotional and social strains [22, 63], motives to provide care [41, 42, 64], burdens associated with caregiving [65, 66], and external resources were not integrated depletive in favour of migration background and due to data restrictions. There might be differences by migration background in these characteristics. However, it is hypothesized that these only marginally mediate the strong and direct impact daily caregiving has on health. Subsequent studies might shed more light on characteristics of the care-recipient as well as the "need" dimension of caregiving considering stress and coping models. Path models could enable to understand passages and transitions, for example the transition into caregiving or the termination of caregiving.

As the analyses were based on longitudinal survey data, panel mortality and non-response might have biased the results. The share of persons with caregiving in the sample is 7.5% and thus slightly lower than other studies of Germany [12], but because only some years (up to a maximum timespan of 16 years per person) were analysed, this share seems reasonable. Nevertheless, the inclusion criteria might contribute to biased estimations. The sample only included non-caring individuals at baseline and thus prevalent as well as long-term caregivers were underrepresented. However, the sample's average physical and mental health was slightly higher, but essentially equal to the health status of the population in Germany. Regarding selective panel mortality, it is likely that ill people, persons with burdensome family events, and migrants were less included the sample [67, 68]. Moreover, survey participation usually is not evenly

distributed within the group of caregivers [69], and it has to be assumed that caregivers were underrepresented and positively selected, and thus the effects are rather underestimated. It must also be borne in mind that the information on the care status (depicting the presence of persons in need of care within the household and average care hours per working day) were based on unvalidated subjective self-assessment. The study design is associated with left- and right-censoring and thus with incomplete information, i.e. persons that used to provide care in the past might be misclassified as non-caregivers, while others were possibly not interviewed until transition into caregiving. Different selection into the sample by migration background cannot be completely excluded. Population-based surveys might solve this problem. Concerning selectivity into caregiving there is positive and negative selection, as persons living with underage children and non-higher vocational education levels are less likely to become caregivers, while persons aged 50 to 59, females, and individuals with better physical and mental health were more likely to provide care. Finally, EGI had a higher likelihood to turn into caregivers than NMG ($p < 0.001$; results upon request).

The longitudinal analyses based on Generalized Estimating Equations allowed for analysis of clustered data and determining associations of cause and effect in the limited framework of non-experimental studies. Background information was taken from the baseline year, which was measured before physical health changes by definition. Additionally, initial caregiving and information on the caregiving history always preceded the follow-up physical health measurement, which was used to quantify health changes. Interdependencies due to autocorrelation of time-variant characteristics, such as mental health, cannot be excluded, but GEE models consider these dependencies and are even robust in the case of misspecification [56, 70]. Usually, GEE models are highly eligible to perform epidemiological studies and cohort studies, and enable to measure average effects over the population of correlated data [71].

Despite the restrictions, the results indicate accumulating disadvantages of caregiving. Caregiving is emotionally and physically demanding and interventions to reduce the health risks of caregivers are needed to prevent caregivers from being the patients of tomorrow, and to reduce possible burdens on care systems and health systems. On the one hand, the analyses illustrate the breadth of potential mechanisms to reduce caregiver burdens, e.g. higher household incomes and employment. The positive effects of marriage and living with underage children underscore the relevance of social support and family cohesion. On the other hand, these results can only partly explain the correlation of caregiving and physical health. In addition to the aforementioned discussed characteristics, there may perhaps also be macrolevel factors [19] which determine the impact of informal caregiving and differences by migration background. Consultation and supporting structures, additional to benefits of the statutory long-term care insurance, might be helpful. The care-related physical health disadvantages of EGI, who are less likely to utilize state benefits and offers [72], emphasize the need to establish user-oriented and accessible state benefits. Moreover, considering these differences reveals the importance of multicomponent interventions at several levels to counteract caregiver burdens [65, 66].

Against the background of cultural and structural proximity of EGI and NMG, it may be discussed whether the associations might be even stronger for other immigrant groups [39]. In this study, in favor of homogeneity no additional groups were integrated. However, considering the care disadvantages of EGI, who are better integrated and healthier than other immigrant groups, it is plausible that the negative impact of caregiving might be even more pronounced for other immigrant groups.

Conclusions

This study contributes to a better understanding of the mechanisms of the caregiving-health-association, and thus helps us to understand the interrelation of the ageing process and providing informal care. Current demographic developments are accompanied by an increasing number of people in need of care who have a migration background, and caregivers, particularly immigrant caregivers, are vulnerable groups. The use of most current data helps us to understand contemporary and future challenges, and emphasizes that a steady care situation might be related to additional challenges for public health in the short-, medium- and long-term. The integration of migration background allows a better understanding of cultural, social, and household-related differences. However, subsequent studies might integrate additional contextual effects and expand the long-term perspective to disentangle the main drivers of care burdens and to understand developments and interdependencies properly.

Abbreviations

GSOEP: German Socio-Economic Panel; EGI: Ethnic German Immigrants; NMG: Non-migrant Germans; PCS: Physical Component Summary; SD: Standard Deviation; GEE: Generalized Estimating Equation; MCS: Mental Component Summary; T-c: Time-constant; T-v: Time-varying; Ref.: Reference category; 95% CI: 95% Confidence Interval; ISCED: International Standard Classification of Education.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12889-022-12550-0.

Additional file 1: Characteristics of the Sample (*n*=26,354), Non-Caregivers (24,379), Current Caregivers (*n*=1,881), and Former Caregivers (*n*=1,495).

Additional file 2: Linear Regression (GEE Models): Determinants of Physical Health Changes (coefficients and corresponding *p*-values).

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Authors' contributions
DG was responsible for the study concept and design, statistical data analysis, interpretation of data and results, literature review, and has drafted the work.

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Availability of data and materials
The raw data were drawn from the German Socio-Economic Panel Study (version 35, https://doi.org/10.5684/soep.v35). The data which support the findings of this study are available from the German Institute for Economic Research (DIW), but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. However, data are available from the authors for scientific research. All information about the public availability of the GSOEP data can be found at: https://www.diw.de/en/diw_01.c.601584.en/data_access.html.

Declarations

Ethics approval and consent to participate
All methods were performed in accordance with the relevant guidelines and regulations. The study protocols of SOEP-Core were approved by the German Institute for Economic Research [50]. Verbal informed consent was obtained from each subject prior to data collection. This procedure is compliant with the privacy agreement: https://www.diw.de/documents/dokumentenarchiv/17/diw_01.c.347090.de/soep_datenschutzverfahren.pdf. All data were anonymized prior to the author receiving the data. Ethics approval was not required due to the processing of anonymized data for this paper.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

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References

1. Christensen K, Doblhammer G, Rau R, Vaupel JW. Ageing populations: the challenges ahead. The Lancet. 2009;374:1196–208. https://doi.org/10.1016/S0140-6736(09)61460-4.
2. Pfaff H. People in Need of Long-term Care: The Present and the Future Ageing. In: Doblhammer G, Scholz R, editors. Care Need and Quality of Life: The Perspective of Care Givers and People in Need of Care. Wiesbaden: VS/GWV; 2010. p. 14–28. https://doi.org/10.1007/978-3-531-92335-2_1.
3. Pickard L, Wittenberg R, Comas-Herrera A, Davies B, Darton R. Relying on informal care in the new century?: informal care for elderly people in England to 2031. Ageing Soc. 2000;20:745–72.
4. Lee M, Ryoo JH, Crowder J, Byon HD, Williams IC. A systematic review and meta-analysis on effective interventions for health-related quality of life among caregivers of people with dementia. J Adv Nurs. 2020;76:475–89. https://doi.org/10.1111/jan.14262.
5. Roth DL, Fredman L, Haley WE. Informal caregiving and its impact on health: a reappraisal from population-based studies. Gerontologist. 2015;55:309–19. https://doi.org/10.1093/geront/gnu177.
6. Kong Y-L, Anis-Syakira J, Jawahir S, R'ong Tan Y, Rahman NHA, Tan EH. Factors associated with informal caregiving and its effects on health, work, and social activities of adult informal caregivers in Malaysia: findings from the National Health and Morbidity Survey 2019. BMC Public Health. 2021;21:1033. https://doi.org/10.1186/s12889-021-11022-1.
7. The World Bank. International migrant stock, total - European Union. 2021. (https://data.worldbank.org/indicator/SM.POP.TOTL?end=2015&locations=EU&start=1960&view=chartAccessed 22 Jun 2021).
8. Eurostat. Immigration. 2021. (https://ec.europa.eu/eurostat/databrowser/view/tps00176/default/tableAccessed 22 Jun 2021).
9. Robert Koch-Institut. Limitations in activities of daily living in old age in Germany and the EU – Results from the European Health Interview Survey (EHIS) 2. 2019. https://doi.org/10.25646/6226.2.
10. Federal Statistical Office (StatistischesBundesamt). People in need of long-term care. 2020. (https://www.destatis.de/EN/Themes/Society-Environment/Health/Long-Term-Care/Tables/people-long-term-care.htmlAccessed 22 Jun 2021).
11. Geyer J, Schulz E. Who cares?: Die Bedeutung der informallen Pflege durch Erwerbstätige in Deutschland [Who cares? The importance of informal care by the working population in Germany]. 2014.
12. Ehrlich U, Kelle N. Hilfe- und Pflegetätigkeiten im Lebensverlauf: wer pflegt, für wen, wo und wie?: [Help and care activities over the life course: who cares, for whom, where and how?]. Berlin; 2019.
13. Schneekloth U, Pupeter M, Geiss S. Studie zur Wirkung des Pflege-Neuausrichtungs-Gesetzes (PNG) und des ersten Pflegestärkungsgesetzes (PSG I): [Study on the Effect of the Nursing Restructuring Act and the First Care Support Act]. 2017.
14. Pinquart M, Sörensen S. Correlates of physical health of informal caregivers: a meta-analysis. J Gerontol B Psychol Sci Soc Sci. 2007;62:P126–37. https://doi.org/10.1093/geronb/62.2.P126.
15. Zwar L, König H-H, Hajek A. Consequences of different types of informal caregiving for mental, self-rated, and physical health: longitudinal findings from the German Ageing Survey. Qual Life Res. 2018;27:2667–79. https://doi.org/10.1007/s11136-018-1926-0.
16. Kim G, Allen RS, Wang SY, Park S, Perkins EA, Parmelee P. The Relation Between Multiple Informal Caregiving Roles and Subjective Physical and Mental Health Status Among Older Adults: Do Racial/Ethnic Differences Exist? Gerontologist. 2019;59:499–508. https://doi.org/10.1093/geront/gnx196.
17. Bom J, Bakx P, Schut F, van Doorslaer E. The Impact of Informal Caregiving for Older Adults on the Health of Various Types of Caregivers: A Systematic Review. Gerontologist. 2019;59:e629–42. https://doi.org/10.1093/geront/gny137.
18. Bauer JM, Sousa-Poza A. Impacts of Informal Caregiving on Caregiver Employment, Health, and Family. Population Ageing. 2015;8:113–45. https://doi.org/10.1007/s12062-015-9116-0.
19. Mohanty I, Niyonsenga T, Cochrane T, Rickwood D. A multilevel mixed effects analysis of informal carers health in Australia: the role of community participation, social support and trust at small area level. BMC Public Health. 2020;20:1801. https://doi.org/10.1186/s12889-020-09874-0.
20. Berman P, Kendall C, Bhattacharyya K. The household production of health: Integrating social science perspectives on micro-level health determinants. Soc Sci Med. 1994;38:205–15. https://doi.org/10.1016/0277-9536(94)90390-5.
21. Meyler D, Stimpson JP, Peek MK. Health concordance within couples: a systematic review. Soc Sci Med. 2007;64:2297–310. https://doi.org/10.1016/j.socscimed.2007.02.007.
22. Roth DL, Perkins M, Wadley VG, Temple EM, Haley WE. Family caregiving and emotional strain: associations with quality of life in a large national sample of middle-aged and older adults. Qual Life Res. 2009;18:679–88. https://doi.org/10.1007/s11136-009-9482-2.
23. Schulz R, Newsom J, Mittelmark M, Burton L, Hirsch C, Jackson S. Health effects of caregiving: the caregiver health effects study: an ancillary study

