

BMJ Open Aetiological research on the health of migrants living in Germany: a systematic literature review

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ABSTRACT

Background Germany has become an important immigration country and health services need to adopt to meet the needs of an increasingly multicultural population. For public health planning, it is essential to understand the aetiology of health problems among migrant populations. The main objective was to systematically identify, evaluate and synthesise population-based studies that investigated exposure–outcome relationships among migrant groups in Germany.

Methods In November 2019, we searched PubMed and LIVIVO, and updated this search in November 2020, to identify peer-reviewed publications that fulfilled our eligibility criteria: English or German language; study on disease aetiology among major migrant groups in Germany, according to the latest microcensus; publication date from inception to 01 November 2020 and observational or experimental study designs. For quality appraisal, we used the Critical Appraisal Skills Programme checklists. Outcomes under investigation were categorised according to the WHO major disease groups, and their associations with risk factors were synthesised as a heat map.

Results Out of 2407 articles retrieved, we included 68 publications with a total number of 864 518 participants. These publications reported on cross-sectional data (n=56), cohort studies (n=11) and one intervention study. The population groups most frequently studied were from the Middle East (n=28), Turkey (n=24), sub-Saharan Africa (n=24), Eastern Europe (n=15) and the former Soviet Union (n=11). The outcomes under study were population group specific. There were consistent associations of demographic and socioeconomic factors with ill health among migrants in Germany.

Discussion In this systematic review, we observed low risk of bias in two-thirds of the studies. There is an increasing body of evidence for aetiological research on migrants' health in Germany. Still, the directions of associations between a wide range of risk factors and major disease groups seem only partially understood.

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INTRODUCTION

Migration has shaped society, culture and economy in Germany.¹ Migrants in Europe consist of various groups of people, including migrants in regular and irregular situations,

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ Comprehensive and transparent synthesis of aetiological migrant health research in Germany through using a preregistered protocol, and independent authors extracted and synthesized the data.
- ⇒ Limited to major migrant groups in Germany and based on heterogenous populations and recruitment strategies, complicating the comparability of findings.
- ⇒ Conduct of meta-analysis and assessment of publication bias were not feasible due to heterogenous exposure-effect measures.

trafficked persons, asylum seekers, refugees and displaced persons and returnees.^{2 3} For this study, we used the broad term 'migrant' to refer to any person who is moving or has moved across an international border away from his/her usual place of residence, regardless of the person's legal status, duration of stay, the drivers of the movement and whether the movement is forced or voluntary,⁴ and the term 'refugee' for someone who has taken safety in another country because of persecution, war or violence. A refugee has a well-founded fear of persecution for reasons of race, religion, nationality, political opinion or membership in a particular social group.²

After the establishment of the German national territory in 1871, millions of people migrated to Germany, mainly from Poland, Russia, Turkey, Italy, Greece, The Netherlands, Belgium and countries in the Middle East. The migration drivers were multifactorial and encompassed work, education, family reunification, refuge, asylum seeking and resettlement. In 2019, 21.2 million people living in Germany were immigrants or their descendants, representing 26% of the population.⁵ Migrants are likely to experience biological, physical, behavioural and social challenges, which potentially determine their health status. Thus, migrant health addresses



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the state of physical, mental and social well-being of migrants and mobile population.⁶

Migration itself is considered a social determinant of health.⁷ Indeed, migrants in high-income countries have, on average, lower mortality than the autochthonous populations, yet certain migrant subgroups may exhibit increased morbidity for some health conditions.⁸ While discrimination, gender inequalities and exclusion from health and social services repeatedly emerge as negative health influences for migrants,⁸ differences in the frequency and severity of ill health conditions between migrants and autochthonous populations are still discernible after adjustment for social factors.⁹ In order to inform health policy-makers, we require a better understanding of the relevance of both, social and other health determinants, among migrants living in Germany. For this purpose, we refer to aetiological population-based studies (observational and experimental), which explore the risk factors and their manner of association with health outcomes to understand possible causal pathways. This encompasses epidemiological studies that ask the questions about exposure–outcome relationships. Up to now, the wealth of scientific literature about aetiological research on migrants' health in Germany remains to be assessed and synthesised.

Therefore, this systematic literature review (SLR) aimed to systematically identify, evaluate and synthesise population-based studies focusing on exposure–outcome relationships among migrant groups in Germany. The specific objectives were to (1) map the existing evidence on aetiological migrant health research in Germany; (2) identify research foci and synthesise the evidence about disease aetiology; and (3) inform future research directions.