of the Cardiovascular Health Study. Ann Behav Med. 1997;19:110–6. https://doi.org/10.1007/BF02883327.
24 Schulz R, Sherwood PR. Physical and mental health effects of family caregiving. Am J Nurs. 2008;108:23–7. https://doi.org/10.1097/01.NAJ.0000336406.45248.4c (quiz 27).
25. Vitaliano PP, Zhang J, Scanlan JM. Is caregiving hazardous to one's physical health? A meta-analysis Psychological Bulletin. 2003;129:946–72. https://doi.org/10.1037/0033-2909.129.6.946.
26. Lee HS, Brennan PF, Daly BJ. Relationship of empathy to appraisal, depression, life satisfaction, and physical health in informal caregivers of older adults. Res Nurs Health. 2001;24:44–56.
27. Pinquart M, Sörensen S. Differences between caregivers and noncaregivers in psychological health and physical health: a meta-analysis. Psychol Aging. 2003;18:250–67.
28. Pruchno RA, Kleban MH, Michaels JE, Dempsey NP. Mental and Physical Health of Caregiving Spouses: Development of a Causal Model. J Gerontol. 1990;45:P192–9. https://doi.org/10.1093/geronj/45.5.P192.
29. Yorgason JB, Roper SO, Sandberg JG, Berg CA. Stress spillover of health symptoms from healthy spouses to patient spouses in older married couples managing both diabetes and osteoarthritis. Fam Syst Health. 2012;30:330–43. https://doi.org/10.1037/a0030670.
30. Lazarus RS, Folkman S. Stress, appraisal, and coping. 11th ed. New York: Springer; 2015.
31. Pearlin LI, Mullan JT, Semple SJ, Skaff MM. Caregiving and the stress process: an overview of concepts and their measures. Gerontologist. 1990;30:583–94. https://doi.org/10.1093/geront/30.5.583.
32. Ho SC, Chan A, Woo J, Chong P, Sham A. Impact of caregiving on health and quality of life: a comparative population-based study of caregivers for elderly persons and noncaregivers. J Gerontol A Biol Sci Med Sci. 2009;64:873–9. https://doi.org/10.1093/gerona/glp034.
33 R Schulz J Eden 2016 Family Caregiving Roles and Impacts R Schulz J Eden Families Caring for an Aging America Washington (DC) 73 122
34. Pharr JR, Dodge Francis C, Terry C, Clark MC. Culture, Caregiving, and Health: Exploring the Influence of Culture on Family Caregiver Experiences. ISRN Public Health. 2014;2014:1–8. https://doi.org/10.1155/2014/689826.
35. Tennstedt S, Chang BH. The relative contribution of ethnicity versus socioeconomic status in explaining differences in disability and receipt of informal care. J Gerontol B Psychol Sci Soc Sci. 1998;53:561-70. https://doi.org/10.1093/geronb/53b.2.s61.
36. Bowen ME, González HM. Racial/ethnic differences in the relationship between the use of health care services and functional disability: the health and retirement study (1992–2004). Gerontologist. 2008;48:659–67. https://doi.org/10.1093/geront/48.5.659.
37. Burton L, Kasper J, Shore A, Cagney K, LaVeist T, Cubbin C, German P. The structure of informal care: are there differences by race? Gerontologist. 1995;35:744–52. https://doi.org/10.1093/geront/35.6.744.
38. Knight BG, Silverstein M, McCallum TJ, Fox LS. A sociocultural stress and coping model for mental health outcomes among African American caregivers in Southern California. J Gerontol B Psychol Sci Soc Sci. 2000;55:P142–50. https://doi.org/10.1093/geronb/55.3.p142.
39. Aranda MP, Knight BG. The influence of ethnicity and culture on the caregiver stress and coping process: a sociocultural review and analysis. Gerontologist. 1997;37:342–54. https://doi.org/10.1093/geront/37.3.342.
40. Dilworth-Anderson P, Anderson NB. Dementia caregiving in Blacks: A contextual approach to research. In: Light E, Niederehe G, Lebowith BD, editors. Stress effects on family caregivers of Alzheimer's patients: Research and Interventions. New York: Springer Publishing; 1994. p. 385–409.
41. Knight BG, Sayegh P. Cultural values and caregiving: the updated sociocultural stress and coping model. J Gerontol B Psychol Sci Soc Sci. 2010;65B:5–13. https://doi.org/10.1093/geronb/gbp096.
42. Pinquart M, Sörensen S. Ethnic differences in stressors, resources, and psychological outcomes of family caregiving: a meta-analysis. Gerontologist. 2005;45:90–106. https://doi.org/10.1093/geront/45.1.90.
43. StatistischesBundesamt. Bevölkerung und Erwerbstätigkeit: Bevölkerung mit Migrationshintergrund - Ergebnisse des Mikrozensus 2020. 2021.
44. Grobecker C, Krack-Roberg E, Pötzsch O, Sommer B. 1.1 Bevölkerungsstand und Bevölkerungsentwicklung. In: Datenreport 2021: Ein Sozialbericht für die Bundesrepublik Deutschland. Bonn: Bundeszentrale für politische Bildung; 2021. p. 11–29.
45. Kreft D, Doblhammer G. Contextual and individual determinants of health among Aussiedler and native Germans. Health Place. 2012;18:1046–55. https://doi.org/10.1016/j.healthplace.2012.05.008.
46. Worbs S, Bund E, Kohls M, Babka von Gostomski C. (Spät-)Aussiedler in Deutschland. Eine Analyse aktueller Daten und Forschungsergebnisse: [Ethnic German Immigrants in Germany. An Analysis of Current Data and Research Results]: Universitätsbibliothek Tübingen; 2013.
47. Dietz B. Aussiedler in Germany: From Smooth Adaptation to Tough Integration. In: Feldman D, Oltmer J, Lucassen L, editors. Paths of integration: Migrants in Western Europe (1880–2004). Amsterdam: Amsterdam University Press; 2006. p. 116–38.
48. Dyck M, Breckenkamp J, Wicherski J, Schröder CC, Du Prel J-B, Razum O. Utilisation of medical rehabilitation services by persons of working age with a migrant background, in comparison to non-migrants: a scoping review. Public Health Rev. 2020;41:17. https://doi.org/10.1186/s40985-020-00134-5.
49. Tezcan-Güntekin H, Razum O. Pflege von Menschen mit Migrationshintergrund: [Care of Persons with a Migrant Background]. In: Jacobs K, Kuhlmey A, Geß S, Klauber J, Schwinger A, editors. Pflege-Report 2017. Stuttgart: Schattauer; 2017.
50. Goebel J, Grabka MM, Liebig S, Kroh M, Richter D, Schröder C, Schupp J. The German Socio-Economic Panel (SOEP). Jahrbücher für Nationalökonomie und Statistik. 2019;239:345–60. https://doi.org/10.1515/jbnst-2018-0022.
51. Bohlender A, Rathje M, Glemser A. SOEP-Core - 2018: Report of survey methodology and fieldwork. Berlin; 2020.
52. Gramlich T. Analyse der Panelausfälle im Sozio-oekonomischen Panel SOEP [Analysis of panel attrition in the socio-economic panel SOEP]. Berlin; 2008.
53. Andersen HH, Mühlbacher A, Nübling M, Schupp J, Wagner GG. Computation of Standard Values for Physical and Mental Health Scale Scores Using the SOEP Version of SF-12v2. Schmollers Jahrbuch. 2007;127:171–82.
54. Hiel L, Beenackers MA, Renders CM, Robroek SJW, Burdorf A, Croezen S. Providing personal informal care to older European adults: should we care about the caregivers' health? Prev Med. 2015;70:64–8. https://doi.org/10.1016/j.ypmed.2014.10.028.
55. Liang K-Y, Zeger SL. Longitudinal data analysis using generalized linear models. Biometrika. 1986;73:13–22. https://doi.org/10.1093/biomet/73.1.13.
56. Cui J. QIC Program and Model Selection in GEE Analyses. Stand Genomic Sci. 2007;7:209–20. https://doi.org/10.1177/1536867X0700700205.
57. Pan W. Akaike's Information Criterion in Generalized Estimating Equations. Biometrics. 2001;57:120–5. https://doi.org/10.1111/j.0006-341X.2001.00120.x.
58. Schmitz H, Westphal M. Short- and medium-term effects of informal care provision on female caregivers' health. J Health Econ. 2015;42:174–85. https://doi.org/10.1016/j.jhealeco.2015.03.002.
59. Leigh A. Informal care and labor market participation. Labour Econ. 2010;17:140–9. https://doi.org/10.1016/j.labeco.2009.11.005.
60. Jenson J, Jacobzone S. Care Allowances for the Frail Elderly and Their Impact on Women Care-Givers. 2000.
61 Wang Y-N, Shyu Y-IL, Chen M-C, Yang P-S. Reconciling work and family caregiving among adult-child family caregivers of older people with dementia: effects on role strain and depressive symptoms. J Adv Nurs. 2011;67:829–40. https://doi.org/10.1111/j.1365-2648.2010.05505.x.
62. Caputo J, Pavalko EK, Hardy MA. The Long-Term Effects of Caregiving on Women's Health and Mortality. J Marriage Fam. 2016;78:1382–98. https://doi.org/10.1111/jomf.12332.
63. Verbakel E, Metzelthin SF, Kempen GIJM. Caregiving to Older Adults: Determinants of Informal Caregivers' Subjective Well-being and Formal and Informal Support as Alleviating Conditions. J Gerontol B Psychol Sci Soc Sci. 2018;73:1099–111. https://doi.org/10.1093/geronb/gbw047.
64. Danilovich M, Xiang X, Pinto D. Factors That Influence Self-Reported Health Changes With Caregiving. J Aging Health. 2017;29:1444–58. https://doi.org/10.1177/0898264316663576.
65. Acton GJ, Kang J. Interventions to reduce the burden of caregiving for an adult with dementia: A meta-analysis. Res Nurs Health. 2001;24:349–60. https://doi.org/10.1002/nur.1036.
66. Gitlin LN, Belle SH, Burgio LD, Czaja SJ, Mahoney D, Gallagher-Thompson D, et al. Effect of multicomponent interventions on caregiver burden and

depression: The REACH multisite initiative at 6-month follow-up. Psychol Aging. 2003;18:361–74. https://doi.org/10.1037/0882-7974.18.3.361.
67. Korkeila K, Suominen S, Ahvenainen J, Ojanlatva A, Rautava P, Helenius H, Koskenvuo M. Non-response and related factors in a nation-wide health survey. Eur J Epidemiol. 2001;17:991–9. https://doi.org/10.1023/A:1020016922473.
68. Morales L, Ros V. Comparing the response rates of autochthonous and migrant populations in nominal sampling surveys: The LOCALMULTIDEM study in Madrid. In: Font J, Méndez M, editors. Surveying ethnic minorities and immigrant populations: Methodological challenges and research strategies. Amsterdam: Amsterdam University Press; 2013. p. 147–72.
69. Oldenkamp M, Wittek RPM, Hagedoorn M, Stolk RP, Smidt N. Survey nonresponse among informal caregivers: effects on the presence and magnitude of associations with caregiver burden and satisfaction. BMC Public Health. 2016;16:480. https://doi.org/10.1186/s12889-016-2948-6.
70. Gardiner JC, Luo Z, Roman LA. Fixed effects, random effects and GEE: what are the differences? Stat Med. 2009;28:221–39. https://doi.org/10.1002/sim.3478.
71. Zorn CJW. Generalized Estimating Equation Models for Correlated Data: A Review with Applications. American Journal of Political Science. 2001;45:470. https://doi.org/10.2307/2669353.
72. Wingenfeld K. Studien zur Nutzerperspektive in der Pflege: [Studies on the User Perspective in Nursing]. Bielefeld; 2003.

Publisher's Note

11.3 Study III

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RESEARCH ARTICLE

Health determinants among refugees in Austria and Germany: A propensity-matched comparative study for Syrian, Afghan, and Iraqi refugees

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Abstract

In recent years, Germany and Austria have been among the leading European receiving countries for asylum seekers and refugees (AS&R). The two countries have cultural and economic similarities, but differ, for example, in their health care systems, with AS&R having unrestricted access to health services upon arrival in Austria, but not in Germany. This study investigates the determinants of health among refugees in Austria and Germany, and how these determinants differ between the two countries. We analyze comparable and harmonized survey data from both countries for Syrian, Afghan, and Iraqi nationals aged 18 to 59 years who had immigrated between 2013 and 2016 (Germany: n = 2,854; Austria: n = 374). The study adopts a cross-sectional design, and uses propensity score matching to examine comparable AS&R in the two receiving countries. The results reveal that the AS&R in Germany (72%) were significantly less likely to report being in (very) good health than their peers in Austria (89%). Age and education had large impacts on health, whereas the effects of length of stay and length of asylum process were smaller. Compositional differences in terms of age, sex, nationality, education, and partnership situation explained the country differences only in part. After applying propensity score matching to adjust for structural differences and to assess non-confounded country effects, the probability of reporting (very) good health was still 12 percentage points lower in Germany than in Austria. We conclude that many of the determinants of health among AS&R correspond to those in the non-migrant population, and thus call for the implementation of similar health policies. The health disadvantage found among the AS&R in Germany suggests that removing their initially restricted access to health care may improve their health.

the Materials and methods section. The German Socio-Economic Panel (GSOEP) data contain potentially sensitive information and due to legal restrictions by the German data protection law, GSOEP data from this study are only available upon request. The scientific use file of the German Socio-Economic Panel (GSOEP) is made available for scientific research by the German Institute for Economic Research (DIW) at doi: 10.5684/soep.iab-bamf-soep-mig.2016. The use of anonymized GSOEP data is subject to strict standards in the data provision and are reserved exclusively for research use. GSOEP data are available free of charge as scientific use files after requesting a data distribution contract. The form is available online: https://www.diw.de/documents/dokumentenarchiv/17/diw_01.c.88926.de/soep_application_contract.pdf. For further information the GSOEP hotline at either soepmail@diw.de or +49 30 89789-292 can be contacted. The ReHIS data are made available upon registration for scientific research by the Austrian Social Science Data Archive (AUSSDA) at doi:10.11587/7LX1BD. The anonymous IDs of the respondents selected for the current study are provided upon request.

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Introduction

In recent years, Europe has been the destination of large inflows of refuge-seeking individuals, with more than 4.6 million individuals arriving in the EU-28 countries over a five-year period [1]. Large shares of these asylum seekers came from Syria, Afghanistan, and Iraq. To date, the political, societal, and scientific discourses on this wave of refugees have focused mainly on its effects on the economies and welfare systems of the receiving countries in Europe [2–5], while less attention has been paid to refugees' health and their access to health services [6–13]. While a number of studies have examined the mental and physical health of refugees in large refugee camps and in low-income countries [14–17], the health of refugees in high- or medium-income country contexts remains under-researched [9–11, 13]. The previous studies that have examined this topic have found that compared to the health status of the total population, AS&R in Germany have better physical but worse mental health [18], while male AS&R in Austria have better self-rated health [19].

This research gap has important consequences, as health is an individual's most important resource for successful integration into a society and the labor market of the receiving country [20, 21]. There are numerous determinants of refugees' health. Among AS&R, being female [7, 22] and being older [7, 12] are associated with worse health, while having higher levels of education [23] and (family) social support [22, 24] are associated with better health. Moreover, the health of AS&R varies by their country of origin [6, 22]. Refugee-specific determinants of health include the circumstances and experiences of individuals before they fled, during their journey, and after their arrival in a host country [16, 20, 21]. Moreover, access to health care services in the destination country has been shown to be a key factor in the health of AS&R. There is, for example, evidence that when AS&R face no formal access barriers to care, they tend to be in better health and have higher levels of social inclusion. Moreover, the lack of such barriers might reduce public health expenditures [8, 25–27].

Germany and Austria are two high-income European countries with high gross domestic product (GDP) levels and above-average medical care standards [28, 29]. Both countries have received large numbers of asylum seekers. During the last five years, about 1.8 million asylum applications have been filed in Germany and 197,000 applications have been filed in Austria [1]. In this period, the number of individuals who were officially granted asylum (including subsidiary protection and protection on humanitarian grounds) was roughly 1.1 million in Germany and 109,000 in Austria [30, 31].

In both countries, health care expenditures are equivalent to 10–11% of the GDP, a share that is above the EU-28 average (numbers refer to 2016; EU-28 includes the 28 member states of the European Union as of 2016) [29]. Health insurance is granted to both asylum seekers and refugees, but in different ways. In Austria, as legally mandated in the Austrian General Social Insurance Law from 2004, individuals can make use of all health care services provided by the medical insurance system upon submission of their asylum application. This includes access to public hospitals, psychological treatments, and medications. Therefore, asylum applicants have the same formal access to the health care system as the resident population [11]. In contrast, as regulated by the German Social Welfare Law for asylum seekers from 1993, Germany provides limited access to asylum seekers up to 15 months after they have submitted their asylum application, including essential medical treatment, vaccinations, and pregnancy care. After that period, asylum applicants receive regular medical care and have the same access to health care as the German resident population. Moreover, once applicants have received a positive decision on their application, refugees enjoy unlimited access to health care.

Taking the cultural and economic similarities as well as the differences in health policy in the two countries into account, our paper has two central research aims: first, we want to provide insight into self-rated health (SRH) and determinants of health among AS&R in Germany and Austria; second, we want to put the factors that may contribute to the differences between the two countries in perspective. We hypothesize that we will find 1) differences in health outcomes by sociodemographic characteristics among AS&R, and 2) health differences among AS&R in Germany and Austria.

Materials and methods

Data and population

This study uses data from the IAB-BAMF-SOEP-Refugee Survey 2016 (for Germany) and from the Refugee Health and Integration Survey (ReHIS) (for Austria). The IAB-BAMF-SOEP-Refugee Survey 2016 [32] includes responses from AS&R who arrived in Germany between 2013 and 2016. Interviews were conducted as CAPIs (computer-assisted personal interviews) in Arabic, Kurmanji, Farsi/Dari, Urdu, German, and English. The translation was carried out conscientiously by two translators, and the responses were subsequently harmonized [33]. The random sample was based on the German Central Register of Foreign Nationals (which contains information about all foreign nationals in Germany), and included 4,527 individuals aged 18 years or older [33]. The response rate was roughly 50%, with only a small proportion of nonresponse being refusal (~10%) or due to illness or nursing care (<1%) [34]. The questionnaire consisted of a detailed personal questionnaire and a household questionnaire. The survey collected information on the health, migration, educational, and employment biographies of AS&R, as well as on their reasons for fleeing, the routes they took, and their personality and attitudes [35, 36].

The ReHIS was conceptualized as an interim survey within FIMAS, a project on the labor market participation of Syrian, Afghan, and Iraqi refugees in Austria. The ReHIS survey was an interim survey between the second and third wave of the FIMAS+INTEGRATION panel [37]. The FIMAS+INTEGRATION sample contained 780 persons that agreed to participate in the interim survey and provided contact details. The response rate was 68%, where the majority could not be reached due to incorrect contact details or not picking up the phone after multiple contact attempts. Only 6% of the non-responding persons refused to participate. The interviews were carried out in early 2018 as CATIs (computer-assisted telephone interviews) mainly in Arabic and Farsi/Dari as well as few interviews in German. The ReHIS was based on selected EHIS (European Health Interview Survey) items and the IAB-BAMF-SOEP-Refugee Survey 2016. The sample consisted of 515 persons aged 18–61 years who arrived in Austria between 2011 and 2018 [38]. The questionnaire spanned 50 items focused on psychosocial and physical health, barriers and patterns of health care utilization, and individual characteristics [38, 39].

For further information on the field phase and data collection, we refer to two other studies [33, 40].

For reasons of comparability, the current study is restricted to AS&R who are Syrian, Afghan, or Iraqi nationals aged 18–59 years who immigrated between 2013 and 2016. These three nationalities have made up a large share of the asylum seekers in Europe in recent years, especially in Austria and Germany [1]. Our sample comprises 2,854 respondents in Germany and 374 in Austria.

Health measure and control variables

Our German data source (IAB-BAMF-SOEF-Refugee Survey 2016) had a broad focus on refugees' lives in their host country of Germany. Each respondent was asked questions about his/

her living situation, legal status, vocational training, language skills, employment, state benefits, religion, worries and concerns, political attitudes and interests, attitudes toward women, family situation, and general life satisfaction. A short cognitive test (the "symbols and numbers test" to test the speed of perception and fluid intelligence) was also administered. In addition, the respondents were asked several questions related to their health, including about their general health, as well as their physical and mental health. The questionnaire was validated via qualitative pretests [34]. During the interview, the interviewer and the respondent were able to simultaneously look at the questionnaire in German and in the respondent's language in order to minimize language barriers [41].

The focus of our Austrian data source (ReHIS) was on psychological health and access to medical care and integration services among refugees in Austria. The respondents were asked questions about their general health, physical health, psychological well-being, experiences with the Austrian healthcare system (including unmet needs), concerns and worries, and the extent to which they feel welcome in the host country. Information on each respondent's demographic characteristics, education, employment, legal status, language proficiency, and family context was derived from an interview conducted shortly before the ReHIS in the framework of the embedded survey on the labor market participation of refugees in Austria FIMAS [37]. All of the relevant question blocks and items were directly taken from the well-established EHIS survey, and from the IAB-BAMF-SOEP-Refugee Survey 2016. After rigorous technical and internal tests/mockup interviews were conducted with native speakers, an intensive pretest phase with 20 completed interviews in Arabic and Farsi was undertaken with refugees residing in Austria [37].

In our comparative study, the main variable of interest is SRH, which was included in both questionnaires. The exact wording of the question was "How would you describe your current state of health? (1) Very well, (2) well, (3) satisfactory, (4) Not very good, (5) poor" in the IAB--BAMF-SOEF-Refugee Survey; and was "In general, would you say your health is (1) very good, (2) good, (3) acceptable, 4 (fair), (5) bad" in the ReHIS. Answer options were dichotomized into "(very) good" (comprising the answers (1) and (2)) and "less than good" (including answer options (3), (4), and (5)). The set of control variables refers to the WHO's "Social Determinants of Health" framework, which describes the interrelation of structural determinants of health inequities (the socioeconomic and political context in the destination country, and the socioeconomic position in the country of origin), intermediary determinants of health (material circumstances, biological and behavioral factors, and psychosocial factors), and health system factors [21]. We included the following as main control variables: sex (male, female), age (18–24, 25–29, 30–34, 35–39, 40–44, 45–59 years) (representing biological factors), nationality (Syrian, Iraqi, Afghan) (representing factors referring to the country of origin), partnership status (never married, married and living with partner, married and not living with partner, married and no information on place of residence of partner, widowed or divorced, or no information on partner status) (representing psychosocial factors), and education (low level (International Standard Classification of Education (ISCED) 0–1) or no information on education, medium level (ISCED 2), high level (ISCED 3–6)) (representing socioeconomic factors). These socio-demographic variables were cited in previous studies as crucial determinants of SRH [42, 43]. For some of our multivariate analyses, we also consider migration-specific characteristics, such as the length of stay (0–18, 19–24, 25–30, 31–36, 37 or more months) and the length of the asylum application process (0–3, 4–6, 7–14, 15 or more months; decision still open; no information on length of asylum process), which represent health system and psychosocial factors.

Statistical analysis methods

The analyses consist of three steps. First, we provide descriptive results on the share of interviewed refugees in (very) good self-rated health (vgSRH) in the two countries. Second, we explore determinants for SRH. Separately for the two countries, probit regression models with SRH as a dependent variable are used to estimate average marginal effects (AME). These AME represent the average effects of a variable on the probability of perceiving one's health as (very) good, and are comparable across different models [44]. Positive/negative coefficients indicate that the corresponding group had vgSRH more/less often than the reference group.

Third, we investigate whether the initially limited access of AS&R to health services in Germany is associated with differences in SRH in Germany and Austria. Matching estimators are used compare the outcomes (i.e., SRH) of individuals who are as similar as possible with the sole exception of their treatment status. Whereas in medical studies "treatment" typically refers to the introduction of a new drug or a new surgical procedure [45, 46], we define treatment as AS&R being given unlimited access to health services in the host country from the time of arrival onward. An individual's treatment status is equal to one if s/he is residing in Austria, and to zero if s/he is residing in Germany. The efficacy of the treatment is estimated via the average treatment effect (ATE) of those receiving it. Within the counterfactual framework [47, 48], we denote Y_0 as the observed outcome if a subject did not receive treatment, and Y_1 as the counterfactual for that subject if s/he was exposed to treatment. For a subject who received treatment, we denote Y_1 as the observed outcome, and Y_0 as the counterfactual outcome. To address this missing data problem, the Stata software package provides methods for estimating treatment parameters like the ATE, which is the mean of the difference between the observed and the counterfactual outcome: $ATE = E(Y_1\text{-}Y_0)$. We perform a five-nearest-neighbor matching procedure, and apply matching with replacement, which increases matching quality and decreases bias [49]. The caliper width for valid matches [50] is set to 0.3.

Propensity score matching is used to control for differences between the two countries in the structure of the AS&R population [51]. Propensity scores are the conditional probability of assignment to treatment (i.e., residing in Austria) given a vector of observed covariates (sex, nationality, age, partnership status, and education) [52]. As implemented in the Stata software via the command *teffects*, after conditioning on these covariates, any remaining influences on the treatment are not related to the potential outcome [53]. Statistical analyses were conducted in Stata version 15 [53].

Ethics

The ReHIS was approved by the research commission of the Vienna University of Economics and Business. The "Ethical Guidelines for Good Research Practice" issued by the Oxford Refugee Studies Centre [54] were fully adhered to. Participants provided their informed consent to participate in the study. Because the survey was conducted via CATIs, interviewee consent was not documented, as only those participants who gave their explicit consent were interviewed.

The authors used only de-identified data from the ReHIS and the IAB-BAMF-SOEP-Refugee Survey 2016, and were thus exempt from IRB review. Consent was obtained by providing all participants with a declaration of data protection indicating that participation was voluntary, and identities would be kept confidential.