METHODS

We conducted this SLR according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis guidelines.¹⁰ The protocol of this SLR has been registered with PROSPERO International prospective register of systematic reviews.

Inclusion and exclusion criteria

We searched peer-reviewed publications that have covered studies about questions on the aetiology of migrants' health in Germany. Specifically, we included observational or experimental studies that reported associations between risk factors and health outcomes, defined according to the WHO International Classification of Diseases. Studies with less than 100 participants were excluded to ensure reasonable statistical power for risk factor–disease associations in heterogeneous studies, and to avoid selection bias within the individual studies.^{11 12} Also, review articles, studies that took place outside Germany, prevalence studies and studies without an exposure–outcome assessment were excluded. We placed no restrictions on geographic location within

Germany, gender distribution or age range of the study participants. Articles published in German or English and that were available as full texts were eligible. The specific eligibility criteria are presented according to the population, intervention, comparator, outcome and study design (PICOS)¹³ approach in online supplemental table S1.

Literature search and selection

Two electronic databases for peer-reviewed scientific publications were accessed. An initial search was conducted on 21 November 2019 in LIVIVO (an interdisciplinary search engine for life sciences) and in PubMed (an international search engine for peer-reviewed biomedical literature) and was last updated on 30 November 2020 to check for new publications. Articles that were published between inception and 01 November 2020 were eligible. For full texts that were not available, we contacted the authors via email to request for the full texts. Additionally, we screened the reference lists of included articles to identify further relevant literature.

Search elements included subject relevant MeSH terms as well as keywords that were linked in the search field using Boolean Operators (AND, OR NOT). The search strategy included the PICOS components, as outlined in online supplemental table S2. The exact search strings are presented in online supplemental table S2. All retrieved articles were imported into the reference management software Endnote (V.X9.3.3, Clarivate Analytics, US).

Study selection progressed according to the prespecified eligibility criteria in three phases: paper identification, title and abstract screening, and full-text screening. Four authors screened and selected the articles for inclusion. Disagreements between authors were resolved on a consensus basis or through consultation with a fifth author (OR).

Quality appraisal

We used the Critical Appraisal Skills Programme (CASP) checklists to assess the overall quality of the studies included. These checklists contain questions about the logical meaning of epidemiological studies in three broad domains: validity, magnitude and precision, and local applicability of the results.^{14–16} Therefore, the checklists guide the assessment of information bias and selection bias in each study. For analytical cross-sectional studies, we used the CASP checklist for case–control studies.¹⁴ The remaining articles were assessed using CASP checklists for cohort studies¹⁶ or for randomised controlled trials (RCTs).¹⁵ We adopted the traffic light system for grading: green indicates low risk of bias, red denotes high risk of bias and orange defines unknown risk of bias. None of the articles were excluded because of their quality. Due to the anticipated heterogeneous outcomes and effect measures, we could not create Funnel plots or calculate Egger's tests to determine publication bias. Alternatively, we plotted the log-transformed sample size of each study against the year of publication to identify any dominance of larger studies.

Data extraction and synthesis of findings

We extracted the data of the included articles, comprising author name, year of publication, study design, country of origin, study location, definition of ‘migrant status’, number of study participants, age range, male gender (%), study objectives, assessments and definitions of exposures and outcomes, assessment of socioeconomic variables, method of statistical analysis, accounting for potential confounders and the exposure–disease associations.

The outcomes assessed in individual studies were classified according to the WHO major disease groups¹⁷: class I—communicable, maternal, perinatal and nutritional conditions, class II—non-communicable diseases, and class III—injuries. An additional group comprised health behaviours, such as smoking, healthcare utilisation and sleep. Exposures were categorised into logical thematic groups. For instance, socioeconomic factors included educational level, occupational situation and measures of wealth and income, while migration-related factors comprised length of stay, migration generation, German language skills and legal residence status. Exposure–outcome associations were categorised into (+) positive relationships, when increased exposure to the risk factor was associated with increased odds, risk or prevalence of the outcome; (–) negative relationships, when increased exposure to the risk factor was associated with decreased odds, risk or prevalence of the outcome; and (0) null findings, when increased exposure to the risk factor was associated with neither increased nor decreased odds, risk or prevalence of the outcome. We synthesised the observed associations between prevailing risk factors and major disease groups as a heat map, presenting positive associations in red, null associations in white and negative associations in blue.