Results

General characteristics

The respondents in our German analytical sample were predominantly male, and had a mean age of 33 years. The majority were Syrian (Table 1). A large share were married and living with

Table 1. Sample characteristics of AS&R and share in vgSRH, by country.

	Sample characteristics		Share in vgSRH mean (95%CI)		t-Test
	Germany	Austria	Germany	Austria	
Sex					
Male	64%	87%	0.76 (0.74; 0.78)	0.90 (0.87; 0.93)	***
Female	36%	13%	0.65 (0.62; 0.68)	0.79 (0.67; 0.91)	+
Nationality					
Syria	67%	62%	0.74 (0.72; 0.76)	0.93 (0.90; 0.96)	***
Iraq	17%	17%	0.68 (0.63; 0.72)	0.88 (0.79; 0.96)	***
Afghanistan	16%	21%	0.66 (0.61; 0.70)	0.75 (0.65; 0.85)	+
Age					
18–24 years	22%	26%	0.84 (0.81; 0.87)	0.87 (0.80; 0.94)	
25–29 years	16%	24%	0.75 (0.71; 0.79)	0.95 (0.90; 0.99)	***
30–34 years	18%	18%	0.76 (0.72; 0.80)	0.89 (0.82; 0.97)	*
35–39 years	17%	15%	0.70 (0.66; 0.74)	0.89 (0.81; 0.98)	**
40–44 years	11%	9%	0.69 (0.64; 0.74)	0.94 (0.86; 1.02)	**
45–59 years	15%	8%	0.49 (0.45; 0.54)	0.67 (0.49; 0.85)	+
Mean age in years	33	31			
Partnership status					
Never married	27%	53%	0.83 (0.80; 0.86)	0.89 (0.85; 0.94)	*
Married, living with partner	59%	26%	0.70 (0.68; 0.72)	0.91 (0.85; 0.97)	***
Married, not living with partner	10%	8%	0.65 (0.59; 0.71)	0.77 (0.62; 0.93)	
Married, no information on partner	1%	10%	0.69 (0.43; 0.94)	0.89 (0.79; 1.00)	+
Widowed/divorced/no answer	4%	3%	0.44 (0.35; 0.53)	0.85 (0.62; 1.07)	**
Education					
Low level (ISCED 0–1) or no answer	43%	25%	0.66 (0.63; 0.68)	0.82 (0.74; 0.90)	**
Medium level (ISCED 2)	19%	13%	0.75 (0.72; 0.79)	0.86 (0.76; 0.96)	+
High level (ISCED 3–6)	38%	62%	0.77 (0.74; 0.79)	0.92 (0.88; 0.95)	***
Length of stay					
0–18 months	70%	3%	0.72 (0.70; 0.74)	0.64 (0.30; 0.98)	
19–24 months	11%	6%	0.72 (0.67; 0.77)	0.82 (0.64; 0.99)	
25–30 months	9%	17%	0.73 (0.67; 0.78)	0.83 (0.73; 0.92)	
31–36 months	5%	39%	0.71 (0.64; 0.79)	0.92 (0.87; 0.96)	***
37 months and more	5%	36%	0.67 (0.59; 0.75)	0.91 (0.86; 0.96)	***
Length of asylum process					
0–3 months	23%	16%	0.73 (0.70; 0.77)	0.88 (0.80; 0.97)	**
4–6 months	18%	13%	0.73 (0.69; 0.77)	0.89 (0.80; 0.99)	*
7–14 months	20%	40%	0.76 (0.72; 0.79)	0.92 (0.88; 0.96)	***
15 months and more	6%	27%	0.77 (0.70; 0.83)	0.83 (0.76; 0.91)	
Decision still open	29%	4%	0.66 (0.63; 0.69)	0.86 (0.65; 1.07)	
No information	4%	0%	0.73 (0.65; 0.81)		
Total	100%	100%	0.72 (0.70; 0.73)	0.89 (0.85; 0.92)	***
Total (N)	2,854	374	2,854	374	

Sources: IAB-BAMF-SOEP 2016, ReHIS

Significance levels:

+ $p<0.10$

* $p<0.05$

** $p<0.01$

*** $p<0.001$.

Note: AS&R: asylum seekers and refugees, vgSRH: (very) good self-rated health.

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a partner, while smaller shares had never been married or were married and not living with their partner. Very few of the respondents were divorced or widowed, or provided no information on their partnership status. Roughly four out of 10 respondents reported having either a low level of education (ISCED 0–1; 37%) or provided no answer (6%), while roughly the same share reported having a high level of education (ISCED 3–6), and two out of 10 said they had a medium level of education (ISCED 2). A large share of the interviewees had arrived in Germany within 18 months of the survey (conducted in 2016). One out of four respondents reported that the duration of their asylum application process was three months or less, and was thus rather short. Two out of four indicated that they had waited 4–6 months for the decision, and two out of 10 said they had waited 7–14 months. Three out of 10 of the respondents reported that the decision regarding their asylum application was still open at the time of the interview.

The gender distribution in our Austrian analytical sample was also unbalanced (87% males). The majority of the respondents were Syrian, and the mean age in the sample was 31 years. More than one half of the respondents had never been married; one out of four were married and living with their partner; 8% were married and were not living with their partner at the time of the interview; and a substantial share were married, but reported no information on their partner's place of residence. A majority of the respondents had a high level of education (62%), while smaller shares had a low level of education or provided no information on their educational level (13% and 12% respectively, totaling to 25%), or had a medium level of education. More than one-third of the respondents had been living in Austria for more than three years, and four out of 10 had been living there for 31–36 months. Therefore, three out of four respondents in the Austrian cohort had been living in the host country for more than two and a half years when they were interviewed in 2018. The refugee status of almost all of the Austrian respondents had been officially recognized, with only 4% reporting that they were still waiting for a decision on their asylum application. Three out of 10 of the respondents reported that the length of their asylum application process had been relatively short (six months or less), while a larger share said they had received a decision on their application within 7–14 months.

Comparison of SRH in Germany and Austria

The shares of AS&R respondents who had vgSRH was smaller in Germany (72%) than in Austria (89%) (Table 1). The difference in the vgSRH levels in the two countries was highly statistically significant ($p<0.001$).

In both countries, males were more likely than females to have vgSRH (76% versus 65% in Germany; 90% versus 79% in Austria). The differences by nationality were substantial: the shares of respondents who had vgSRH were higher among Syrians (74% in Germany; 93% in Austria) than among Iraqis (68% in Germany; 88% in Austria) or Afghans (66% in Germany; 75% in Austria). There were also large differences in self-reported health by age in Germany: 84% of young people aged 18–24, but only 49% of those aged 45–59, had vgSRH. The variation by age was less pronounced in Austria, where the respondents aged 35–39 (89%) and aged 40–44 (94%) were most likely to have vgSRH. In Austria, married people who were not living with their partner had comparably poor health (77% with vgSRH), whereas most of the respondents with other partnership statuses had vgSRH (85%-91%). In Germany, by contrast, the level of SRH was highest among those who had never been married (83% with vgSRH), and was lowest among those who were widowed or divorced (44% with vgSRH). As expected, education was associated with SRH, with the respondents with higher educational levels being most likely to

have vgSRH. Due to overlapping confidence intervals (Table 1), the health differences within the two countries lack statistical significance for some of the analyzed covariates.

T-tests indicated that the differences between the AS&R in Germany and Austria were statistically significant for males (76% versus 90%). This was also found to be the case for Syrian nationals (74% versus 93%) and for Iraqi nationals (68% versus 88%); for the majority of age groups; and for various partnership groups, such as married people who were living with their partner (70% versus 91%). Furthermore, the differences between the AS&R in the two countries were statistically significant for those with low educational levels (66% versus 82%) and with high educational levels (77% versus 92%), and for various groups based on the length of their stay and the length of their asylum application process. All of the statistically significant differences indicate that the share of AS&R who had vgSRH was lower in Germany than in Austria.

Probit regressions

Among the AS&R in Germany, sex, nationality, age, and education were found to be significantly associated with vgSRH: men, Syrians, younger individuals, and those with higher levels of education were significantly more likely than other groups to have vgSRH (Table 2, Model 1 for Germany). Looking at partnership status, we can see that the respondents who were widowed or divorced, or provided no information on their partner status, were less likely than those who were married or had never been married to have vgSRH, but the differences were not statistically significant. In Austria, Afghans and people aged 45–59 were significantly less likely than other groups to have vgSRH. The estimated coefficients were also statistically significant at the 10% level for females, for the 30–34 age group, and for those with high levels of education (Table 2, Model 1 for Austria). Overall, the effects were found to be similar in Germany and Austria, with the exception that being divorced or widowed was shown to be detrimental in Germany, but not in Austria.

Adjustment for the length of the asylum application process (Table 2, Model 2) or the length of stay (Table 2, Model 3) did not mediate the differences in the likelihood of having vgSRH, with the exception that in Germany, individuals with an asylum application process that lasted 15 months or longer were significantly more likely to have vgSRH. Fig 1 illustrates the average marginal effects of the socio-demographic control variables included in the analysis.

Propensity score matching

To assess the differences in SRH between the AS&R in Germany and Austria, we performed propensity score matching (PSM), and estimated the ATE (see Table 3 for PSM specifications). As we mentioned earlier, PSM was used to identify the AS&R with similar characteristics (in terms of age, sex, nationality, education, and partnership status) in Austria and Germany, and thus allowed us to estimate non-confounded remaining country effects [52].

The matched sample for the comparative analysis consisted of 374 refugees in Austria and 506 refugees in Germany (Table 3). The estimated ATE was 0.12 (Table 3). This indicates that the probability of the AS&R having vgSRH was, on average, 12% higher in Austria than in Germany.

The characteristics of the matched sample (Table 4) indicated that unlike in the unmatched sample, there was a rough convergence of matching variables (Table 1). To assess the matching quality and the bias in the estimation of the causal effect, we provided the mean bias, LR chi^2, before and after matching and Rosenbaum bounds were applied (Table 3). The model specification showed a mean bias of 3.3% (i.e., the relative difference between the matched samples

Table 2. Average marginal effects (and 95%CI) for vgSRH, by country.

	Model 1	Model 1	Model 2	Model 2	Model 3	Model 3
	Germany	Austria	Germany	Austria	Germany	Austria
Sex						
Male (ref.)	0	0	0	0	0	0
Female	-0.08***	-0.11+	-0.09***	-0.10+	-0.08***	-0.07
	(-0.12; -0.05)	(-0.23; 0.01)	(-0.12; -0.05)	(-0.22; 0.01)	(-0.12; -0.05)	(-0.18; 0.04)
Nationality						
Syria (ref.)	0	0	0	0	0	0
Iraq	-0.06**	-0.05	-0.04+	-0.05	-0.06**	-0.06
	(-0.10; -0.01)	(-0.14; 0.03)	(-0.09; 0.00)	(-0.14; 0.03)	(-0.10; -0.01)	(-0.15; 0.02)
Afghanistan	-0.09***	-0.18**	-0.07**	-0.19**	-0.09***	-0.19***
	(-0.13; -0.04)	(-0.29; -0.07)	(-0.12; -0.02)	(-0.31; -0.06)	(-0.14; -0.04)	(-0.30; -0.08)
Age						
18–24 years (ref.)	0	0	0	0	0	0
25–29 years	-0.07**	-0.00	-0.07**	-0.00	-0.07**	-0.02
	(-0.12; -0.02)	(-0.07; 0.06)	(-0.12; -0.03)	(-0.07; 0.07)	(-0.12; -0.02)	(-0.08; 0.05)
30–34 years	-0.06*	-0.10+	-0.07*	-0.09+	-0.06*	-0.11*
	(-0.12; -0.01)	(-0.20; 0.01)	(-0.12; -0.02)	(-0.20; 0.01)	(-0.12; -0.01)	(-0.21; -0.00)
35–39 years	-0.13***	-0.07	-0.13***	-0.07	-0.13***	-0.09+
	(-0.18; -0.07)	(-0.18; 0.03)	(-0.19; -0.07)	(-0.17; 0.04)	(-0.18; -0.07)	(-0.20; 0.02)
40–44 years	-0.15***	-0.09	-0.15***	-0.08	-0.15***	-0.10
	(-0.21; -0.08)	(-0.26; 0.08)	(-0.22; -0.09)	(-0.24; 0.09)	(-0.21; -0.08)	(-0.27; 0.07)
45–59 years	-0.33***	-0.40***	-0.34***	-0.40***	-0.33***	-0.40***
	(-0.40; -0.27)	(-0.59; -0.20)	(-0.40; -0.28)	(-0.59; -0.20)	(-0.40; -0.27)	(-0.59; -0.21)
Partnership status						
Never married (ref.)	0	0	0	0	0	0
Married, living with partner	0.00	0.06	0.01	0.06	0.00	0.06
	(-0.05; 0.06)	(-0.03; 0.14)	(-0.04; 0.06)	(-0.03; 0.14)	(-0.05; 0.06)	(-0.02; 0.15)
Married, not living with partner	-0.05	-0.03	-0.05	-0.03	-0.06	-0.02
	(-0.12; 0.01)	(-0.17; 0.11)	(-0.12; 0.02)	(-0.17; 0.11)	(-0.13; 0.01)	(-0.15; 0.11)
Married, no information on partner	0.09	0.05	0.09	0.05	0.08	0.05
	(-0.09; 0.26)	(-0.05; 0.16)	(-0.09; 0.26)	(-0.06; 0.15)	(-0.09; 0.26)	(-0.05; 0.16)
Widowed/divorced/no answer	-0.19***	0.08	-0.19***	0.07	-0.19***	0.07
	(-0.29; -0.09)	(-0.04; 0.20)	(-0.29; -0.09)	(-0.05; 0.19)	(-0.29; -0.09)	(-0.05; 0.19)
Education						
Low level (ISCED 0–1) or n.a. (ref.)	0	0	0	0	0	0
Medium level (ISCED 2)	0.06*	0.01	0.05*	0.01	0.05*	-0.01
	(0.01; 0.10)	(-0.10; 0.13)	(0.01; 0.10)	(-0.11; 0.13)	(0.01; 0.10)	(-0.13; 0.11)
High level (ISCED 3–6)	0.09***	0.08+	0.09***	0.08+	0.09***	0.07+
	(0.05; 0.13)	(-0.01; 0.17)	(0.05; 0.12)	(-0.01; 0.17)	(0.05; 0.13)	(-0.01; 0.16)
Length of asylum process						
0–3 months (ref.)			0	0		
4–6 months			-0.01	-0.01		
			(-0.06; 0.04)	(-0.14; 0.13)		
7–14 months			0.04	0.04		
			(-0.01; 0.09)	(-0.05; 0.14)		
15 months and more			0.08*	0.03		
			(0.01; 0.15)	(-0.08; 0.14)		

(*Continued*)

Table 2. (Continued)

	Model 1 Germany	Model 1 Austria	Model 2 Germany	Model 2 Austria	Model 3 Germany	Model 3 Austria
Decision still open			-0.04	0.04		
			(-0.09; 0.01)	(-0.12; 0.20)		
No information			0.06			
			(-0.02; 0.13)			
Length of stay						
0–18 months					0	0
19–24 months					-0.02	0.09
					(-0.07; 0.03)	(-0.21; 0.39)
25–30 months					0.01	0.14
					(-0.04; 0.07)	(-0.12; 0.41)
31–36 months					0.04	0.22
					(-0.03; 0.11)	(-0.04; 0.47)
37 months and more					-0.00	0.21
					(-0.07; 0.07)	(-0.05; 0.47)
N	2,854	374	2,854	374	2,854	374

Sources: IAB-BAMF-SOEP 2016, ReHIS

Significance levels:

+ $p<0.10$

* $p<0.05$

** $p<0.01$

*** $p<0.001$.

Note: vgSRH: (very) good self-rated health.

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across all included covariates), and thus indicated a good match [55]. When we compared LR chi^2 before and after matching, we found that after matching, the covariates no longer predicted group assignment [56]. The Rosenbaum bounds strategy was used to assess the potential impact of hidden bias; i.e., the bias arising from confounding variables that were simultaneously associated with the treatment variable and the outcome variable [57]. This approach enabled us to obtain a high level of matching quality. The use of other specifications (regarding caliper width, number of nearest neighbors, matching variables) resulted in very similar ATEs (results available upon request), but the goodness of fit parameters were lower. We discarded the length of stay and the length of the asylum application process as matching characteristics due to the sample composition; however, these characteristics certainly can be included in future studies.

Discussion

The vast majority of the AS&R who were interviewed after arriving in Germany and Austria in recent years rated their health as (very) good. The vgSRH proportions of 72% found in Germany and of 89% found in Austria exceeded those reported in earlier studies in the high-income countries of Germany and the Netherlands [12, 22], which might be attributable to period effects or to differences in sample compositions.

While the overall health ratings in our sample were positive, SRH varied considerably by age and education, confirming that certain health determinants of non-migrant populations

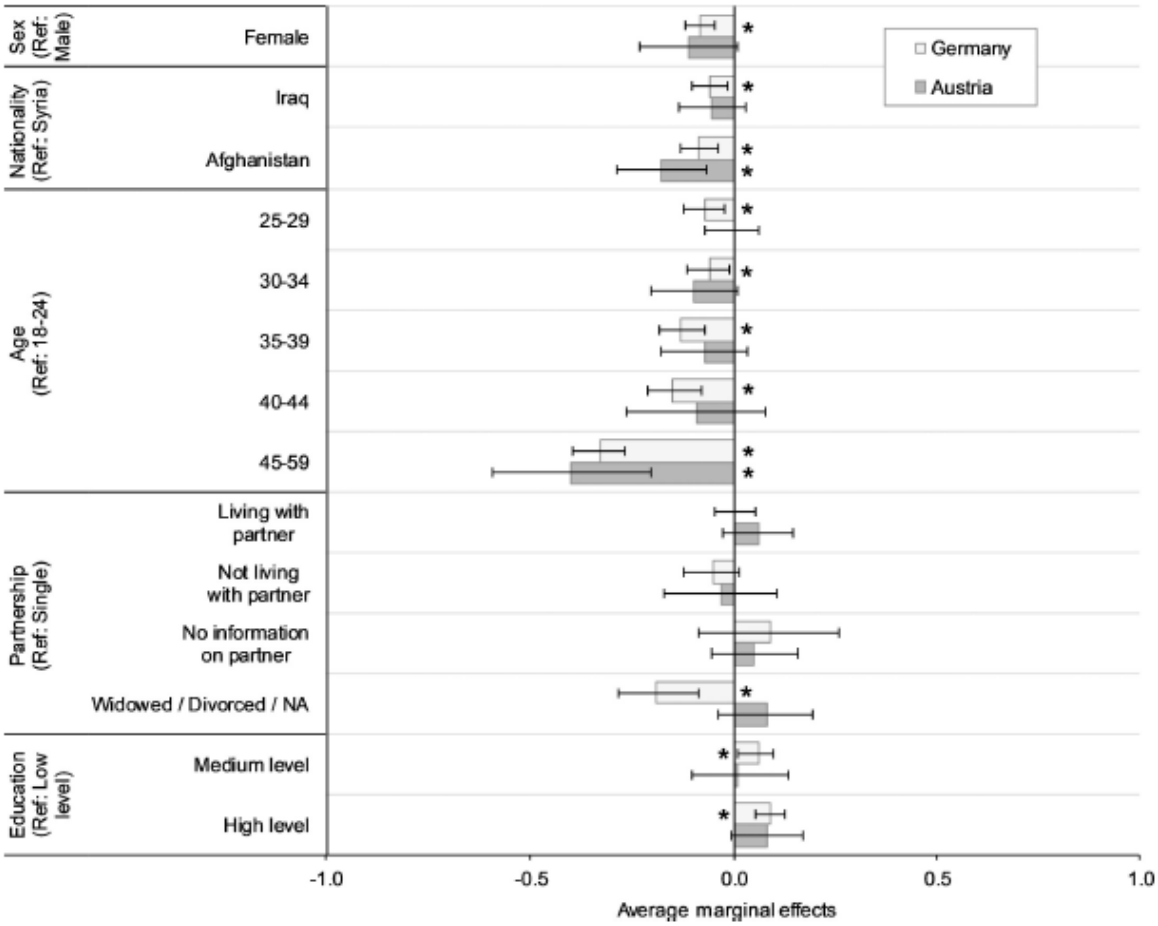

Fig 1. Average marginal effects for sex, nationality, age, partnership status, and education; by country. Sources: IAB-BAMF-SOEP 2016, ReHIS; Remark: Average marginal effects as estimated in model 1 in Table 2. Asterisks denote significant within-country differences compared to the reference group (Ref) ($p<0.05$).

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Table 3. Model specifications and outcome of propensity score matching.

Criterion	Value
Matching variables	Sex, nation, age group, partnership status, education
Maximum number of nearest neighbors	5
Caliper width	0.3
Number of matched individuals in Germany	506
Number of matched individuals in Austria	374
Mean bias	3.3
LR chi^2	346.95 ($p<0.001$) before matching; 5.40 ($p = 0.979$) after matching
Rosenbaum's bounds Γ	2.7 ($p = 0.031$) – 2.8 ($p = 0.052$)
ATE (95%CI)	**0.12 (0.04; 0.20)**

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Table 4. Characteristics of matched sample, by country.

	Sample characteristics		Share in vgSRH mean (95%CI)		t-Test
	Germany	Austria	Germany	Austria	
Sex					
Male	77%	87%	0.76 (0.71; 0.80)	0.90 (0.87; 0.93)	***
Female	23%	13%	0.61 (0.52; 0.70)	0.79 (0.67; 0.91)	+
Nationality					
Syria	56%	62%	0.75 (0.70; 0.80)	0.93 (0.90; 0.96)	***
Iraq	23%	17%	0.68 (0.58; 0.76)	0.88 (0.79; 0.96)	**
Afghanistan	21%	21%	0.70 (0.62; 0.79)	0.75 (0.65; 0.85)	+
Age					
18–24 years	19%	26%	0.84 (0.77; 0.92)	0.87 (0.80; 0.94)	
25–29 years	22%	24%	0.73 (0.65; 0.82)	0.95 (0.82; 0.97)	***
30–34 years	19%	18%	0.80 (0.71; 0.88)	0.89 (0.82; 0.97)	+
35–39 years	18%	15%	0.65 (0.55; 0.75)	0.89 (0.81; 0.98)	**
40–44 years	10%	9%	0.75 (0.62; 0.87)	0.94 (0.86; 1.02)	**
45–59 years	11%	8%	0.48 (0.35; 0.62)	0.67 (0.49; 0.85)	
Mean age in years	33	31			
Partnership status					
Never married	34%	53%	0.82 (0.76; 0.87)	0.89 (0.85; 0.94)	*
Married, living with partner	26%	26%	0.70 (0.63; 0.76)	0.91 (0.85; 0.97)	***
Married, not living with partner	8%	8%	0.75 (0.67; 0.84)	0.77 (0.62; 0.93)	
Married, no information on partner	10%	10%	0.67 (0.35; 0.98)	0.89 (0.79; 1.00)	+
Widowed/divorced/no answer	3%	3%	0.36 (0.20; 0.53)	0.85 (0.62; 1.07)	**
Education					
Low level (ISCED 0–1) or no answer	32%	25%	0.68 (0.61; 0.75)	0.82 (0.74; 0.90)	**
Medium level (ISCED 2)	20%	13%	0.76 (0.68; 0.85)	0.86 (0.76; 0.96)	
High level (ISCED 3–6)	48%	62%	0.73 (0.68; 0.79)	0.92 (0.88; 0.95)	***
Length of stay					
0–18 months	72%	3%	0.72 (0.67; 0.76)	0.64 (0.30; 0.98)	
19–24 months	10%	6%	0.73 (0.62; 0.84)	0.82 (0.64; 0.99)	
25–30 months	8%	17%	0.77 (0.65; 0.89)	0.83 (0.73; 0.92)	
31–36 months	5%	39%	0.81 (0.60; 1.03)	0.92 (0.87; 0.96)	
37 months and more	5%	36%	0.65 (0.44; 0.86)	0.91 (0.86; 0.96)	***
Length of asylum process					
0–3 months	21%	16%	0.78 (0.70; 0.86)	0.88 (0.80; 0.97)	
4–6 months	16%	13%	0.74 (0.64; 0.83)	0.89 (0.80; 0.99)	*
7–14 months	18%	40%	0.76 (0.67; 0.85)	0.92 (0.88; 0.96)	***
15 months and more	7%	27%	0.76 (0.61; 0.90)	0.83 (0.76; 0.91)	
Decision still open	34%	4%	0.64 (0.57; 0.72)	0.86 (0.65; 1.07)	
No information	5%	0%	0.77 (0.58; 0.96)		
Total	100%	100%	0.72 (0.68; 0.76)	0.89 (0.85; 0.92)	***
Total (N)	506	374	506	374	

Sources: IAB-BAMF-SOEP 2016, ReHIS

Significance levels:

+ $p<0.10$

* $p<0.05$

** $p<0.01$

*** $p<0.001$.

Note: vgSRH: (very) good self-rated health.

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also apply to the AS&R population. Significant sex differences in favor of men were found only in Germany, but displayed the same tendency in Austria.