Patient and public involvement statement

This is not applicable to this systematic review study.

RESULTS

Overview of study selection

The initial literature search in PubMed and LIVIVO yielded 2407 articles in total. After removal of duplicates and screening of titles and abstracts, we included 187 articles in the full-text screening. From these, we finally included 59 articles into the synthesis of results. We excluded articles for the following reasons: the occurrence of disease was compared between migrants and non-migrants; the studies were not conducted on migrant populations in Germany; the publications were not covering epidemiological research. In addition, we included nine articles that were identified from the reference lists of included publications, yielding a final total of 68 publications (figure 1). All articles were published between 1988 and November 2020. With regard to study design, the majority of articles presented data from cross-sectional studies (54/68), followed by eleven cohort

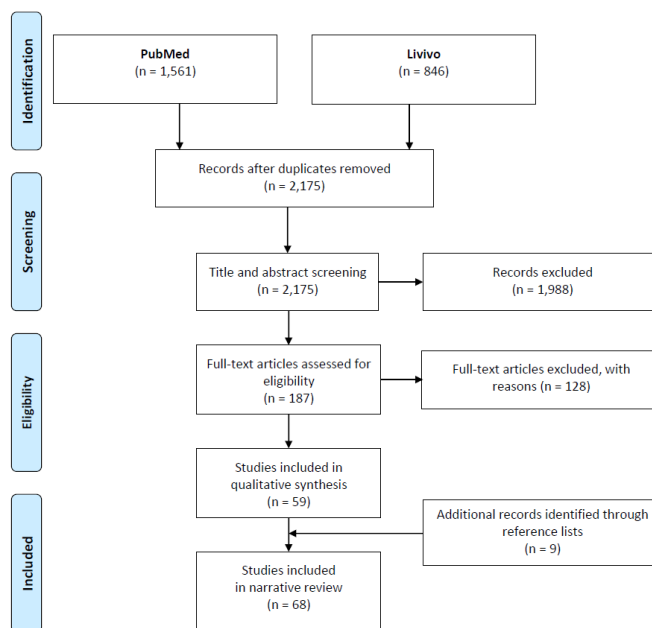


Figure 1 Flow chart of included articles.

studies, one intervention study,¹⁸ one nested case–control study¹⁹ and one ecological study.²⁰

Characteristics of studies

The 68 articles included in this systematic review reported on 55 population-based studies with a total of 864 518 participants. The metadata of the publications are presented in online supplemental table S3. The number of participants in the individual studies ranged from 116 to 441 199, with a median sample size of 861 participants. Overall, 12 articles focused on children (<18 years), 44 articles presented data about adults (≥18 years) and 12 articles combined results of children and adults. Most articles (59/68) included female and male participants. However, there were eight publications that addressed only women (online supplemental table S3), and one publication focused on men only.²¹ In six articles, the authors did not clarify how they defined migrant status. This occurred mainly in articles published between 1988 and 2008. In 11 articles, migration status was defined according to country of birth, while parental country of birth (either parent) was the definition criterion in 17 articles. A combination of both criteria (foreign place of birth and parents born abroad) were used in 15 publications. Being registered in a refugee camp or reception centre served to define migrant status in 11 articles, while citizenship (outside Germany) was used in 4 articles. In three articles, name-based algorithms were applied to register data for the identification of persons with migration background.^{22–24}

Quality appraisal

Except for the intervention study by Arendt and Karadas,¹⁸ all findings of the quality assessment according to the CASP checklists are presented in online supplemental table S4 and are summarised in online supplemental

figure S1. The intervention study¹² showed no substantial risk of bias in the CASP RCT checklist. Only blinding of the study personnel for the intervention group was lacking due to the nature of the intervention itself: ethnically discordant versus ethnically concordant physician treatment.¹⁸ In general, articles that were published before 2015 showed lower quality than more recent publications. This was mainly seen for impaired internal validity. For instance, there was a lack of precision measures for the effect estimates, such as CIs or SEs, in 26 out of 56 cross-sectional studies, and in 1 out of the 11 cohort studies. Also, potential confounding was not addressed in the analyses of one-third of the cross-sectional studies (16/56). With regard to external validity and thus, generalisability of the findings, seven cross-sectional studies showed high risk of selection bias due to false or unclear choice of the comparator group.^{25–31}

To approximate the assessment of publication bias, we log-transformed the y-axis, reflecting the number of participants of each study and plotted it by year of publication (online supplemental figure S2). Two studies had exceptionally large sample sizes (>100 000 participants): Reime *et al* (N=441 199)³² and Spallek *et al* (N=1 40 249).²² Generally, the sample sizes continuously increased over the years, and larger studies (>10 000 participants) were less common than smaller ones (≤10 000 participants). This indicated low risk of publication bias.