Refugee-specific characteristics were found to have almost no significant impact, which is not in line with the findings of previous studies [26, 27]. The length of stay (LOS) in the host country and the length of the asylum application process turned out to be of minor importance for SRH. These findings may be explained by large within-group heterogeneity in terms of health. For example, in Germany, the asylum application process is shorter for individuals with special needs, such as a disability. Thus, having a longer LOS might be associated with being better integrated into the host society, but it can also lead to an accumulation of economic and social disadvantages [58]. Both outcomes are associated with health [20, 21, 59].

The health differences found by country of origin–in Germany and Austria, Syrians had the highest levels of SRH; while in Austria, Afghans had particularly low levels of SRH–point to different trajectories over time. Additionally, these patterns may reflect country-specific values toward and processes of marginalization of subgroups of AS&R [60–63], and they may indicate the interdependency of origin-related and host-country-specific conditions.

The AS&R surveyed in Germany assessed their health as being worse than those surveyed in Austria. This difference could be only partially explained by compositional differences. Balancing the samples in terms of age, sex, education, nationality, and partnership status, the probability of having vgSRH was found to be 12% lower for the AS&R in Germany than for the AS&R in Austria. However, this finding might be driven by several limitations, as discussed below.

Limitations and strengths

First, although the sample was balanced with PSM, unobserved heterogeneity across the samples cannot be ruled out; e.g., in terms of social and economic integration, health needs, and initial and migration-related circumstances. Nevertheless, we found no evidence of large differences in these characteristics in the German and the Austrian samples. Moreover, the decision of the AS&R to settle in Austria (and not to move on to Germany) might have been driven by negative health selection, i.e., those with poorer health remained in Austria due to their state of health [64]; or by positive causation, i.e., those who remained in Austria might have experienced a slightly shorter and less exhausting journey, which would be associated with better health outcomes [22].

Second, host country-specific characteristics at the societal levels–such as offers of support, integration measures, perceptions of minorities, experiences of discrimination or segregation, and ethnic networks–might contribute to the differences in the health assessments of the AS&R in Austria and Germany [62]. However, it is important to keep in mind that Germany and Austria are culturally very closely aligned, with similar languages and similar attitudes toward AS&R [65, 66].

Third, the initially limited access to health care that the AS&R in Germany experienced might partly explain the differences. Up to 15 months after they arrive, AS&R in Germany receive only basic medical treatment, which might exacerbate their unmet health needs. Earlier findings reported that AS&R in Germany often have problems accessing psychiatric care and medical treatment [67].

Fourth, as the surveys were conducted at an interval of two years, there may have been period effects; i.e., whether and, if so, to what extent the health assessments of the AS&R in the years 2016 and 2018 differed should be considered. Both the actual changes in health between 2016 and 2018 and indirect effects–e.g., changes in the attitudes of the majority population toward AS&R [68] or the integration processes of AS&R [69, 70]–might have influenced the

respondents' health assessments. These effects might partially account for the health differences found among the AS&R in Germany and Austria.

Fifth, the instruments and data collection of the IAB-BAMF-SOEP 2016 and the ReHIS differed, which might have influenced response patterns. Compared to the ReHIS questionnaire, the IAB-BAMF-SOEP questionnaire was much more comprehensive. For example, in the IAB-BAMF-SOEP, the core household questionnaire (100 questions) was designed to last 15 minutes, and each personal questionnaire (450 questions) was designed to take an additional 30 minutes [35, 71]. The face-to-face interviews conducted in the IAB-BAMF-SOEP lasted 28 minutes (first percentile) to 250 minutes (99th percentile), with a median of 83 minutes, and differed by self-rated health (vgSRH: median of 81 minutes, not good SRH: median of 87 minutes). The question regarding SRH followed questions regarding personal characteristics and migration history, which may have caused a halo effect. The interviews conducted in the ReHIS lasted nine minutes (first percentile) to 60 minutes (99th percentile), with a median of 19 minutes. The question regarding SRH was asked almost at the beginning. The length of the interview differed by self-rated health (vgSRH: median of 18 minutes, not good SRH: median of 21 minutes). Thus, the different approaches to data collection used in the surveys (length of interviews, structure of the questionnaires, and interview mode (IAB-BAMF-SOEP: CAPI face-to-face-interviews, ReHIS: telephone interviews)) might have resulted in different forms of measurement bias, and might have biased the answers.

Sixth, there are limitations in the representativeness of the samples. Overall, the selectivity of respondents is a well-known issue that arises when conducting refugee surveys [72–74]. In their respective country contexts, the ReHIS and the IAB-BAMF-SOEP-Refugee Survey 2016 were among the first surveys to focus on the recently arrived AS&R population from Syria, Iraq, and Afghanistan. However, neither survey sample was fully representative of the national AS&R population [2, 40]. It might be assumed that AS&R with lower levels of education and poor health were underrepresented in our analysis [75, 76]. Moreover, the sample was unbalanced in terms of sex and host country; the majority were male and lived in Germany. These imbalances do neither reflect the population of refugees or locals in the respective countries nor a proportionality of AS&R in Germany and Austria. In 2016, 34% of AS&R in Germany [77] and 33% of AS&R in Austria [78] were female; however, female refugees are still less researched and underrepresented in surveys [79]. The number of AS&R in Germany was more than nine times higher than in Austria [1]. The (disproportionally) higher number of AS&R in our German sample was based on the larger sample in the IAB-BAMF-SOEP-Refugee Survey 2016. The analyses were adjusted for gender and host country, i.e. these imbalances do not bias the results. The propensity score matching allows imbalances to be compensated.

To evaluate how, for example, the different educational profiles influenced our results, we calculated weights adjusting for education. After applying these weights, the share of individuals who had vgSRH decreased only slightly, from 89% to 86% in Austria (results available on request). The high proportion of the AS&R in the German sample who had a lower level of education cannot be fully explained, and country-specific or education-specific self-selection into the surveys cannot be ruled out. After analyzing educational differences by country and sex (see S1 Fig), we found that the Syrians and Iraqis in Austria reported having substantially higher levels of education than their counterparts in Germany. We also found significant differences between men and women among the Iraqi and Afghan AS&R in Germany, with lower shares of women than men reporting a high level of education. However, after our models were adjusted for education, sex, and nationality, these compositional differences did not explain the differences in the SRH of AS&R in Austria and Germany. To minimize language barriers and to ensure that all of the participants understood the questions–and, thus, to minimize the educational bias–both of the questionnaires were subject to pretests before the data

collection. Moreover, qualified interviewers conducted the interviews, and questionnaires in several languages (translated and harmonized by two translators) were made available during the interviews. In addition, audiovisual tools and aids were applied in the IAB-BAMF-SOEP survey.

Seventh, the data provide comparable information on health and individual characteristics, but do not cover the full set of possible health determinants among the AS&R. To improve comparability, only a small set of socio-demographic characteristics, as derived from the Social Determinants of Health framework, were integrated into the analyses. To achieve comparability between two samples, we applied PSM, which is appropriate for estimating non-confounded effects [52]. Further relevant determinants, as elaborated in earlier studies [80], might be addressed in future studies.

Eighth, the focus of this paper was on SRH, which represents perceived, but not a medically certified health. SRH is based on self-disclosure, and does not cover all elements of health. It does not provide information on special health circumstances, and it might be driven by subjective short-term influences, as well as by external and internal differences in assessments of and responses to this question. Nonetheless, SHR has been verified as a useful and valid summary of perceived overall health [81–83] that includes both somatic and physical health [84, 85]. Our data indicate that there are strong correlations between SRH and mental health (e.g., depressiveness, Chi^2: $p<0.001$), as well as between SRH and physical health (e.g., frequency of physical pain, Chi^2: $p<0.001$). Thus, in our sample, it is not possible to differentiate the impact of psychiatric and somatic health on the assessment of SRH. As the AS&R had traumatizing reasons for fleeing, and were having to manage post-displacement stressors [86, 87], they frequently reported mental health problems [7, 88]. Thus, SRH might reflect psychiatric health. Both data sources include question related to mental health, but available data do not allow to generate in both surveys standard scales for mental health, like EURO-D scale or Kessler-10 scale [89, 90]. Another caveat is the fact that experience of violence and torture, which are crucial for refugee health, are nor captured in the two surveys. However, compared to a mere mental health assessment, self-rated health is less subject to bias [91]. We assume a simultaneity and an interaction of the two health areas, and interpret the results in terms of the general health status of individuals. Moreover, previous research has suggested that SRH is sensitive to cultural differences [92, 93], and that SHR responses depend in part on the interview language and on the translation of that language [94]. However, these effects are unlikely to explain the health differences found among the AS&R in Germany and Austria. Subsequent studies could address other health dimensions or specific health determinants.

Finally, cultural differences in self-reported health are relevant [95, 96], but are not further explored in this paper.

The great strength of our study is that it provides a comparative perspective on health differences and health mechanisms in two neighboring, culturally similar, high-income European countries that have experienced high levels of AS&R immigration in recent years. Our approach allowed us to elaborate general determinants and country-specific differences for three nationalities of one refugee cohort (who immigrated between 2013 and 2016). However, future studies might consider additional countries in order to analyze the impact of nationally diverse health policies and settings, or to take the internal heterogeneity of the AS&R population into account. While previous studies on this population for Europe mainly focused on the mental health of refugees [97, 98], this study provides findings on the general subjective health of AS&R. While mental health is a major concern for AS&R from conflict regions [98, 99], the general health of this population should not be neglected. Assessments that cover mental health only are not comprehensive, and could lead to an overestimation of the health challenges associated with refugee immigration.

Conclusions

When assessing the health levels in a society, AS&R represent a particularly vulnerable group. Our results do not indicate that the general health needs of AS&R are greater than those of the non-migrant population. Nevertheless, the SRH levels within the AS&R population vary considerably. As women, older refugees, and refugees with lower levels of education report having worse health than other groups, the needs of these groups in particular should be addressed by health-promoting measures. As these determinants correspond to those in the non-migrant population, similar strategies are conceivable. For example, comprehensive care, including more frequent screenings and better professional health advice, could be offered for some groups. Additionally, as the Afghan refugees in our sample reported having lower levels of health than other nationality groups, there may be a need for nationality-specific and culturally sensitive treatments and health services. While we cannot clearly identify the causes of this poorer health assessment, previous studies have highlighted the multidimensionality of health risks [100], which act at different levels. In terms of individual characteristics, language abilities, institutionalized knowledge, and exchange networks are important health resources [7, 25]. Thus, promoting these resources might lead to improvements in health.

Moreover, the results of our analyses are in line with the known differences between the two countries in access health care, as the AS&R in our sample reported having better health in Austria than in Germany. Although Germany and Austria have very similar healthcare delivery systems in terms of health expenditures and the density of practitioners [28], the German model has more barriers to initial access for AS&R. This lack of access may be associated with long-lasting unmet health needs, poorer health, and higher public health expenditures [101–104]. Thus, the health of AS&R and health systems in general may be improved by removing barriers to accessing health services.

Supporting information

S1 Fig. Educational level by nationality and sex, by country. Sources: IAB-BAMF-SOEP 2016, ReHIS.
(TIF)

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References

1. Eurostat (2019) Asylum and first time asylum applicants. Available: https://ec.europa.eu/eurostat/databrowser/view/tps00191/default/table?lang=en. Accessed 15 October 2019.
2. Clemens MA, Hunt J (2019) The Labor Market Effects of Refugee Waves: Reconciling Conflicting Results. ILR Review 72 (4): 818–857.
3. Hainmueller J, Hangartner D, Lawrence D (2016) When lives are put on hold: Lengthy asylum processes decrease employment among refugees. Science advances 2 (8): e1600432. https://doi.org/10.1126/sciadv.1600432 PMID: 27493995
4. Dustmann C, Fasani F, Frattini T, Minale L, Schönberg U (2017) On the economics and politics of refugee migration. Econ Pol 32 (91): 497–550.
5. Borjas GJ, Monras J (2017) The labour market consequences of refugee supply shocks. Econ Pol 32 (91): 361–413.
6. WHO (2018) Report on the health of refugees and migrants in the WHO European region. No public health without refugee and migrant health. Copenhagen: WHO.
7. Pavli A, Maltezou H (2017) Health problems of newly arrived migrants and refugees in Europe. Journal of travel medicine 24 (4). https://doi.org/10.1093/jtm/tax016 PMID: 28426115
8. Bozorgmehr K, Razum O (2015) Effect of Restricting Access to Health Care on Health Expenditures among Asylum-Seekers and Refugees: A Quasi-Experimental Study in Germany, 1994–2013. PloS one 10 (7): e0131483. https://doi.org/10.1371/journal.pone.0131483 PMID: 26201017
9. Georgiadou E, Zbidat A, Schmitt GM, Erim Y (2018) Prevalence of Mental Distress Among Syrian Refugees With Residence Permission in Germany: A Registry-Based Study. Frontiers in psychiatry 9: 393. https://doi.org/10.3389/fpsyt.2018.00393 PMID: 30210373
10. Leiler A, Bjärtå A, Ekdahl J, Wasteson E (2019) Mental health and quality of life among asylum seekers and refugees living in refugee housing facilities in Sweden. Social psychiatry and psychiatric epidemiology 54 (5): 543–551. https://doi.org/10.1007/s00127-018-1651-6 PMID: 30580381
11. Kohlenberger J, Buber-Ennser I, Rengs B, Leitner S, Landesmann M (2019) Barriers to health care access and service utilization of refugees in Austria: Evidence from a cross-sectional survey. Health policy (Amsterdam, Netherlands). https://doi.org/10.1016/j.healthpol.2019.01.014 PMID: 30878171
12. Schneider C, Joos S, Bozorgmehr K (2015) Disparities in health and access to healthcare between asylum seekers and residents in Germany: a population-based cross-sectional feasibility study. BMJ open 5 (11): e008784. https://doi.org/10.1136/bmjopen-2015-008784 PMID: 26537498
13. Mendola D, Busetta A (2018) Health and Living Conditions of Refugees and Asylum-seekers: A Survey of Informal Settlements in Italy. Refug Surv Q 37 (4): 477–505.
14. Sirin SR, Rogers-Sirin L (2015) The educational and mental health needs of Syrian refugee children. Washington, DC: Migration Policy Institute.

15. Karnouk C, Böge K, Hahn E, Strasser J, Schweininger S et al. (2019) Psychotherapy in Jordan: An Investigation of the Host and Syrian Refugee Community's Perspectives. Frontiers in psychiatry 10: 556. https://doi.org/10.3389/fpsyt.2019.00556 PMID: 31456702

16. Abu Kishk N, Shahin Y, Mitri J, Turki Y, Zeidan W et al. (2019) Model to improve cardiometabolic risk factors in Palestine refugees with diabetes mellitus attending UNRWA health centers. BMJ open diabetes research & care 7 (1): e000624.

17. UNHCR, UNICEF, WFP (2017) Vulnerability assessment of Syrian refugees in Lebanon. VASyR 2017. Geneva: WFP/UNHCR/UNICEF.

18. Metzing M, Schacht D, Scherz A (2020) Psychische und körperliche Gesundheit von Geflüchteten im Vergleich zu anderen Bevölkerungsgruppen. [Mental and physical health of refugees compared to other population groups]: DIW—Deutsches Institut für Wirtschaftsforschung.

19. Buber-Ennser I, Kohlenberger J, Rengs B, Al Zalak Z, Goujon A et al. (2016) Human Capital, Values, and Attitudes of Persons Seeking Refuge in Austria in 2015. PloS one 11 (9): e0163481. https://doi.org/10.1371/journal.pone.0163481 PMID: 27662373

20. Newbold KB (2005) Self-rated health within the Canadian immigrant population: risk and the healthy immigrant effect. Social science & medicine (1982) 60 (6): 1359–1370. https://doi.org/10.1016/j.socscimed.2004.06.048 PMID: 15626530

21. CSDH (2008) Closing the gap in a generation: Health equity through action on the social determinants of health. Final report of the commission on social determinants of health. Geneva.

22. Gerritsen AA, Bramsen I, Devillé W, van Willigen, Loes H M, Hovens JE et al. (2006) Physical and mental health of Afghan, Iranian and Somali asylum seekers and refugees living in the Netherlands. Social psychiatry and psychiatric epidemiology 41 (1): 18–26. https://doi.org/10.1007/s00127-005-0003-5 PMID: 16341619

23. Sheikh-Mohammed M, MacIntyre CR, Wood NJ, Leask J, Isaacs D (2006) Barriers to access to health care for newly resettled sub-Saharan refugees in Australia. Med. J. Aust. 185 (11–12): 594–597. https://doi.org/10.5694/j.1326-5377.2006.tb00721.x PMID: 17181498

24. Shishehgar S, Gholizadeh L, DiGiacomo M, Green A, Davidson PM (2017) Health and Socio-Cultural Experiences of Refugee Women: An Integrative Review. J. Immigr. Minor. Health 19 (4): 959–973. https://doi.org/10.1007/s10903-016-0379-1 PMID: 26976004

25. Morris M d., Popper ST, Rodwell TC, Brodine SK, Brouwer KC (2009) Healthcare Barriers of Refugees Post-resettlement. Journal of Community Health 34 (6): 529–538. https://doi.org/10.1007/s10900-009-9175-3 PMID: 19705264

26. Laban CJ, Gernaat HB, Komproe IH, Schreuders BA, Jong JT (2004) Impact of a long asylum procedure on the prevalence of psychiatric disorders in Iraqi asylum seekers in The Netherlands. The Journal of nervous and mental disease 192 (12): 843–851. https://doi.org/10.1097/01.nmd.0000146739.26187.15 PMID: 15583506

27. Hondius AJ, van Willigen LH, Kleijn WC, van der Ploeg HM (2000) Health problems among Latin-American and middle-eastern refugees in The Netherlands: relations with violence exposure and ongoing sociopsychological strain. Journal of traumatic stress 13 (4): 619–634. https://doi.org/10.1023/A:1007858116390 PMID: 11109235

28. Reibling N, Ariaans M, Wendt C (2019) Worlds of Healthcare: A Healthcare System Typology of OECD Countries. Health policy (Amsterdam, Netherlands) 123 (7): 611–620. https://doi.org/10.1016/j.healthpol.2019.05.001 PMID: 31133444

29. Eurostat (2019) Healthcare expenditure statistics.

30. Eurostat (2019) First instance decisions on applications. Available: http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do. Accessed 15 October 2019.

31. Eurostat (2019) Final decisions on applications. Available: http://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do. Accessed 18 September 2019.

32. Schupp J, Brücker H, Kroh M, Leistner-Rocca R, Goebel J et al. (2018) IAB-BAMF-SOEP-Befragung Geflüchteter 2016 [IAB-BAMF-SOEP-Refugee Survey 2016]: SOEP Socio-Economic Panel Study.

33. Kuehne S. et al (2019) Sampling in Times of High Immigration: The Survey Process of the IAB-BAMF-SOEP Survey of Refugees. Surv Methods Insights Field.

34. Kroh M, Kühne S, Jacobsen J, Siegert M, Siegers R Sampling, nonresponse, and integrated weighting ofthe 2016 IAB-BAMF-SOEP Survey of Refugees (M3/M4).

35. Brücker H, Rother N, Schupp J, editors (2018) IAB-BAMF-SOEP-Befragung von Geflüchteten 2016: Studiendesign, Feldergebnisse sowie Analysen zu schulischer wie beruflicher Qualifikation, Sprachkenntnissen sowie kognitiven Potenzialen. Nürnberg: Bundesamt für Migration und Flüchtlinge. 73 Seiten p.

36. DIW Berlin / SOEP (2016) Erhebungsinstrumente des IAB-SOEP-Migrationssamples 2016: Integrierter Personen- und Biografiefragebogen (Erstbefragte 2016), Stichproben M1-M2. [Survey Instruments of the IAB-SOEP migration sample 2016: Integrated personal and biography questionnaire (initial interviews), samples M1-M2]. Available: https://www.econstor.eu/handle/10419/148957.

37. Hosner R, Palinkas M (2020) Prozesse der Arbeitsmarktintegration von Geflüchteten in Österreich. Kurzbericht zur Datenerhebung 2017/2018 (2. Welle) im Projekt FIMAS+INTEGRATION. [Processes of refugee integration in Austria. A brief report on data collection 2017/2018 (2nd wave) in the project FIMAS+INTEGRATION]. Vienna.

38. Kohlenberger J (2019) Refugee Health and Integration Survey (ReHIS) (SUF edition): AUSSDA Dataverse.

39. Kohlenberger J, Buber-Ennser I, Rengs B, Leitner S, Landesmann M Gesundheitszugang von syrischen, irakischen und afghanischen Geflüchteten in Österreich: Ergebnisse aus dem Refugee Health and Integration Survey. [Access to health care among Syrian, Iraqi and Afghan refugees in Austria: Results from the Refugee Health and Integration Survey]. In: Czaika M, Rössl L, Altenburg F, Faustmann A, Pfeffer T, editors. Migration und Integration 7: Dialog zwischen Politik, Wissenschaft und Praxis. Reihe Dialogforum Integration. [Migration and integration 7: Dialogue between politics, academia and practice. Serie Dialogforum Integration]. Krems: Edition Donau-University Krems. pp. 239–259.

40. Kohlenberger J, Buber-Ennser I, Rengs B (2018) Datenerhebungen unter Geflüchteten und ihren Familien: Methodologische Aspekte und Beobachtungen aus dem Feld des "Displaced Persons in Austria Survey (DiPAS)"[Data collection among refugee seeking persons and their families: Methodological aspects and observations from the field from "Displaced Persons in Austria Survey (DiPAS)"]. In: Kapella O, Schneider N, Rost H, editors. Familie–Bildung–Migration. Tagungsband zum 5. Europäischen Fachkongress Familienforschung [Family—education—migration. Proceedings of the 5th European conference family research]. Opladen: Barbara Budrich. pp. 281–295.

41. Jacobsen J (2018) Language Barriers during the Fieldwork of the IAB-BAMF-SOEP Survey of Refugees in Germany. In: Behr D, editor. Surveying the Migrant Population: Consideration of Linguistic and Cultural Issues. Cologne. pp. 75–84.

42. Moor I, Spallek J, Richter M (2017) Explaining socioeconomic inequalities in self-rated health: a systematic review of the relative contribution of material, psychosocial and behavioural factors. Journal of epidemiology and community health 71 (6): 565–575. https://doi.org/10.1136/jech-2016-207589 PMID: 27682963

43. Kawachi I, Kennedy BP, Glass R (1999) Social capital and self-rated health: a contextual analysis. Am J Public Health 89 (8): 1187–1193. https://doi.org/10.2105/ajph.89.8.1187 PMID: 10432904

44. Best H, Wolf C (2012) Modellvergleich und Ergebnisinterpretation in Logit- und Probit-Regressionen [Comparing models and interpreting results in logit and probit regressions]. Köln Z Soziol 64 (2): 377–395.

45. Ramos R, García-Gil M, Comas-Cufí M, Quesada M, Marrugat J et al. (2016) Statins for Prevention of Cardiovascular Events in a Low-Risk Population With Low Ankle Brachial Index. Journal of the American College of Cardiology 67 (6): 630–640. https://doi.org/10.1016/j.jacc.2015.11.052 PMID: 26868687

46. Royston P (2015) Estimating the Treatment Effect in a Clinical Trial Using Difference in Restricted Mean Survival Time. Stata J 15 (4): 1098–1117.

47. Rubin DB (1974) Estimating causal effects of treatments in randomized and nonrandomized studies. J Edu Psychol 66 (5): 688–701.

48. Imbens GW (2004) Nonparametric Estimation of Average Treatment Effects Under Exogeneity: A Review. Rev Econ Stat 86 (1): 4–29.

49. Caliendo M, Kopeinig S (2008) Some practical guidance for the implementation of propensity score matching. J Economic Surveys 22 (1): 31–72.

50. Cochran WG, Rubin DB (1973) Controlling bias in observational studies. Sankhya Ser A 35 (4): 417–446.

51. Hirano K, Imbens GW (2001) Estimation of causal effects using propensity score weighting: An application to data on right heart catheterization. Health Serv Outcomes Res Methodol. 2 (3/4): 259–278.

52. Rosenbaum PR, Rubin DB (1983) The central role of the propensity score in observational studies for causal effects. Biometrika 70 (1): 41–55.

53. StataCorp (2017) Stata. College Station, TX: StataCorp LLC.

54. (2007) Ethical Guidelines for Good Research Practice. Refug Sur Q 26 (3): 162–172.

55. Rosenbaum PR, Rubin DB (1985) Constructing a Control Group Using Multivariate Matched Sampling Methods That Incorporate the Propensity Score. Am Stat 39 (1): 33–38.

56. Sianesi B (2004) An Evaluation of the Swedish System of Active Labor Market Programs in the 1990s. Rev Econ Stat 86 (1): 133–155.

57. DiPrete TA, Gangl M (2004) Assessing bias in the estimation of causal effects: Rosenbaum bounds on matching estimators and instrumental variables estimation with imperfect instruments. Berlin.

58. Bakker L, Dagevos J, Engbersen G (2014) The Importance of Resources and Security in the Socio-Economic Integration of Refugees. A Study on the Impact of Length of Stay in Asylum Accommodation and Residence Status on Socio-Economic Integration for the Four Largest Refugee Groups in the Netherlands. J Int Migr Integr 15 (3): 431–448.