Geographical origins, dominating risk factors and prevailing health outcomes

The distribution of geographic origin and outcomes under study are presented in figure 2. This Sankey chart illustrates that the majority of studies investigated risk factor–disease associations among individuals from the

Middle East, followed by Turkey and sub-Saharan Africa (SSA), Eastern Europe, Russia/former Soviet Union and the Mediterranean region. The major health outcomes according to the WHO classification were class II (Non-communicable diseases (NCDs), followed by class I (communicable, maternal, perinatal and nutritional conditions) and health behaviours. Figure 2 also shows that health outcomes under study were distinct between population groups. For instance, more than half of the studies among Turkish background, African descent and Middle East origin populations focused on class II outcomes. While for SSA migrants, NCDs under study mainly comprised cardiometabolic diseases, the focus among Turkish background and Middle East origin populations was on mental health conditions. Similarly, mental health predominated as the outcome in studies among individuals from Eastern Europe. Figure 3 depicts the predominating exposure–outcome relationships under study. The majority of studies assessed demographic, socioeconomic and migration-related factors as exposures, while mental health conditions predominated as outcomes. Migration-related aspects comprised comparisons between different migrant groups (14/68), length of stay in Germany (7/68), German language skills (5/68), legal status of residence (4/68) and migration generation (4/68). The dominating outcome in relation to migration-related factors were mental health and lifestyle factors (figure 2). Socioeconomic variables referred to educational level (13/68), occupational class (8/68) and some measure of affluence (eg, income, wealth score, deprivation score) (8/68). These studies investigated the role of socioeconomic background for maternal and child health, adiposity, cardiometabolic diseases and lifestyle

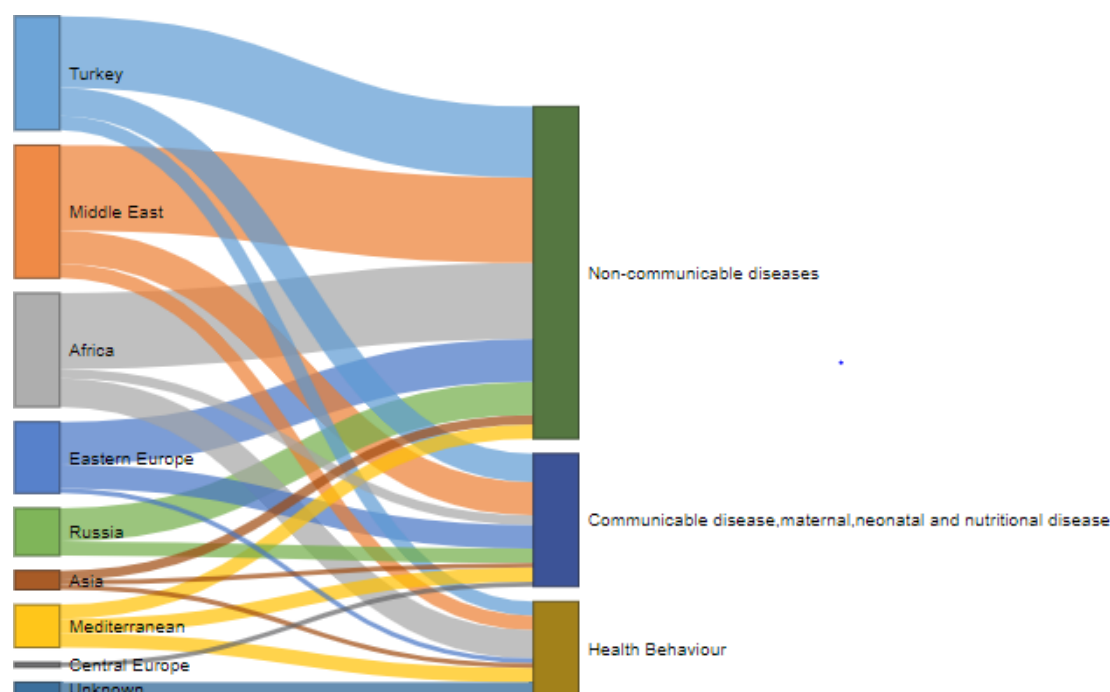


Figure 2 Sankey chart for the main regions of origin and major disease groups under study.

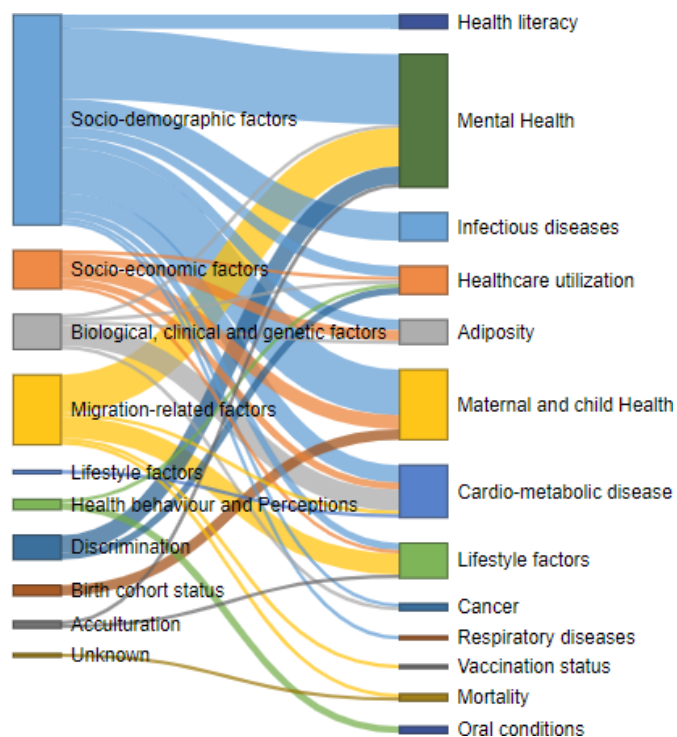


Figure 3 Sankey chart for exposures and health outcomes under study.

factors (figure 3). Other prominent risk factor–disease combinations included the role of clinical and biological factors for cardiometabolic diseases and the link between perceived discrimination and mental health.

Synthesis of risk factors for ill health among migrants in Germany

The meta-synthesis of the risk factor–disease associations is presented as a heat map in table 1. Demographic risk factors had overall consistent and strong associations. Increasing age among migrants was associated with higher risk of communicable disease, including tuberculosis³³ and helicobacter pylori seroprevalence³⁴; maternal and child health conditions,³⁵ including risk of caesarean section,³⁶ near miss³⁷ and stillbirth³⁸; cardiometabolic conditions, comprising cardiovascular risk,³⁹ metabolic syndrome⁴⁰ and impaired glucose metabolism^{41 42}; and mental health conditions, including psychosocial distress,⁴³ post-traumatic stress syndrome,⁴⁴ depression^{45 46} and anxiety.⁴⁷ These associations of increasing age with other NCDs were also discernible for oral health⁴⁸ but not for cancer survival,⁴⁹ and were less clear-cut for adverse health behaviours.^{49 50} Overall, women appeared to present with a more favourable health profile than men, with the exception of a female preponderance for adiposity,⁵¹ as well as depression and perceived stress in some but not all studies.^{43 46 52}

In addition, socioeconomic risk factors were prominent exposures in the articles included. While higher educational level was not associated with communicable diseases, there were clear protective associations of higher educational level on the occurrence of NCDs, including

adiposity, type 2 diabetes and mental disorders,^{46 47 51 53} and on health behaviours such as better uptake of psychotherapy⁵⁴ and abstaining from smoking.^{52 55} For occupational class, such inverse relationships were discernible for most outcomes under study. Yet, this was less clear-cut for cardiometabolic diseases, particularly adiposity and type 2 diabetes.⁵³ Wealth was rarely assessed in the studies included, and mainly with regard to health behaviour.⁵⁶ Proxy markers such as the number of people living in the household, income or family affluence showed protective associations with healthy lifestyle.^{56 57} In most of the studies that examined migration-related factors, inverse associations with health outcomes were observed, translating into better health status among participants with longer stay in Germany, second-generation or third-generation as compared with first-generation migrants, better German language proficiency and longer permission to reside in Germany.^{58 59} Exceptions were seen for cardiometabolic conditions such as adiposity and type 2 diabetes,³⁹ and other NCDs, including ill oral health, cancers and atopic diseases.⁶⁰ Only three studies reported on the health status and potential risk factors before or during migration: Pachankis *et al* studied antigay stigma in the home country and the receiving country as a potential risk factor for HIV prevention⁶¹; Bauer *et al* investigated the role of premigration socioeconomic status for perceived health status⁶²; and Georgiadou *et al* determined the associations between the duration of the escape journey and depression symptoms.⁴⁴ Large studies among Ghanaians compared individuals in their home country with Ghanaian adults living in Europe (Research on Obesity and Diabetes among African Migrants Study) but did not track the status before and after migration.^{63–66} Regarding clinical, biological and lifestyle parameters as potential risk factors, these were mainly assessed in relation to class I (communicable disease, maternal and child health conditions) and class II disease groups (NCDs).^{67–69} The biological factors such as (epi)genetic variation in candidate genes,⁷⁰ presence of concomitant diseases⁷¹ and increased BMI were positively associated with ill health, particularly adiposity, type 2 diabetes and cardiovascular risk.⁵¹ In a few articles, associations of concomitant diseases and adiposity with infectious diseases were absent.^{72 73} Lastly, for adverse health behaviours as potential risk factors, consistent direct associations were seen between smoking and maternal and child health outcomes (class I), and between unhealthy diet and cardiometabolic diseases as well as mental health conditions (class II).

DISCUSSION

The present SLR quantified and synthesised aetiological research for migrants' health in Germany. This review has three key findings. First, the design of most studies was cross-sectional and showed improved methodological quality since 2015. Second, the included studies focused on prevailing migrant groups from a few



Table 1 Heat map of risk factor–disease associations among migrants in Germany

Risk factor	Class I			Class II			Health behaviours		
	Communicable diseases	Maternal and child health conditions	Cardiometabolic conditions	Mental health conditions	Other Non-communicable diseases	Smoking	Poor healthcare uptake		
Demographic	Age								
	Female versus male								
Socioeconomic	Educational level	n.a.							
	Occupational class				n.a.				
	Wealth			n.a.					
Migration related	Length of stay								
	Migration generation	n.a.							
	German language skills						n.a.		
	Length residence permit	n.a.					n.a.		
Biological and clinical	(Epi)genetic variation								
	Concomitant diseases								
	Adiposity (yes vs no)								
Lifestyle	Smoking (yes vs no)								
	Unhealthy diet (yes vs no)	n.a.							

*Other NCDs: oral health, cancers, respiratory diseases, atopic diseases.

†Blue indicates inverse/negative association (increased exposure to the risk factor was associated with lower risk/odds/prevalence of the outcome).

‡White indicates null/no association (increased exposure to the risk factor was not associated with the risk/odds/prevalence of the outcome).

§Red indicates direct/positive association (increased exposure to the risk factor was associated with higher risk/odds/prevalence of the outcome).

¶Grey (n.a.) indicates not assessed

specific geographic origins, under-representing Mediterranean Europe but over-representing Africa due to one dominant study. Third, there were consistent associations of demographic, socioeconomic and partly migration-related factors with ill health among migrants in Germany, while biological and lifestyle factors were rarely assessed.

Study design and quality

Most articles presented results from cross-sectional studies that were published between 1988 and 2020. However, since 2015, we identified an increase in published studies with larger sample sizes of more than 5000 participants and with an improved methodological approach. This time period paralleled the so-called 'migration wave', characterised by the movement of 1.2 million individuals to Germany. We observed that articles published before 2015 showed lower methodological quality compared with more recent publications. Over the years, some scholars have critically assessed the methods used in epidemiological research on migrants' health in Germany and have called for study designs with higher epidemiological evidence, such as case-control, cohort or intervention studies.^{74 75} One of the gaps in migrant health research is low prioritisation of global health and public health training, unlike in the UK and the USA, where global health education is well established.^{76 77} Another methodological challenge identified by the German Emigration and Remigration Panel Study) for high-quality migrant health research constitutes the lack of detailed information on nationality, duration of stay and socioeconomic status in national registries, therefore, limiting reflections on diversity and heterogeneity in the German population.⁷⁸ These factors may contribute to the observed lack of precision with regard to the effect estimates and generalisation of most of our findings.⁷⁹ Notably, there were only three studies on the associations of premigration factors with health outcomes experienced in Germany.^{44 61 62} One large cross-sectional studies among Ghanaian adults investigated factors in the home country and among Ghanaian migrants in Europe.⁶⁴⁻⁶⁶ However, the comparison does not necessarily reflect changes, and more work needs to be done to understand the relationship between the sending situation and the status in the receiving country. In addition, lack of funding may prevent from personnel-intensive and longitudinal research designs. In general, global health research focusing on poverty-related and poverty-neglected diseases in Germany has only recently gained interest. In fact, funding for these diseases is 60 times lower than would be expected based on the percentage rate of global burden of diseases.⁸⁰ This may account for the use of understaffed, less complex and time-efficient research designs in epidemiological migrant health research. It is, however, important that hypothesis-building findings from cross-sectional studies can transition to appropriate monitoring mechanisms and explanatory research designs.

Geographic origin and research focus

The proportions of population groups across all articles mirrored the population share of migrant groups in Germany.⁸¹ Interestingly, study populations with Southern/Mediterranean European background were under-represented in the articles included, in relation to the number of people with Italian or Greek origin living in Germany. At the same time, articles presenting associations among African populations were over-represented relative to the official demographic statistics.⁸¹ Likely, this dominance resulted from the inclusion of several reports about risk factor-disease associations from one large study among Ghanaian migrants.⁸²⁻⁸⁶ The identified observed exposure-outcome investigations appear to be distinct according to geographic origin of the study population. This may reflect the health needs of individual migrant groups. However, we cannot rule out whether some of these research foci were investigator driven or need driven.

In terms of subjective health, there is little evidence for substantial differences between immigrant groups and the autochthonous population in Germany. Our Sankey diagram (figure 3) depicts that mental health is the most common health outcome under study, and this research focus is corroborated by the burden of mental illness among migrant populations.⁸⁷⁻⁹² This is also seen among migrant populations elsewhere. For instance, the Mexican Migration Project reported high levels of mental stress resulting from low standard of living among Mexican migrants in the USA.⁹³ However, studies indicate poorer mental health among immigrants compared with non-immigrants, particularly for migrants of Turkish origin.⁹⁴ It is important to note that premigration factors such as geographical or environmental origin may play an important role on migrant health. Some studies have reported that migrants may carry latent infection from their home country on arrival as asylum seekers or may develop mental health problems in the process of assimilating or coping into their new environment.⁹⁵⁻⁹⁷ However, no such literature is available about migrants living in Germany. In fact, it is perceived that compared with receiving countries, the health status of countries from which migrants originate is lower.⁹⁸ According to the data of the Federal Statistical Office of Germany, migrants have 7.1 times higher risks for chronic and infectious diseases than the autochthonous population.⁹⁶ Contrary to our results, a comparative cohort study among black immigrants and US born black adults reported a more favourable health profile among black immigrants than among African Americans. The study further reported better self-reported health among black immigrants on arrival than US born blacks.⁹³ This phenomenon has been termed 'healthy migrant effect'; this is either explained by cultural buffering in which the cultural practices of migrants influence healthy lifestyle or selective migration, speculating that only healthy migrants travel.⁹³

And in terms of differences in health status among migrant groups, it is important to understand that

exposures during migration and post migration continue to affect the health status of migrants. For example, experiences among migrants from neighbouring countries, who travel short distances by train to cross the borders to Germany, differ substantially from those of conflict zones who travelled several months under life-threatening conditions before they had arrived in Germany.⁷⁹ The importance of these differential exposures has recently been addressed in migrant health research^{28 51 59 62}; however, more research is needed to better understand these relationships.⁹⁹

Risk factors for ill health

This SLR revealed demographic and socioeconomic factors to be the strongest and most consistent risk factors for migrant health in Germany. Migration-related aspects, biological factors and health behaviour were under-represented in previous aetiological migrant health research in Germany.

Generally, as age increases, issues related to risks of chronic diseases and multimorbidity also increase. Our findings partly align with studies that have associated susceptibility to mental health with older age and female gender among migrants in other parts of Europe.^{100 101} Still, earlier studies have reported that the advantage of the healthy migrant effect will decrease drastically with older age.¹⁰² Another study reported that migrant females are mostly confronted by complicated patterns of health problems associated with social deprivation and traditional cultural values, which may conflict with the host nation's norms, and thus, results in inferior self-esteem and ambiguity of feelings.¹⁰⁰ In this SLR, the ability to identify sociocultural risk factors among ageing migrants was limited to three studies, focusing on perceived discrimination.^{103 104} It is therefore important that more robust research is done to address the importance of traditions and norms for health among ageing migrants.¹⁰¹

Just as for migrants in Europe, higher socioeconomic status showed protective associations with most of the health outcomes also among migrants in Germany, except for cardiometabolic health.^{3 105} This may be attributed to the strong involvement of lifestyle in the aetiology of cardiometabolic diseases, which is linked to socioeconomic factors. In fact, affluence makes junk food and physical inactivity affordable, but unhealthy lifestyles spread to lower socioeconomic classes when overall living standards improve.¹⁰⁵ In the average population, lower socioeconomic status is associated with adverse health outcomes, and migrant groups often belong to this population group and bear the corresponding health consequences.⁷⁹ This is partly attributed to language difficulties and conflicting perceptions of work or immigration policies that restrict access to the labour market.⁷⁹ In line with our findings, low socioeconomic status has been associated with chronic stress, cardiovascular disease and higher rates of morbidity and mortality among migrants.¹⁰⁶

Lifestyle activities such as alcohol consumption and smoking do not substantially differ between population

groups with and without migration background,¹⁰⁷ except that women are considerably less likely to smoke or drink alcohol as compared with the autochthonous population. Hence, positive associations of smoking and unhealthy diet with maternal and child health conditions and with cardiometabolic diseases among migrants may be a manifestation of adopted lifestyle patterns such as increased intake of westernised diet, physical inactivity and the adoption of tobacco smoking among migrant women in the host country.^{107 108} Our findings are in line with the universal observation that unhealthy lifestyles are strong risk factors for obesity and many NCDs.¹⁰⁹ Interestingly, general obesity is not a strong risk factor for NCDs among some migrant groups, and unhealthy diets do not fully explain the observed occurrence of obesity. Early-life insults have been proposed as an alternative explanation, particularly for first-generation migrants, who were born in low-income and middle-income countries with different environmental and nutritional exposures during foetal development and early childhood.¹¹⁰

Migration-related factors have been associated with chronic stress, which can trigger the central nervous system and thus increase the risk of cardiovascular diseases among migrants.⁹⁶ In our study, longer stay in Germany and good language proficiency were associated with better healthcare utilisation but not all health outcomes.^{111 112} In line with our findings, a recent meta-analysis of studies across Western societies showed that the health status of migrant groups converges to the health status of autochthonous populations when migrants have a permanent residence permit or longer length of stay.¹¹³ In Germany, language barriers and low health literacy among immigrated persons are known to adversely influence the access to and the utilisation of the healthcare system.¹¹⁴ It is therefore important to improve communication such as provision of interpreters or trained mediators with migrant backgrounds who will disseminate information on health topics to their own cultural group and facilitate access to the health system.

Strength and limitations

Studies were independently searched, screened and extracted by at least five authors (TBO, PNS, IM, RS, FF, CH, ID) with a standard protocol, limiting selection bias. Our study has notable limitations. First, most of the published studies included were cross-sectional. Hence, causal inference is limited. Our results might be biased because we included only studies focusing on the major migrant groups in Germany and limited our literature search to quantitative study designs. Second, we might have overlooked articles not included in the two databases (PubMed and LIVIVO) and not published in German or English. Moreover, the generalisability of risk factor–disease relationships was complicated by including all kinds of migrant groups (refugees, legal migration, first, second and third, re-emigration) and recruitment strategies (registered base, community oriented), thus making comparability of data limited. Nonetheless, it

offers a comprehensive overview of exposure–outcome relationships on health risk among migrant groups.

CONCLUSION

This SLR shows that there is increasing body of evidence for aetiological research on migrant health in Germany. The directions of associations between a wide range of risk factors and major disease groups seem to be partially understood. However, our findings call for long-term observational studies to determine the temporal dimension and the exact magnitude of the relationships. In addition, more research is warranted into the role of diet, physical activity and sleep. Experimental studies are required to evaluate tailored intervention approaches.

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