59. Trummer U, Krasnik A (2017) Migrant health: the economic argument. European journal of public health 27 (4): 590–591. https://doi.org/10.1093/eurpub/ckx087 PMID: 28961880

60. Mckay FH, Thomas SL, Kneebone S (2012) 'It Would be Okay If They Came through the Proper Channels': Community Perceptions and Attitudes toward Asylum Seekers in Australia. Int Migr Rev 25 (1): 113–133.

61. Louis WR, Duck JM, Terry DJ, Schuller RA, Lalonde RN (2007) Why do citizens want to keep refugees out? Threats, fairness and hostile norms in the treatment of asylum seekers. Eur. J. Soc. Psychol. 37 (1): 53–73.

62. Dell'Orto G, Wetzstein I, editors (2018) Refugee news, refugee politics. New York, NY: Routledge.

63. Hadley C, Patil C (2009) Perceived discrimination among three groups of refugees resettled in the USA: associations with language, time in the USA, and continent of origin. J Immigrant Health 11 (6): 505–512.

64. Akresh IR, Frank R (2008) Health selection among new immigrants. American journal of public health 98 (11): 2058–2064. https://doi.org/10.2105/AJPH.2006.100974 PMID: 18309141

65. Gerhards J, Lengfeld H, Soler M, Ignácz ZS, Kley FK et al. (2017) Research Report on transnational solidarity in the EU—Results from the Transnational European Solidarity Survey (TESS).

66. Renner W, Thomas A, Mikulajová M, Newman D (2017) Threat Perception and Modern Racism as Possible Predictors of Attitudes towards Asylum Seekers: Comparative Findings from Austria, Germany, and Slovakia. IJBSR 7 (12): 10.

67. Altunoz U, Castro Nunez S, Graef Calliess IT (2016) Mental health of traumatized refugees and asylum seekers: Experiences of a centre of transcultural psychiatry in Hannover, Germany. European Psychiatry 33: S398.

68. Liebe U, Meyerhoff J, Kroesen M, Chorus C, Glenk K (2018) From welcome culture to welcome limits? Uncovering preference changes over time for sheltering refugees in Germany. PloS one 13 (8): e0199923. https://doi.org/10.1371/journal.pone.0199923 PMID: 30067769

69. Walther L, Fuchs LM, Schupp J, Scheve C von (2020) Living Conditions and the Mental Health and Well-being of Refugees: Evidence from a Large-Scale German Survey. J. Immigr. Minor. Health 22 (5): 903–913. https://doi.org/10.1007/s10903-019-00968-5 PMID: 31974927

70. Dowling A, Enticott J, Kunin M, Russell G (2018) An Investigation into the Association of Pre- and Post-Migration Experiences on the Self-Rated Health Status Among New Resettled Adult Humanitarian Refugees to Australia: A Longitudinal Study. SSRN Journal.

71. Bohlender A, Huber S, Glemser A SOEP-Core—2016: Methodenbericht Stichproben A-L1. [SOEP Core 2016: Report Samples A-L1]. Berlin.

72. Bloch A (1999) Carrying Out a Survey of Refugees: Some Methodological Considerations and Guidelines. Journal of Refugee Studies 12 (4): 367–383.

73. Sulaiman-Hill C, Thompson SC (2011) Sampling challenges in a study examining refugee resettlement. BMC international health and human rights 11: 2. https://doi.org/10.1186/1472-698X-11-2 PMID: 21406104

74. Bloch A (2004) Survey research with refugees. Policy Studies 25 (2): 139–151.

75. Korkeila K, Suominen S, Ahvenainen J, Ojanlatva A, Rautava P et al. (2001) Non-response and related factors in a nation-wide health survey. Eur. J. Epidemiol. 17 (11): 991–999. https://doi.org/10.1023/a:1020016922473 PMID: 12380710

76. Cheung KL, Klooster PM ten, Smit C, Vries H de, Pieterse ME (2017) The impact of non-response bias due to sampling in public health studies: A comparison of voluntary versus mandatory recruitment in a Dutch national survey on adolescent health. BMC public health 17 (1): 276. https://doi.org/10.1186/s12889-017-4189-8 PMID: 28330465

77. Federal Office for Migration and Refugees (Bundesamt für Migration und Flüchtlinge) (2017) Das Bundesamt in Zahlen 2016 [The Federal Office in Numbers 2016]. Nuremberg.

78. Bundesministerium für Inneres (Ministry of the Interior) (2017) Asylstatistik 2016 [Asylum statistics 2016]. Vienna.

79. Schouler-Ocak M, Kurmeyer C (2017) Study on Female Refugees. Repräsentative Untersuchung von geflüchteten Frauen in unterschiedlichen Bundesländern in Deutschland [Representative study on refugee women in different federal states in Germany]. Berlin.

80. WHO (2018) Health of refugees and migrants. Regional situation analysis, practices, experiences, lessons learned and ways forward. Copenhagen: World Health Organization.

81. Jylhä M, Guralnik JM, Ferrucci L, Jokela J, Heikkinen E (1998) Is self-rated health comparable across cultures and genders. The journals of gerontology. Series B, Psychological sciences and social sciences 53 (3): S144–52.

82. Fayers PM, Sprangers MAG (2002) Understanding self-rated health. The Lancet 359 (9302): 187–188. https://doi.org/10.1016/S0140-6736(02)07466-4 PMID: 11812551

83. Galenkamp H, Braam AW, Huisman M, Deeg DJH (2020) Self-Rated Health: When and How to Use It in Studies Among Older People. In: Jagger C, Crimmins EM, Saito Y, Carvalho Yokota RT de, van Oyen H et al., editors. International Handbook of Health Expectancies. Cham: Springer International Publishing. pp. 173–181.

84. Vingilis ER, Wade TJ, Seeley JS (2002) Predictors of Adolescent Self-rated Health. Can. J. Public Health 93 (3): 193–197. https://doi.org/10.1007/BF03404999 PMID: 12050986

85. Krause NM, Jay GM (1994) What Do Global Self-Rated Health Items Measure. Medical Care 32 (9): 930–942. Available: www.jstor.org/stable/3766597, https://doi.org/10.1097/00005650-199409000-00004 PMID: 8090045

86. Jamil H, Nassar-McMillanb S, Lambert R, Wangd Y, Ager J et al. (2010) Pre- and post-displacement stressors and time of migration as related to self-rated health among Iraqi immigrants and refugees in Southeast Michigan. Med. Confl. Surviv. 26 (3): 207–222. https://doi.org/10.1080/13623699.2010.513655 PMID: 21291168

87. Dow HD (2011) An Overview of Stressors Faced by Immigrants and Refugees: A Guide for Mental Health Practitioners. Home Health Care Manag. Pract. 23 (3): 210–217.

88. Ullmann E, Barthel A, Taché S, Bornstein A, Licinio J et al. (2015) Emotional and psychological trauma in refugees arriving in Germany in 2015. Mol. Psychiatry 20 (12): 1483–1484. https://doi.org/10.1038/mp.2015.164 PMID: 26527128

89. Kessler RC, Andrews G, Colpe LJ, Hiripi E, Mroczek DK et al. (2002) Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol. Med. 32 (6): 959–976. https://doi.org/10.1017/s0033291702006074 PMID: 12214795

90. Prince MJ, Reischies F, Beekman AT, Fuhrer R, Jonker C et al. (1999) Development of the EURO-D scale—a European, Union initiative to compare symptoms of depression in 14 European centres. Br. J. Psychiatry 174: 330–338. https://doi.org/10.1192/bjp.174.4.330 PMID: 10533552

91. Snowden LR (2003) Bias in mental health assessment and intervention: theory and evidence. Am J Public Health 93 (2): 239–243. https://doi.org/10.2105/ajph.93.2.239 PMID: 12554576

92. Roudijk B, Donders R, Stalmeier P (2017) Cultural values: can they explain self-reported health. Quality of life research: an international journal of quality of life aspects of treatment, care and rehabilitation 26 (6): 1531–1539. https://doi.org/10.1007/s11136-017-1512-x PMID: 28185039

93. Vuorisalmi M, Pietilä I, Pohjolainen P, Jylhä M (2008) Comparison of self-rated health in older people of St. Petersburg, Russia, and Tampere, Finland: how sensitive is SRH to cross-cultural factors. Eur. J. Ageing 5 (4): 327. https://doi.org/10.1007/s10433-008-0093-5 PMID: 28798583

94. Seo S, Chung S, Shumway M (2014) How good is "very good"? Translation effect in the racial/ethnic variation in self-rated health status. Quality of life research: an international journal of quality of life aspects of treatment, care and rehabilitation 23 (2): 593–600. https://doi.org/10.1007/s11136-013-0522-6 PMID: 24026633

95. Hassan G, Kirmayer LJ, Mekki-Berrada A, Quosh C, el Chammay R et al. (2015) Culture, Context and the Mental Health and Psychosocial Wellbeing of Syrians: A Review for Mental Health and Psychosocial Support staff working with Syrians Affected by Armed Conflict. Geneva.

96. Jürges H (2007) True health vs response styles: exploring cross-country differences in self-reported health. Health Econ. 16 (2): 163–178. https://doi.org/10.1002/hec.1134 PMID: 16941555

97. Bradby H, Humphris R, Newall D, Phillimore J (2015) Public health aspects of migrant health. Health Evidence Network synthesis report 44, Copenhagen: WHO.

98. Satinsky E, Fuhr DC, Woodward A, Sondorp E, Roberts B (2019) Mental health care utilisation and access among refugees and asylum seekers in Europe: A systematic review. Health policy (Amsterdam, Netherlands) 123 (9): 851–863. https://doi.org/10.1016/j.healthpol.2019.02.007 PMID: 30850148

99. Fazel M, Wheeler J, Danesh J (2005) Prevalence of serious mental disorder in 7000 refugees resettled in western countries: a systematic review. The Lancet (365): 1309–1314.

100. Kirmayer LJ, Narasiah L, Munoz M, Rashid M, Ryder AG et al. (2011) Common mental health problems in immigrants and refugees: general approach in primary care. CMAJ: Canadian Medical Association journal = journal de l'Association medicale canadienne 183 (12): E959–67. https://doi.org/10.1503/cmaj.090292 PMID: 20603342

101. Oda A, Tuck A, Agic B, Hynie M, Roche B et al. (2017) Health care needs and use of health care services among newly arrived Syrian refugees: a cross-sectional study. CMAJ open 5 (2): E354–E358. https://doi.org/10.9778/cmajo.20160170 PMID: 28490426

102. Tuck A, Oda A, Hynie M, Bennett-AbuAyyash C, Roche B et al. (2019) Unmet Health Care Needs for Syrian Refugees in Canada: A Follow-up Study. J Immigrant Health. https://doi.org/10.1007/s10903-019-00856-y PMID: 30617545

103. Bauhoff S, Göpffarth D (2018) Asylum-seekers in Germany differ from regularly insured in their morbidity, utilizations and costs of care. PloS one 13 (5): e0197881. https://doi.org/10.1371/journal.pone.0197881 PMID: 29795638

104. Langlois EV, Haines A, Tomson G, Ghaffar A (2016) Refugees: towards better access to health-care services. The Lancet 387 (10016): 319–321. https://doi.org/10.1016/S0140-6736(16)00101-X PMID: 26842434

A. Supplementary Files

A.1 Angabe des Eigenanteils bei den Arbeiten mit mehreren Autorinnen bzw. Autoren

Study I:

Georges, D.; Kreft, D.; Doblhammer, G. (2018): The Contextual and Household Contribution to Individual Health Status in Germany: What is the Role of Gender and Migration Background? In: Gumá, J.; Doblhammer, G. (Ed.) (2018): Family and Health from a Gender Perspective in Europe. Springer Brief.

Eigenanteil von Daniela Georges: Formulierung der Fragestellung: 50%, Konzeption der Studie: 50%, Durchführung und Auswertung der Studie: 80%, Verfassen des Textes: 90%

Ich bestätige mit meiner Unterschrift die obenstehende Einschätzung meiner Koautorin Daniela Georges über ihren Eigenanteil unserer gemeinsamen Arbeit.

Name: Daniel Kreft Unterschrift:

Name: Gabriele Doblhammer Unterschrift:

Study III:

Georges D.; Buber-Ennser I.; Rengs B.; Kohlenberger J.; Doblhammer G. (2021): Health determinants among refugees in Austria and Germany: A propensity-matched comparative study for Syrian, Afghan, and Iraqi refugees. PLOS ONE 16(4): e0250821. https://doi.org/10.1371/journal.pone.0250821

Eigenanteil von Daniela Georges: Formulierung der Fragestellung: 50%, Konzeption der Studie: 50%, Durchführung und Auswertung der Studie: 50%, Verfassen des Textes: 70%

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Name: Isabella Buber-Ennser Unterschrift:

Name: Bernhard Rengs Unterschrift:

Name: Judith Kohlenberger Unterschrift:

Name: Gabriele Doblhammer Unterschrift: