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Older employees with migrant background in Germany:

employment perspective, needs and utilisation of rehabilitation

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Abstract

As a result of the demographic change, the labour force in Germany is shrinking. Increasing the labour force participation of older employees can contribute to ensure social stability in this country. However, the extension of working life poses a challenge for society, as health and work ability often decline with age. This raises the question on whether an increase in the statutory retirement age also corresponds to the personal situation of employees. Medical rehabilitation can help to prevent premature work exits by maintaining the ability to work. In this context, it should be kept in mind that the older working population in Germany is not a homogenous group in many respects. For example, almost a quarter of all older employees have a migrant background.

As little is known about this group, the aim of the present thesis is to give insights into differences between employees with and without migrant background with respect to their last working years. On the one hand, the individual motivation, ability and plans to continue working until the statutory pension age (employment perspective) were analysed and on the other hand the utilisation of rehabilitation, particularly considering need for rehabilitation. The theoretical foundation of the studies was derived from the "lidA conceptual framework" (1) and the "Behavioural Model of Health Services Use" (2). The cumulative dissertation includes three articles published in international peer-reviewed journals. For all studies, data of the German lidA study was used. The lidA-study is a representative cohort study on work, age, health, and work participation and includes socially insured employees either born in 1959 or 1965. The three studies were analysed with data from the first three surveys in 2011 (n=6585), 2014 (n=4244) and 2018 (n=3586). The data provides the possibility to distinguish employees with migrant background into different generations, meaning first- and second-generation, which was used as a classification for all studies.

Study I investigated the subjective employment perspective in form of willing, planning and being able to work (at least until the individual statutory pension age), while adjusting for sociodemographic, health and work-related factors. The analysis was based on the third survey of the lidA study. The results of the bivariate analyses showed that the migrant employees of the first-generation was more frequently planning to work longer. This was confirmed in the adjusted regression analyses compared to employees without a migrant background.

Study II examined the utilisation of medical rehabilitation in the first survey of the lidA study. Bivariate analyses revealed a lower utilisation of outpatient rehabilitation in the first-generation compared to the other groups. This was again confirmed in the adjusted logistic regression when separating different types of rehabilitation (outpatient and inpatient). No significant

differences were found for the utilisation of rehabilitation in general without differentiating between subtypes.

Study III investigated whether rehabilitation was utilised in accordance with the subjective need for rehabilitation. As the need is a prerequisite for the utilisation of health services like rehabilitation, the need was defined using data of the first survey and the utilisation using data of the second survey. To derive the need for rehabilitation, a summarising score was developed from different factors. Employees of the first-generation showed the highest need based on this score, followed by those of the second generation and those without migrant background. In the stratified logistic regression analyses, the need was shown to be predictive for subsequent utilisation of rehabilitation in all groups. However, further investigations revealed that under- and overuse existed at the same time in almost all groups, in the sense of no use despite need or use despite low need.

Overall, the results show that older migrant employees of the second-generation in Germany today are quite similar to those without a migrant background and have a better overall situation compared to the first-generation. In contrast, older employees of the first-generation (mostly foreigners) represent a risk group in social, occupational and health terms who have a higher need for rehabilitation. However, they plan to a greater extent to work until the statutory pension age (usually under poor working conditions). However, according to the study results of this thesis, they might not (yet) be provided with the rehabilitative services they need. Therefore, the first-generation represent a special risk group in the context of extending working lives, which should be paid attention to in the coming years. The findings emphasise the need for diversity-specific approaches in healthcare provision, employment support, and policy interventions to meet the specific needs and challenges faced by older workers with a migrant background.

Keywords: older workers; migrant workers; diversity; health; work ability; stay at work; medical rehabilitation

Zusammenfassung

Im Zuge des demografischen Wandels verringert sich die Erwerbsbevölkerung in Deutschland. Insbesondere die Erhöhung der Erwerbsbeteiligung älterer Beschäftigter kann hierzulande dazu beitragen, die soziale Stabilität weiter zu gewährleisten. Die Verlängerung der Lebensarbeitszeit stellt dabei eine gesellschaftliche Herausforderung dar, da Gesundheit, Arbeitsfähigkeit und -motivation oft mit dem Alter abnehmen. Dies wirft die Frage auf, ob eine gesetzliche Erhöhung des Rentenalters auch der persönlichen Situation der Beschäftigten entspricht. Medizinische Rehabilitation kann durch Erhaltung der Arbeitsfähigkeit dazu beitragen, ein vorzeitiges Ausscheiden aus dem Erwerbsleben zu verhindern. Dabei ist zu berücksichtigen, dass die ältere Erwerbsbevölkerung in Deutschland keine homogene Gruppe ist. So hat fast ein Viertel aller älteren Beschäftigten einen Migrationshintergrund.

Da über diese Gruppe bislang wenig bekannt ist, ist es Ziel vorliegender Dissertation Unterschiede zwischen Beschäftigten mit und ohne Migrationshintergrund hinsichtlich ihrer letzten Arbeitsjahre aufzuzeigen. Dabei wurden einerseits die individuelle Motivation, Fähigkeit und Pläne, bis zum gesetzlichen Rentenalter zu arbeiten (Erwerbsperspektive), andererseits die Inanspruchnahme von Rehabilitationsmaßnahmen, vor allem unter Berücksichtigung des jeweiligen Bedarfs, analysiert. Die theoretische Fundierung der Untersuchungen wurde aus dem konzeptionellen lidA-Modell (1) und dem „Behavioural Model of Health Services Use" (2) abgeleitet. Die kumulative Dissertation umfasst drei Artikel, die in internationalen Fachzeitschriften mit Peer-Review-Verfahren veröffentlicht wurden. Für alle Untersuchungen wurden Daten der deutschen lidA-Studie verwendet. Die lidA-Studie ist eine repräsentative Kohortenstudie zu Arbeit, Alter, Gesundheit und Erwerbsbeteiligung und umfasst sozialversicherte Beschäftigte, die entweder 1959 oder 1965 geboren wurden. Die drei Studien wurden mit Daten aus den ersten drei Studienwellen von 2011 (n=6585), 2014 (n=4244) und 2018 (n=3586) analysiert. Die Daten bieten die Möglichkeit, Beschäftigte mit Migrationshintergrund in verschiedene Generationen zu unterteilen, d. h. in die erste und die zweite Generation, was als Klassifikation für alle Studien verwendet wurde.

Studie I untersuchte die subjektive Erwerbsperspektive in Form von arbeiten wollen, planen und können (bis mindestens zum individuellen Renteneintrittsalter) unter Berücksichtigung von soziodemografischen, gesundheitlichen und arbeitsbezogenen Faktoren. Die Analyse basierte auf der dritten Welle der lidA-Studie. Die Ergebnisse der bivariaten Analysen zeigten, dass die erste Generation vermehrt plante länger zu arbeiten. Dies wurde im Rahmen der adjustierten Regressionsanalysen erneut bestätigt im Vergleich zu den Beschäftigten ohne Migrationshintergrund.

In Studie II wurde die Inanspruchnahme der medizinischen Rehabilitation in der ersten lidA-Studienwelle untersucht. Bivariate Analysen ergaben eine geringere Inanspruchnahme

ambulanter Rehabilitation in der ersten Generation im Vergleich zu den anderen Gruppen. Dies bestätigte sich auch in der adjustierten logistischen Regression, wenn man zwischen den verschiedenen Arten der Rehabilitation (ambulant und stationär) unterschied. Für die Inanspruchnahme von Rehabilitationsmaßnahmen im Allgemeinen wurden ohne Unterscheidung eines Subtyps keine signifikanten Unterschiede festgestellt.

In Studie III wurde untersucht, ob die Inanspruchnahme von Rehabilitationsmaßnahmen dem subjektiven Rehabilitationsbedarf entspricht. Da der Bedarf eine Voraussetzung für die Inanspruchnahme von Gesundheitsleistungen wie Rehabilitation ist, wurde der Bedarf durch Daten der ersten Studienwelle und die Inanspruchnahme durch Daten der zweiten Studienwelle definiert. Zur Ableitung des Rehabilitationsbedarfs wurde ein zusammenfassender Score aus verschiedenen Faktoren entwickelt. Beschäftigte der ersten Generation zeigten auf Grundlage dieses Scores den höchsten Bedarf, gefolgt von denen der zweiten Generation und denen ohne Migrationshintergrund. In den stratifizierten logistischen Regressionsanalysen zeigte sich der Bedarf in allen Gruppen als prädiktiv für die spätere Inanspruchnahme. Weitere Untersuchungen zeigten jedoch, dass in fast allen Gruppen sowohl Unter- als auch Überversorgung existierten, also keine Nutzung trotz Bedarf oder Nutzung trotz geringem Bedarf.

Insgesamt zeigen die Ergebnisse, dass ältere Beschäftigte der zweiten Generation in Deutschland heute denen ohne Migrationshintergrund ähnlich sind und im Vergleich zur ersten Generation eine bessere Gesamtsituation aufweisen. Ältere Beschäftigte der ersten Generation (meist Ausländer) stellen dagegen eine Risikogruppe in sozialer, beruflicher und gesundheitlicher Hinsicht dar, die einen höheren Rehabilitationsbedarf haben. Sie planen jedoch in höherem Maße, bis zum gesetzlichen Rentenalter (unter meist schlechten Bedingungen) zu arbeiten. Allerdings werden sie nach unseren Untersuchungsergebnissen möglicherweise (noch) nicht ausreichend mit den notwendigen Rehabilitationsleistungen versorgt. Daher stellen ältere Beschäftigte mit Migrationshintergrund in der ersten Generation ein besonderes Risikokollektiv im Zusammenhang mit der Verlängerung des Arbeitslebens dar. Auf sie sollte in den kommenden Jahren ein besonderes Augenmerk gelegt werden. Die Ergebnisse unterstreichen die Notwendigkeit von diversitätsspezifischen Ansätzen in der Gesundheitsversorgung, der Beschäftigungsförderung und bei politischen Maßnahmen, um den besonderen Bedürfnissen und Herausforderungen älterer Beschäftigte mit Migrationshintergrund gerecht zu werden.

Schlagworte: Ältere Beschäftigte; Migrationshintergrund; Diversität; Gesundheit; Arbeitsfähigkeit; Erwerbsverbleib; medizinische Rehabilitation

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Tables and figures

List of Abbreviations

CCS.. *Chloé Charlotte Schröder*

EMB.. *employees with migrant background*

EWL.. *extension of working lives*

G1.. *first generation of PMB*

G2.. *second generation of PMB*

HMH .... *Hans Martin Hasselhorn*

iSPA .... *individual state pension age*

JB .... *Jürgen Breckenkamp*

JP .... *Jean-Baptist du Prel*

lidA .... *leben in der Arbeit*

MD.. *Maria Dyck*

non-EMB .... *employees without migrant background*

OECD .... *Organisation for Economic Cooperation and Development*

OSH.. *Occupational Safety and Health*

PMB.. *Persons with migrant background*

SF.. *Short Form Health Survey*

SOEP .... *German socioeconomic panel*

Preface

This dissertation consists of three studies published in international peer-reviewed journals, embedded in a general introduction and discussion at the end.

[I] Schröder CC, Hasselhorn HM, du Prel J-B, Breckenkamp J. Subjective employment perspective among older workers with and without migrant background in Germany—Results of the lidA cohort study. J Occup Health. 2020; 62:e12166. doi: 10.1002/1348-9585.12166

[II] Schröder CC, Dyck M, Breckenkamp J, Hasselhorn HM, du Prel J-B. Utilization of rehabilitation services for non-migrant and migrant groups of higher working age in Germany - results of the lidA cohort study. BMC Health Serv Res. 2020; 20:31. doi: 10.1186/s12913-019-4845-z

[III] Schröder CC, Breckenkamp J, du Prel J-B. Medical rehabilitation of older employees with migrant background in Germany: Does the utilization meet the needs? PLoS ONE. 2022; 17(2): e0263643. https://doi.org/10.1371/journal.pone.0263643

1. General introduction

The first section introduces the thesis topic and contains the background in 1.1, the used theoretical approaches in 1.2, previous empirical findings in 1.3, and the aim and scope of the thesis in 1.4. The second section is about the summary of the single studies which is followed by a general and overarching discussion as the third section at the end.

1.1 Background

The demographic change is now one of the greatest and current challenges for industrialised countries like Germany. While large parts of society are leaving the labour market and fewer young people are joining, the potential labour force for the German labour market is declining (3, 4). When there are fewer younger employees on the labour market, employers and politicians need to focus on older employees' "stay at work" to guarantee further social stability. Therefore, in many European states the extension of working lives (EWL) was politically implemented by increasing the statutory retirement age and reducing pathways and incentives for early exit from work (5). As a consequence, the proportion of employees among the 60-64 years old in Germany increased from 44% in 2011 to 61% in 2021, which was the highest proportional increase compared to other age groups (6).

The associated prolonged working life and changing transition to retirement could be a challenge for older employees, employers, and the society for several reasons. The person-job-fit may decrease for older employees, as the labour market and work characteristics are changing permanently because of globalisation and digitalisation. Simultaneously, health and work ability are known to often decline with age (7, 8). This can partly be attributed to unfavourable working conditions which are particularly demanding for older employees (9–12). As a consequence of EWL, the proportion of employees with health limitations (13) and thus less ability and motivation to continue working may rise.

This raises the question of whether a legislation that increases the retirement age also corresponds to the personal motivation and intention and, of main importance, the work ability and health of the older population. More precisely, it remains unclear whether future employees in higher working age will be individually able to, willing to, and planning to remain in the labour force to the extent hoped for (14, 15). These aspects comprise the subjective perspective on further employment prior to retirement and constitute the employees' inner representation of how long they are *able* to work, *willing* to work and/or *plan* to work. In the context of EWL this subjective perspective may display how likely employees are to further participate or leave the labour market. Thus, these factors of ability, willing, and planning could be of relevance for policy-making and planning of target-group specific measures, as they seem to be valid predictors for future retirement decisions (16, 17). Former research on these outcomes has shown that several factors during the process of retirement play a role in this

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context, such as personal, social and occupational factors as well as health status (16-19). Especially poor health has been identified as a key determinant of early retirement in international research (1, 20–22), meaning that the health status constitutes an important prerequisite to stay at work.

Therefore, in the future, one primary public health goal will be to prevent early work exits due to poor health by applying the principle "rehabilitation before retirement" (23, 24). According to Stucki et al. (25) rehabilitation might be "the key health strategy of the 21st century" as it has the potential to improve, retain or prevent the worsening of disability and poor functioning which influences work ability. Rehabilitation services intend to minimise the limitations due to chronic disease and disabilities to guarantee participation in society and the labour market, according to social security code (23, 26-28). In general, rehabilitation, re-integration and prevention in general will become more relevant in the future as these are aiming at continuous active participation in working life.

If the older employee's health and work ability to participate in the labour market is decreasing, not only the individual motivation and plans to keep working might decrease. It can rather lead to the workers' reduced interest to sustain or improve health and work ability through medical rehabilitation. This motivation, however, is essential for seeking rehabilitation and likewise for the effectiveness of the rehabilitation afterwards (29, 30). Thus, among older employees not only the individual health situation but also the individual motivation and planning may impact the utilisation patterns for health services like rehabilitation, thus the ability to stay at work and in the long run actual retirement age.

1.1.1 Older migrant employees in Germany

Against this background, it is of relevance to consider that the older employees in Germany are not homogenous (31, 32). Therefore, the transition to retirement and its processes described above may not proceed similarly in all groups of older employees. One specific subgroup are employees with a migrant background (EMB), which comprises the process of international migration for the person themselves or some part of the family in the past. Their proportion in the German workforce is steadily growing and has increased from e.g. 16.8% in 2011 to 22.8%[1] in 2019, which largely corresponds to the proportions of the older working population aged 45-65 years (33, 34).

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[1] According to the strict definition for the migrant background in the German micro-census, where only the information about the parents who also live in the same household is used. When applying all information about the parents collected in certain years from the surveyed person themselves, this group constituted 24.4% in the broader definition, which includes systematically more persons with migrant background than in 2011.

The largest proportion of EMB in Germany had their origin in Turkey, followed by Poland, the Russian Federation, Romania and Italy (34). This entails a high degree of heterogeneity within this group, e.g. with regard to their origin, culture, education and religion (35, 36).

This situation has its origin in the second half of the 20th century, when many migrants came as "immigrant workers" to Germany due to the recruitment agreements between Germany and Turkey and other South European countries from 1955 to 1973, as German companies had an increased demand for unskilled and semi-skilled employees in industrial sectors. Their main motivation was to leave unemployment in their home countries behind and raise their standard of living. At first, however, no permanent residence in Germany was planned, because there would be an exchange of workers within a rotation. No integration was attempted. But in the long term, as the numbers show, many immigrant workers stayed in Germany after the ban on recruitment in 1973 and the family reunification started (36, 37).

The other big group of migrants are mostly ethnic German (late) resettlers from Eastern Europe and the Russian Federation. They are immigrants of German descent who came to Germany from an Eastern Bloc state or the former Eastern Bloc in order to settle there (about 4.5 million people in the period between 1950 and 2010) (36).

To identify this subgroup of migrants different criteria can be used (38), which produces several different definitions and partly inconsistent research findings. In Germany, the criterion nationality and the term foreigners were used for a long time to describe migrants. However, with the increasing naturalisation of migrants this criterion seemed increasingly inappropriate (39) and can lead to misclassification of about half of the people with a migrant background (PMB), as they have German nationality (24, 34). For this reason, the concept of migrant background was introduced in 2005 for the German micro-census, which also allows to identify their own migration experiences and hence different "generations" of migrants.

Accordingly, a person has a migrant background if the person them self or at least one parent does not have German nationality by birth. With the help of this operationalisation, it is now possible, to differentiate more precisely within the group of migrants. There is the first-generation (G1), which was born abroad and has its own migration experience. G1 can either have foreign (foreign first-generation/G1) or German nationality after naturalisation (German first-generation/G1). Furthermore, there are their descendants born in Germany without own migration experience, which is called second-generation (G2). Their proportions in employees further separated for nationality can be found in Figure 1. Correspondingly, there is also a third-generation and so on, but this is out of the scope of this thesis.
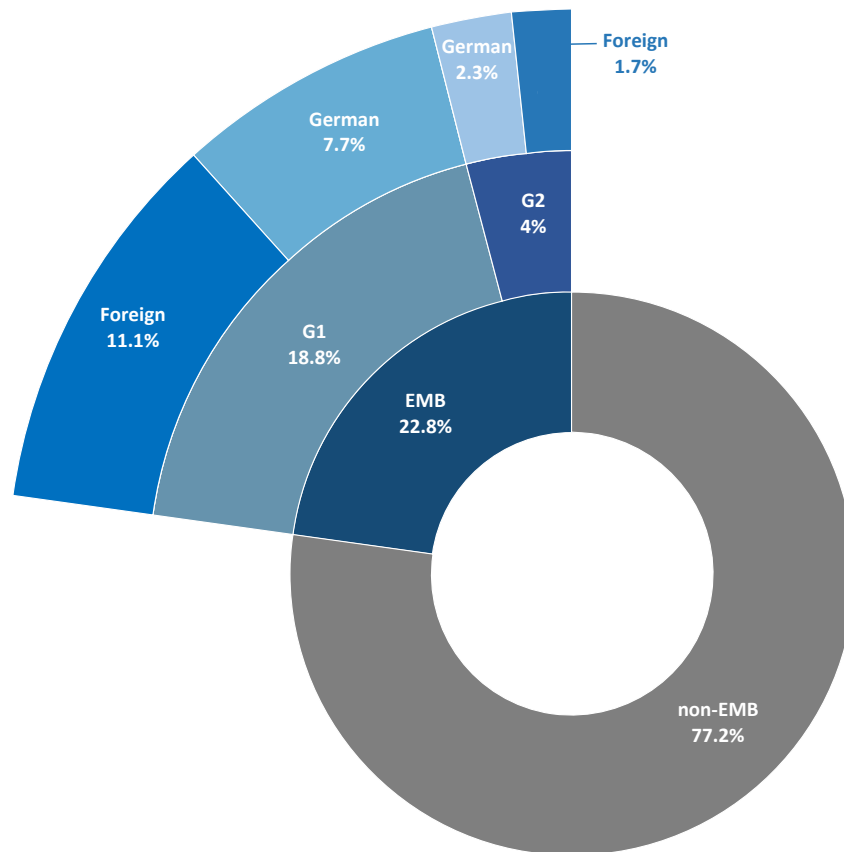
Figure 1. Employees with migrant background in Germany in 2019 (according to the strict definition of the German micro-census, separated for first and second generation and German and foreign nationality) (34)

Although EMB constitute a comparatively young population group on average (37), 35.8% of them were 45 to 65 years old in 2019, which is further increasing according to the population pyramid (34). Thus, many older EMB in Germany have already reached the retirement age by now or are in the transition to retirement, which will have far-reaching economic and socio-political consequences, as many stayed in Germany and have not migrated again (36). In this context, the necessity of further employment of older persons for the German labour market has already been discussed many times. This applies equally to German and foreign nationals. However, it can be assumed that the population of foreigners and older EMB in general are additionally confronted with migration-specific challenges in the transition to retirement due to their biographical and cultural experiences. These circumstances might differ between subgroups of EMB but also in relation to non-EMB, which shows the need for further differentiation as well as the complexity and therefore difficulties for research. Consequently, there is a need to analyse and consider the specific situation and experiences of migrants in the older age groups, so that resulting disadvantages in society, e.g. in the health system, can be adjusted (40).

The differentiation between generations of EMB and its additional comparison to non-EMB will be the focus of this thesis, so that differences and potential risk groups can be identified. The

research questions of this cumulative dissertation are firstly what the employee's individual perspective (incl. planning, willing, being able) towards further employment and retirement look like, secondly how rehabilitation services are utilised and thirdly, whether they are used adequately (need-based). Based on these investigations, possible target group specific measures could be developed to keep them healthy and capable to work until their individual retirement age or possibly the official statutory retirement age.

1.1.2 Context of the Thesis

The doctoral thesis is embedded in an interdisciplinary context, as it focusses on the group of older employees with migrant background and the employment perspective but also rehabilitation which both include e.g., social, health and occupational aspects. The discipline *occupational health science* (in German: "Arbeitswissenschaft") views work from an interdisciplinary perspective and thus serves as a basis for this thesis. Its central subject is the relationship of people and work and its determinants to design work as humane as possible. For this, e.g., technical, organisational, or social working conditions and processes are analysed. The understanding of occupational health science in Germany is only partially transferable to the international context, where the terms "ergonomics" and "human factors" are more common (41).

With its research subject, this doctoral thesis touches several sub-disciplines of occupational health science, which all have overlaps in content and theory regarding the superior research topic of employee health and work participation. These disciplines will be briefly explained.

For example, *Sociology* examines each individual as an employee in a specific work situation and ones function as part of a social system, where the organisational structures and its changes at the workplace but also the work satisfaction and motivation are considered and analysed (41). In comparison, the discipline *social epidemiology* is very young in Germany but closely connected to sociology. It deals with inequality among people and whether socially and economically disadvantaged population groups are also disadvantaged in terms of health. Subsequently, it examines the reasons for these inequalities and how they can be changed (42). The aims of *Occupational medicine* are to promote, maintain and improve people's health and work ability by holistically considering the working individual and their work environment, demands and processes. It is a predominantly prevention-oriented discipline. *Occupational and organisational psychology* determines experiences, behaviours, and developments of people in organisations and the relevant reasons for that, such as working conditions or tasks. It is assumed that each employee has individual needs, intentions, purposes and plans which can be part of specific research questions (41).

And lastly, the core tasks of *Occupational safety sciences* (e.g. Safety Engineering) are the identification, assessment and prevention of technical, organisational and social risks and

accidents with the aim of "safe work" (41, 43). It is based on the German Occupational Safety and Health Act (Gesetz über die Durchführung von Maßnahmen des Arbeitsschutzes zur Verbesserung der Sicherheit und des Gesundheitsschutzes der Beschäftigten bei der Arbeit, 1996). According to this, both - employers and employees – are responsible for maintaining the employee's work ability with e.g., recommending, or utilising medical rehabilitation as tertiary prevention to improve, restore or at least inhibit deterioration of work ability and poor health. This in turn is linked to the disciplines of health services research and public health and once again illustrates the interdisciplinarity of this doctoral thesis.

1.2 Theoretical approaches

To embed this interdisciplinary topic holistically in the context of work and health, the theoretical approach of this thesis is based on two comprehensive and multifactorial conceptual frameworks: The "lidA conceptual framework on work, age and employment" (1) and the "Behavioural Model of Health Services Use" (2, 44). In general, conceptual models and frameworks summarise theories but also existing research findings, explorative results and findings from experiments or experiences (45). The suitability of these two conceptual frameworks for this thesis will be explained and both described in the following. Lastly, the importance of a life course view in such models will be highlighted in another paragraph.

1.2.1 The lidA conceptual framework

In the context of older working-age population and EWL, the decision of when and how to retire and leave working life becomes more and more important the older the employees. In this field of "employee retirement" a lot of behavioural scientific theories (e.g. rational choice theory) can be identified (46), however these would go beyond the scope of this thesis. Instead, the "lidA conceptual framework on work, age and employment" is used and discussed here, which was developed in 2011. Hasselhorn et al. hypothesised that the probability of a single factor being the reason to retire is close to 0, as it is a rather complex decision making process (1). Thus, it includes individual and environmental factors from eleven domains which cohesively influence the transition from work to retirement. These comprise the working conditions and work ability, but also social position, private circumstances, health and health-related lifestyle, legislation, or the motivation to work (see Figure 2). On the overarching macro level, the individual person is embedded in a system of society, economy, and other social relationships, which hinders an individual autarchic decision. Additionally, there is the labour market which represents the supply and demand for labour in the respective society (1, 47).
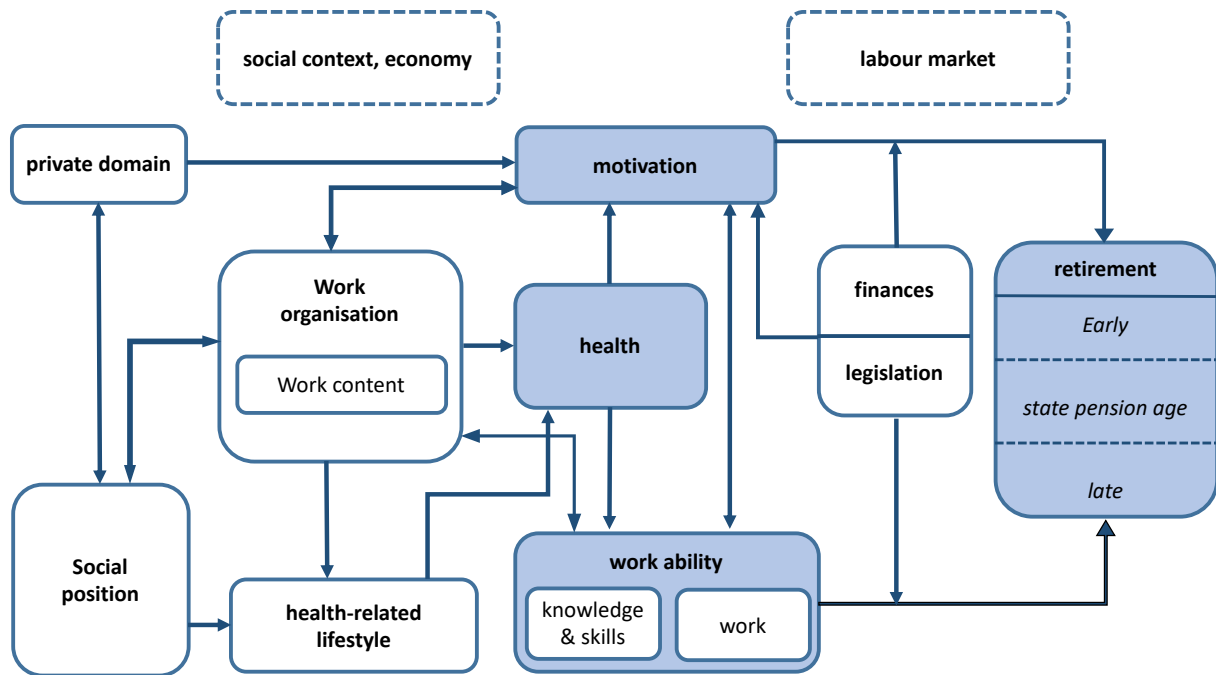
Figure 2. The lidA conceptual framework on work, age and employment (1)

Furthermore, the authors theorise that retirement can be understood as a process which is already influenced by the social position a person is born in, as this determines the choice of occupation and therefore impacts later working conditions, health, and work ability (includes life course view/perspective) (1, 12). According to this, countermeasures need to be implemented well in advance to effectively counteract e.g., early retirement. Therefore, it is reasonable and important to investigate indicators of (early) retirement so that suitable measures and interventions can be developed, planned, and realised in practice.

In this context, this thesis' subject is mainly located in between the domains of motivation, health, work ability, and retirement (highlighted by the author in Figure 2). As mentioned before, the individual perspective including the willing and planning to continue working (domain motivation) in older age towards retirement is understood as an indicator of future employment participation and retirement (16, 17, 47).

In the lidA framework, the domain of health does not have a direct impact on the domain of retirement, but its effect is mediated through the factors of work ability and motivation. Work ability is a concept that comprises the own perception of the employee about personal resources and the capability to work in dependence of the current job demands on the other side. Although work ability is highly connected to health, it is defined separately, as it is possible to have poor health and good work ability at the same time when beneficial work circumstances compensate health restrictions (1). The two domains of health and work ability lead to the other part of this thesis: the (need-based) utilisation of medical rehabilitation as a possible measure to help employees to stay at work despite their older age and increasing

health problems. As medical rehabilitation is a health care service, it seems suitable to likewise consider the behavioural model of health services use, which will be further explained in the next section 1.2.2 as the second conceptual framework. Both models show parallels in terms of further influential factors which should be kept in mind and considered in analyses, if possible. For example, the topics of finances and legislation are presented in the lidA model as mediators, as they promote or prevent the exit from the labour market. In the past in Germany, a lot of people retired early due to financial incentive options which contrasts with today, where changed legislation and financial regulations prevent this circumstance.

Further barriers and facilitating factors in the transition from work to retirement are anchored in other domains like private life, social position, health-related lifestyles and basically in the work itself including the work content but also its organisation. Consequently, the lidA framework serves as a solid theoretical basis to investigate these outcomes for the group of EMB.

1.2.2 Behavioural Model of Health Services Use

As described in the lidA conceptual framework, the (maintenance of) health and work ability represent central and important factors in the transition from work to retirement, especially in times of EWL. Thus, it is of special interest to get a deeper understanding on what these determinants look like among EMB and non-EMB, subsequently if there is a need for measures like medical rehabilitation and if it is used accordingly and equally. As medical rehabilitation is a health service of tertiary prevention, the "Behavioural Model of Health Service Use" (2, 44) is ideally suited and complements the lidA framework as the theoretical approach of this thesis. The behavioural model represents one of the leading international theories in health services research (48), so that a lot of previous research was based on this model (49–51). It was initially developed to explore why families use health services, to quantify adequate access to health care, and to help establish policies to encourage fairly distributed access (44). The model was first published in the 1960s by Andersen and has been further developed many times since then with the help of new research findings. Figure 3 shows the sixth revision (with highlights made by the author), which suggests a causal order of factors determining health behaviours and consecutive outcomes such as perceived health in a self-influencing cycle (2). The model implies, that the influential factors can be on the contextual but also on the individual level. For each level the model differentiates between predisposing, enabling and need characteristics which lead to and explain certain health behaviours and outcomes as presented in Figure 3 (2). From these facilitating or hindering factors interventions at different levels can be derived to improve access to care.
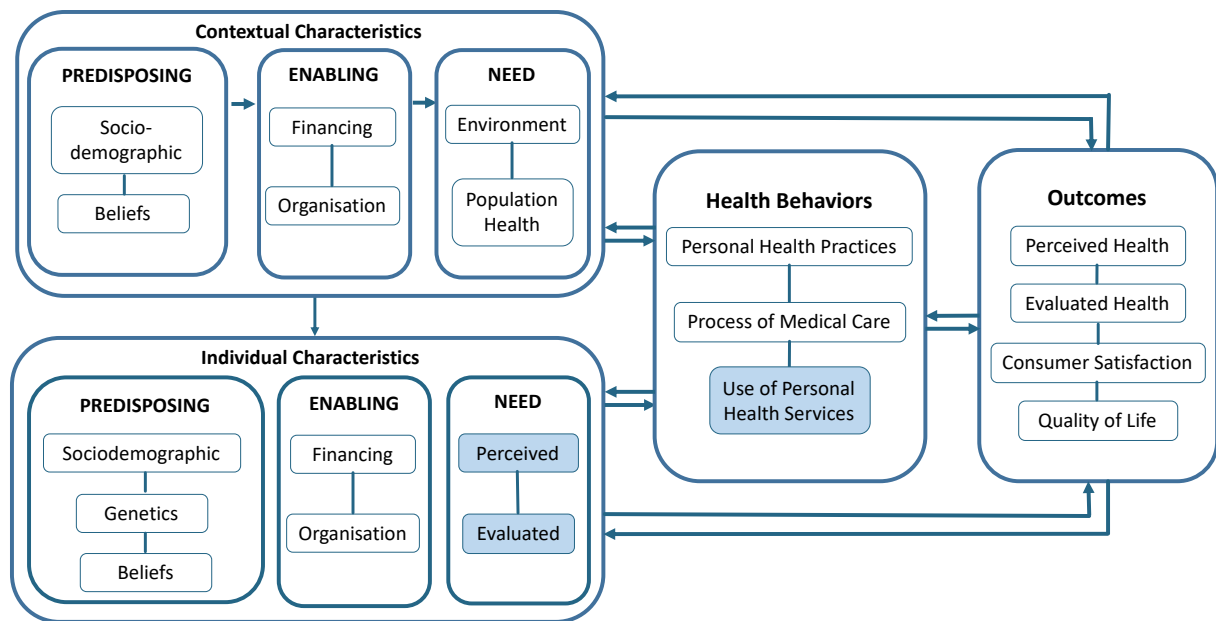
Figure 3. The Behavioural Model of Health Services Use, sixth revision (2)

Contextual factors are measured at the aggregate rather than the individual level and result from the environment and society the individual is working and living in. They can include e.g. sociodemographic and health indices like mortality rates, the existence and organisation of health care providers, but also political and economic regulations. As the model indicates, these contextual characteristics influence the individuals living in this context. Besides their own individual characteristics leading to a specific health behaviour, they are dependent on the given circumstances.

The individual predisposing characteristics can comprise socio-demographic conditions, biological predispositions, and cognitive beliefs. These are supplemented by individual enabling factors e.g., financial, and organisational resources like income, health insurance, availability of health services or social support in the individual environment (2). Finally, the most important individual factor is the individual need which can be considered on one side as self-perceived health, how the people assess their own health, illness, pain, or functional state and consider it as a major problem to look for professional help. On the other hand, it can be measured in form of evaluated need like objective medical diagnoses or laboratory measures etc. (44, 52). These predisposing, enabling and need factors affect certain health behaviours such as the utilisation of health services (e.g., outpatient care at physicians, dental care, or inpatient and hospital services) to a different degree. This in turn can lead to consumer feedback after receiving care, but also to an updated health status connected to quality of life (2) which form the basis for a new circulatory flow of the model.

In this context, the subject of this thesis is mainly located in the part of the model that shows how individual factors affect the utilisation of medical rehabilitation as a health service.

Determinants from all individual subcategories can be considered in the analyses, however a special focus will be put on the individual need for rehabilitation as a prerequisite for the utilisation (highlighted by the author in Figure 3). This is because one of the topics of this thesis is to examine whether there is needs-based utilisation of rehabilitation comparing EMB and non-EMB. To answer this research question seems particularly important for the planning of measures to assure equitable access for all older employees.

1.2.3 Life course epidemiology

When looking at older employees, especially in those with migrant background, the life course must not be ignored, as a lot of factors accompany and influence each other until a higher working age. Both presented models somehow imply a life course perspective as well. Different researchers in work and health but also retirement research suggested that the life course with its changing experiences due to individual life circumstances and the likewise changing labour market and society should be acknowledged (46, 53). This life course perspective can identify sensitive sequences in different working life trajectories which subsequently can and should be considered in policies and interventions to "create successful labour markets and health trajectories" (53).

Especially in immigrants those different migrant-specific trajectories must be kept in mind, created by the incisive event of migration in life and subsequent living in a new country with a different cultural background. The conceptual life course approach by Spallek and colleagues (54–56) is built up on earlier ideas by Schenk (57) and takes a lot of factors for the association between migration and health into account (see Figure 4).
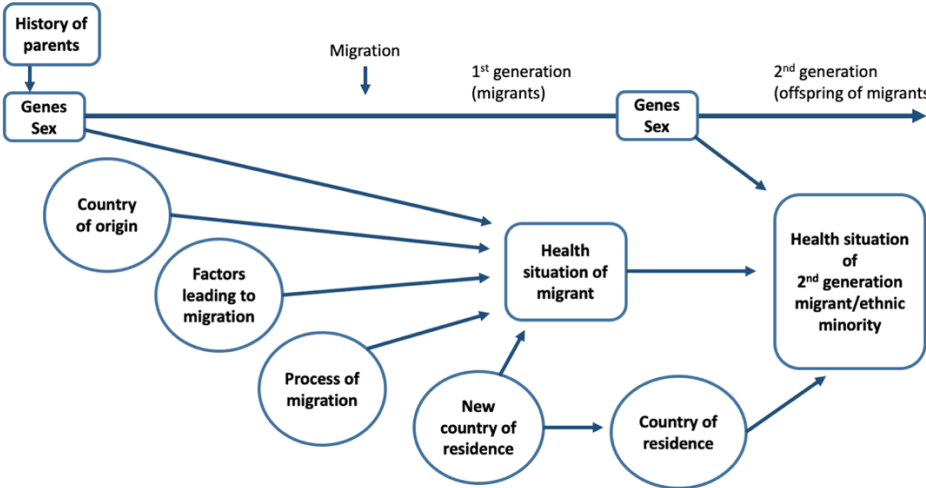

Figure 4. The life course approach on migrant health (55)

In immigrants and especially older ones, not only genes and sex, but more importantly exposures in the country of origin, the process of migration and the situation after migration

have an influence. Thus, migration is understood as a process and life course shaping determinant which can have positive but also negative effects on their life and health. It can also be seen as a health transition (55). Here, the so-called "healthy migrant effect" as a selection effect becomes meaningful, as rather people with better health decide to migrate. This phenomenon is similar to the "healthy worker effect" in the occupational setting, where workers are healthier in comparison to the general population.

It is important to note, that the accumulation of risks is differently distributed within PMB. For the second-generation (G2), only parts of the influential phases apply as they don't have the migration experience and the exposures of the country of origin. However, predisposing factors are still passed on from their parents e.g., genetics or cultural and health behaviours and beliefs. Especially the parental socio-economic position is a strong determinant while growing up and in later life (58). Besides, they are likewise exposed to factors of the country of residence. Therefore, the health situation of PMB/EMB can not only differ from the native population but additionally between generations. Its health consequences can occur during, or a short time after migration but likewise years or decades later (54, 55).

1.2.4 The overarching view

As the before presented theoretical approaches show parallels in regard to factors/domains influencing the final outcome, they are visualised in combination in Figure 5 to allow a specific and overarching view on the thesis context.
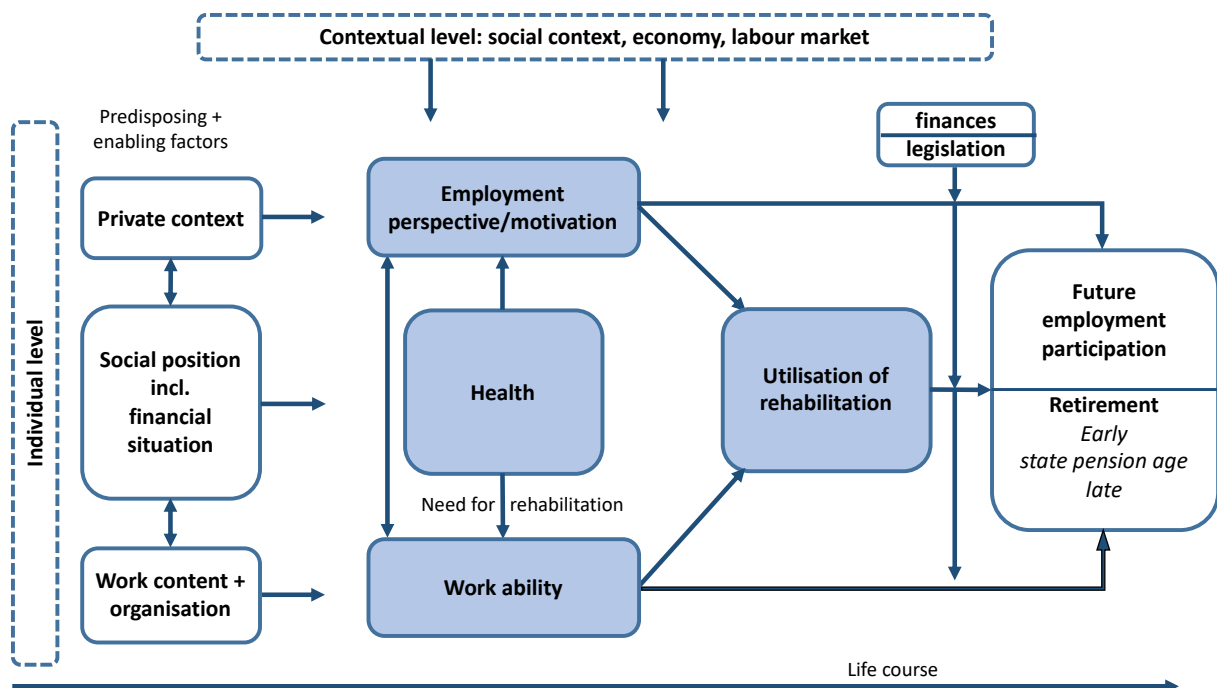

Figure 5. The thesis context (own illustration)

Several factors on the individual level as presented on the left-hand side influence health, work ability and employment perspective. The latter serve as central aspects in the lidA framework and likewise in this own illustration. But if the older employee's health and work ability to participate in the labour market is decreasing, not only the individual motivation and plans to keep working (employment perspective) might decrease. It can also lead to a reduced interest to sustain or improve health and work ability through medical rehabilitation. This motivation, however, is essential for the application for rehabilitation and also for the effectiveness of the rehabilitation afterwards (29, 30). Thus, among older employees not only the individual health and work ability but also the individual motivation and intention like the planning may impact the utilisation patterns for health services like rehabilitation and in the long run their actual retirement age as shown in Figure 5.

Contextual factors play a significant role in the lidA framework and in Andersen's behavioural model (1, 2). In regard of future employment participation towards retirement, these can include the current economic situation of each country and its labour market like the employment rate or the shortage of skilled manpower, but also changing policies and legislations regarding retirement and pensions incl. disability pension or unemployment benefits (59, 60). Related to this is the role of finances and legislation which is known to push older workers involuntarily or pull them voluntarily out of work, as e.g. access to early retirement programmes or occupational pensions lead to early exit from work (61–63). However, by now, the changed policies of several European countries restrict early retirement to a great extent which has slowly increased the labour force potential and thus retirement age (60).

1.3 Previous empirical findings

Based on these theoretical and conceptual assumptions, the following section provides an overview of the current state of research. It is compulsory to first review the social and occupational health situation of (older) EMB in Germany, as the underlying conceptual models have presented them as influential determinants for retirement or health services use. After this, the current empirical findings on the respective outcomes will be elucidated: first the subjective employment perspective and then the utilisation of rehabilitative care in migrant groups.

1.3.1 The occupational (health) situation

The most important key factors for participation in society and in employment are educational and vocational training. A lower educational and vocational status or no official degree at all among migrants compared to natives has been documented many times in German process and survey data (34, 37, 64, 65). However, those differences can be partly attributed to the

lack of recognition of qualifications acquired abroad (64, 66), which prevents successful integration into the labour market.

This (official) lower level of education of migrants in general, especially in the older population, consequently influences their employment participation and occupational position. They have higher chances of being unemployed and if they are employed, they are highly likely to have less skilled occupational positions with temporary work contracts in production and construction or in the retail, hospitality, and transport sectors. These positions are highly connected to more physical demanding and chemical work exposures, weekend and shift work, with less scope for influence and decision-making, as well as monotonous and fast-paced work tasks. Additionally, these jobs are characterised by low wages (34, 64, 65, 67, 68).

All in all, lower educational and vocational qualifications, but also the lack of language skills and the experience of discriminations are reflected in the entire employment history. Accordingly, migrants' employment histories are more frequently unstable and characterised by interruptions, especially in the form of unemployment. This situation makes it difficult for EMB to build up private assets for older age when retired (34, 64, 65, 67, 69).

As a result, the proportion of the immigrant population over 65 years without their own statutory pension is 6.7% higher than among natives and they rarely have any other source of income and therefore live in risk of poverty with basic security benefits in older age (70).

Precarious and unfavourable working conditions reflect a high work-related burden and lead to worse work-related health. As EMB are known to be more exposed to adverse occupational conditions, they are more likely to report physical discomfort and pain (71) and poorer self-rated health (72, 73). Also, the risk of sick leave (67), occupational diseases and accidents are higher among EMB with foreign nationality than among Germans (74). These health problems can be caused and additionally intensified by deficient language skills and lack of knowledge about danger and protective measures, cultural competency, social discrimination, as well as by persisting inequalities in healthcare access (75, 76).

The results above were mainly found in G1 EMB, particularly with foreign nationality (from Turkey or former Yugoslavia), who represent EMBs in the older population in Germany nowadays (64). The overall situation of naturalised German EMB or G2 EMB (including resettlers) seems to be better and comparable to the native population, which shows a certain convergence of the migrants to the native German population, in line with international findings (65-67, 77). The same applies for immigrants from countries within the European Union, especially from western or northern Europe (68). Therefore, results clearly differ depending on the generation and country of origin, but also on e.g. sex or educational status (76).

1.3.2 The subjective employment perspective

With this knowledge about the occupational (health) situation of EMB, it is of special interest what their personal motivation (willing), intention (planning) and ability (being able to) in the work-retirement transition looks like. Research on the subjective employment perspective, representing the employees' inner attitude towards the transition to retirement, while considering migrant subgroups is rare.

In a German study population in higher working age, it was found that first-generation EMB were significantly less willing to retire before the age of 65 (18). Additionally, older employees with low qualifications and income, working in mostly precarious jobs, would like to retire with a younger age than they plan to (18, 78). Foreigners and first-generation EMB can frequently be found in such positions. A Canadian study investigated that immigrants (first-generation) planned to leave work later into retirement than native Canadians (79).

Concerning the outcome of realised retirement, only marginal research has focused on ethnic minorities or migrant groups. Likewise, Canadian immigrants are less likely to retire early (79). In a German study with data from the Socio-Economic Panel (1984-2007), Buchholz and Rinklake found that migrants (definition not known) entered retirement significantly later compared to West-Germans while including control variables like employment status at the age of 50 and right before retirement entry (80).

More often first-generation migrants and those with foreign nationality leave the working life earlier than the iSPA because of disability, compared to those with German nationality. This is again especially pronounced in Turkish and former Yugoslavian nationals (69, 81-83). Again, the same was found for Canada (79) and for Sweden, although the authors here concluded that the type of occupation explained the early exit from working life even more than the country of birth (84).

Other findings from the United Kingdom indicate higher probabilities of unemployment for certain migrant groups before reaching pension age (like Pakistanis and Bangladeshis compared to white 50-64 years old). This is very likely due to health issues and thus pointing on the healthy worker effect, which is even more pronounced in higher working age (62). In Germany but also in Finland, it was found that physically demanding positions and deteriorating health situations lead to unplanned early exit from work (85), likely through disability pensions, which was mostly the case for low-skilled employees in Germany (16).

1.3.3 The rehabilitative care

To avoid early retirement due to disability pensions and recreate active work participation in older working life, medical rehabilitation measures are the means of choice, according to social security code. They have the potential to improve, retain or prevent the worsening of disability

and poor functioning which influences work ability (23, 27, 28) and subsequently the employment perspective prior to retirement.

Due to the afore mentioned differences in occupational health, attributed to more physically demanding jobs and further social inequalities, one would naturally conclude that there is high need for rehabilitation in EMB. However, with respect to rehabilitation needs, there are only few studies attempting to operationalise and quantify objective needs for rehabilitative care among people in general, but not considering the migrant status (29, 30, 86) or focussing only on specific types of rehabilitation such as psychosomatic rehabilitation (87).

Concerning the actual utilisation of rehabilitation, former studies have mostly shown lower utilisation among PMB compared to non-PMB in Germany. However, the results available are not fully consistent which might be due to different study designs, data sources and operationalisations of migrant background. Most studies were limited to the differentiation via nationality, e.g. when using routine data of the German pension insurance, which is one of the main providers for rehabilitation in Germany. This data showed that foreign nationals utilised medical rehabilitation significantly less frequently with 20-44% lower chances than persons with German nationality (82, 88–92).

Even in studies, where the migrant background was not defined exclusively by nationality, e.g. in the socioeconomic panel (SOEP), it was found that PMB were less likely to take part in medical rehabilitation than non-PMB (93, 94). Differences could neither be explained solely by sociodemographic, nor by health factors, as these factors were adjusted for, but significant differences persisted.

However, in a study within a random sample of insured persons of the German Pension Insurance who received sickness benefits in 2012 (sociomedical panel, SPE-III), no significant differences were found between PMB and non-PMB for rehabilitation in general. Here, more than foreign nationality was considered as identification of PMB, namely place of birth or spoken language (50).

The newest results from Germany analysed a cohort of employed persons aged 45 to 59 years (Rehabilitation access and effectiveness cohort study for persons with back pain, REHAB-BP). Fauser and his team examined different definitions of migrant background while adjusting for several influencing and supporting factors and barriers. They found significantly lower utilisation of medical rehabilitation in all PMB-groups compared to non-PMB, but not for the second-generation or those with one-sided migrant background (person born in Germany and one parent not born in Germany), as the authors designated those groups (49).

Only when looking at individual diagnostic groups and forms of rehabilitation such as psychosomatic rehabilitation, it was observed that these were used more frequently by foreign rehabilitants, especially those of Turkish origin, than by non-Turkish rehabilitants (95–97).

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Also, the special subgroup of resettlers had a higher chance for utilisation of rehabilitation compared to Germans without resettler status when analysing routine data of the German pension insurance (91).

Further outcomes around rehabilitation, like satisfaction with the treatment, were likewise researched and it was found that these are lower in PMB than in non-PMB, particularly in Turkish PMB, as they had high or false expectations of the rehabilitation. Also, following the rehabilitation, different treatment outcomes and subsequently effectiveness of rehabilitation were mostly lower for foreign rehabilitants (26, 98).

The findings of underutilisation of rehabilitation in PMB are likely the result of barriers that those PMB-groups are facing in access to, and utilisation of health services, such as information deficits, poor health literacy, missing language skills or cultural beliefs (26, 99–101).

Concluding, studies on the need (in terms of health determinants) for and utilisation of rehabilitative care distinguishing between subgroups with a migrant background became more frequent in the last decade in Germany, even in older employees. However, representative studies focussing on the German older workforce in general and not only risk cohorts are missing as well as a broader consideration of work factors. Additionally, systematic investigations of the employment perspective of older employees with a distinct differentiation by migrant background are largely lacking. By now, it is not known how the individual planning and the self-perceived ability to work until the state pension age is in older employees with a migrant background in Germany, which is an important aspect for the future in the context of extending working lives (EWL).

1.4 Aim and scope of the thesis

1.4.1 Aim

In this doctoral thesis, the heterogeneity of people with a migrant background is a central aspect, as migrant subgroups act differently in many respects (77, 102). This group will not only be investigated for their individual employment perspective but also for their needs and utilisation of rehabilitation to scrutinize their specific situation. These older EMB in Germany will be compared to non-EMB to identify possible differences and specific needs. With this aim, the thesis shall contribute to fill research gaps regarding the work-retirement transition of older EMB in Germany.

1.4.2 Research questions

As introduced above, this doctoral thesis contains three analyses of older EMB compared to non-EMB that build on each other with the subsequent focus: 1.) the subjective employment

perspective, 2.) the utilisation of outpatient and inpatient rehabilitation, and 3.) the need for rehabilitation and its subsequent utilisation.

The following research questions are answered:

1. What does the subjective employment perspective (how long they are *willing*, *planning* and/or are *able* to work) for subgroups of EMB look like and is it different from non-EMB?

2. Does the utilisation of (outpatient and inpatient) medical rehabilitation among older workers differ for subgroups of EMB compared to non-EMB?

3. Is there a different need for rehabilitation among EMB and non-EMB and does the utilisation meet the needs?

1.4.3 Data and methods

Quantitative analyses of the data from the lidA (leben in der Arbeit) study were conducted to answer these questions. The lidA-study is a representative German cohort study on work, age, health and work participation (www.lida-studie.de) (103, 104). The study includes participants born in 1959 or 1965 who were socially insured on 31/12/2009 prior to sampling. The main assessment was done with the help of Computer Assisted Personal Interviews (CAPI) covering topics like work, health, private life. Three surveys were realised in the years 2011 (N=6.585), 2014 (N=4.244) and 2018 (N=3.586). The representativeness of the study sample for the respective birth cohorts was confirmed for all three surveys (105). This allows conclusions about this specific population group of all socially insured employees in these two birth cohorts at three points in time. In the survey participants were 46 and 52 years old, in the second 49 and 55 years and in the third survey 53 and 59 years old. The entire lidA cohort study with the described procedures was approved by the responsible ethics committee at the University of Wuppertal on 5 December 2008 and confirmed again on 20 July 2017. A description of the lidA-study and its design can be found elsewhere in more detail (104, 106).

In the lidA study, the migrant background can be identified by different indicators such as nationality, but also country of birth of the participant and the parents' countries of birth, as recommended by Schenk et al. (38). Here, those with German nationality with both parents born in Germany and their own birthplace in Germany, were defined as non-EMB, who constituted the reference group in most analyses. In contrast, for the group of EMB, the before mentioned concept of generations was predominantly used.

The first-generation (G1 EMB) is defined as people who were born abroad and immigrated to Germany later. For this reason, people with German nationality who were born abroad, and whose parents were born in Germany, were also assigned to this group. Depending on the length of their stay abroad, these people may have been socialised to a greater or lesser extent in the host country and may therefore behave differently in Germany than natives. In the three

lidA surveys, their proportion in G1 was around 10 %, so that they are not particularly significant in terms of numbers. The second-generation (G2 EMB) was defined as being born in Germany, but at least one parent was born in a country other than Germany. Accordingly, there is the third-generation and so on, but this is out of the scope of this thesis.

Analyses of nationality (German vs. other/foreign) were partly carried out separately in the subgroup of EMB (study I and II). However, as people with foreign nationality almost exclusively belong to G1, the criterion of nationality was combined with the status by generation in further analyses (study III). Regarding countries of origin, only a few had higher case numbers (n>50), so that detailed multivariate analyses with further differentiation by country of origin while guaranteeing sufficient statistical power were not possible.

The samples for the respective analyses are described in more detail in the subsequent section of each study, as well as the analyses methods. In addition to descriptive methods, group-comparative bivariate statistics (Chi-square, Kruskal-Wallis, Wilcoxon test, ANOVA), but also multiple logistic regression analyses were used, where appropriate with calculations of average marginal effects (AMEs). Participant losses across the surveys due to attrition were addressed in some analyses with multiple imputation and in others with inverse probability weighting. The latter was done regarding the group characteristics with particularly high loss rates (foreign nationality and low level of education).

All statistical analyses were performed with the help of SPSS version 25.0 (IBM. Corp.), except the AMEs, which were performed with SAS 9.4.

1.4.4 Studies

The thesis consists of three studies published in international open-access and peer-reviewed journals (see full texts in appendix), embedded in a general introduction and discussion at the end.

[I] Schröder CC, Hasselhorn HM, du Prel J-B, Breckenkamp J. Subjective employment perspective among older workers with and without migrant background in Germany - Results of the lidA cohort study. J Occup Health. 2020; 62:e12166. doi: 10.1002/1348-9585.12166

[II] Schröder CC, Dyck M, Breckenkamp J, Hasselhorn HM, Du Prel J-B. Utilization of rehabilitation services for non-migrant and migrant groups of higher working age in Germany - results of the lidA cohort study. BMC Health Serv Res. 2020; 20:31. doi: 10.1186/s12913-019-4845-z

[III] Schröder CC, Breckenkamp J, du Prel J-B. Medical rehabilitation of older employees with migrant background in Germany: Does the utilization meet the needs? PLoS ONE. 2022; 17(2): e0263643. doi: 10.1371/journal.pone.0263643

The three different peer-reviewed journals have in common that they are all open-access and thus strive to advance science without any barriers. As the journal titles of the first two studies describe, these are specifically focussed on research of the respective discipline. Accordingly, the Journal of Occupational Health has a higher focus on the occupational setting while the BMC Health Services Research generally publishes in any setting about all kind of health services research. The last journal, Plos One, is a multidisciplinary online journal designed to reach a wider scientific audience from different disciplines. Thus, these three journals represent the interdisciplinary context in which this thesis is embedded and provides the opportunity to reach various international stakeholders.

All three studies have a different aim, but still complement each other and provide deeper understanding into the overall topic. Each study and its research object, method and results are outlined in the second section and a summary of the results can be found in Table 1 (p. 27). The full versions of the studies can be found in the appendix. However, the superior discussion of the results, implications and conclusions of all three studies are combined in the third section.

The authors' different contributions are mentioned in the following for each study, as well as in each publication (see appendix).

2. Summary of the studies

2.1 Study I

Schröder CC, Hasselhorn HM, du Prel J-B, Breckenkamp J. Subjective employment perspective among older workers with and without migrant background in Germany - Results of the lidA cohort study. J Occup Health. 2020; 62:e12166. doi: 10.1002/1348-9585.12166

In study I, Chloé Charlotte Schröder (CCS) and Hans Martin Hasselhorn (HMH) developed the study design together. CCS carried out the analyses and wrote the first draft of the article while HMH, Jürgen Breckenkamp (JB) and Jean-Baptist du Prel (JP) contributed to its developments. All the authors critically reviewed and approved the final article.

2.1.1 Research objective

In the context of EWL, not only political regulations will influence the timing of retirement and the development of work participation in the older labour force, it also depends on the preference, the plans and, above all, the ability and health of the employees (107). All these factors are somehow intertwined as the "lidA conceptual framework on work, age and employment" (section 1.2.1) suggests. It remains important whether future generations of older employees will be individually able, willing, and planning to remain in the labour force to the extent hoped for. This applies to all older groups of employees, but especially to the group with a migrant background. Its majority is predisposed to poor health - partly due to years of physically demanding work - and is now increasingly in the transitional age to retirement. By now, research about the subjective employment perspective prior to retirement while considering migrant background is lacking (see section 1.3.1). Moreover, EMB are not a homogenous group, as the working conditions and occupational health differ between nationalities or between generations. Therefore, the investigation of the subjective employment perspective in EMB subgroups might be of interest to tackle further work participation with specific group interventions accordingly. This study aims to analyse this perspective with the help of willing, planning and being able to work until the individual state pension age (iSPA) while differentiating for certain subgroups of EMB and non-EMB.

2.1.2 Method

To reply to this research question, data of the third survey of the lidA cohort study in 2018 was used and the sample defined by those working for at least one hour per week. The sample was weighted by inverse probability weighting (for the variables migrant and educational background) which was necessary due to attrition from the first to the third survey. For G1 EMB with low educational level attrition was 76%, for example. The complete case analysis involved 3286 participants at the end.

For willing, planning and being able to work until iSPA, the participants should indicate until which age they want, they plan and think they would be able to work. The responses were dichotomised at the iSPA, so less than vs. at least until 66 or 67 years of age, respectively. Not until the third survey the outcomes have been measured as detailed as this.

EMB were analysed with different operationalisations bivariately for each outcome to examine group differences between generations (G1 vs. G2 EMB), nationalities (German/dual vs. foreign), by descent (unilateral vs. bilateral, only G2 EMB) and all EMB vs. non-EMB. Further, logistic regressions were done for the outcomes of planning and willing (strongest in bivariate analyses) while comparing G1 and G2 EMB to non-EMB. The regressions were adjusted for sociodemographic factors (sex, age, educational level, household income), physical and mental health and work factors (influence at work, effort-reward-imbalance, cumulative physical work exposure). More details on the operationalisation of these variables can be found in the manuscript of study I in the appendix of this thesis. Additionally, to the odds ratios of the regression analyses, average marginal effects were computed to directly compare the adjusted models.

2.1.3 Results

The characterisation of the sample had shown significant differences between the groups while pointing G1 EMB out as a risk group. They exhibited higher proportions of lower educational level, lower household income, lower physical health, higher physical work exposures and lower influence at their own work. However, they showed lower work stress than G2 EMB and non-EMB.

The bivariate analyses comparing proportions revealed mainly significant differences for the outcome of willing and planning, but not for being able to work until iSPA. When differentiating EMB by nationality (German/dual vs. foreign), a significant difference appeared for the outcome planning, showing that a higher proportion of those with foreign nationality plan to work at least until iSPA than those with German nationality (29% vs. 20%, p=0.035). The same appeared for the outcome of willing (18% vs. 9%, p=0.004). When comparing EMB by generations, only the outcome of planning showed significant differences as G1 EMB had a higher proportion of planning to work until iSPA than G2 EMB (25% vs. 16%, p=0.014). For the comparison between non-EMB and all EMB, as well as the comparison between the subgroup of unilateral and bilateral G2 EMB, no differences were found for any outcome.

In the regression analyses, G1 and G2 EMB were compared to non-EMB for the outcomes of planning and willing, as these indicated higher relevance in the bivariate analyses. The fully adjusted logistic regression showed higher odds and probability for G1 willing to work until iSPA, while G2 had lower odds and probability compared to non-EMB. However, these differences were not significant. Whereas for planning, even in the fully adjusted model,

significantly higher odds and probability were detected for G1 EMB than for non-EMB (OR 1.38, 95% CI 1.04-1.82; AME +5.1%-points). For G2 EMB no significant differences could be shown in comparison to non-EMB.

2.2 Study II

Within study II, all authors developed the study idea and its design. Under the supervision of JP and HMH, CCS executed and interpreted the analyses. JB helped with the analysis in SAS. CCS put the first draft of the article together while HMH and JP added their competences at this stage. Maria Mader, born Dyck (MD), supported the literature search. All authors critically reviewed and approved the final manuscript before submission.

2.2.1 Research objective

To avoid early retirement due to disability pensions and recreate active work participation in older working life, medical rehabilitation measures are the means of choice, according to social security code. They have the potential to improve, retain or prevent the worsening of disability and poor functioning which influences work ability (23, 27, 28) and subsequently the employment perspective prior to retirement. Potential needs for action could then be derived from this and active work participation for all older employees ensured.

At the beginning of study II, there was a lack of large-scaled primary studies about migrants' utilisation of rehabilitation services in Germany with a more differentiated operationalisation of migrant background than using "nationality" only (32). Previous empirical results have added further evidence since then (see section 1.3.2). However representative studies focussing on older populations with and without migrant background in contrast to risk cohorts are still missing, as well as a broader consideration of work factors. Therefore, this study should contribute to the existing research and examined, whether there are differences in the utilisation of rehabilitation and its subtypes outpatient and inpatient, primarily between non-migrants and employees with a migrant background (first- or second-generation) and secondly, between German and foreign nationals within employees with a migrant background.

2.2.2 Method

To answer these research questions, data from the first survey of the German lidA cohort study in 2011 were used and the sample restricted to those working at least one hour per week (n=6303). The main analysis compared first-generation (G1 EMB) and second-generation (G2-

EMB) employees to those without a migrant background (non-EMB). Another subsample analysis only included EMB while differentiating by nationality: German and dual vs. foreign.

The dependent variable was the utilisation of rehabilitation, while the independent variable was the migrant background. The outcome of rehabilitation utilisation was based on self-reported information from the lidA questionnaire where the participants were asked if they have used an in- or outpatient rehabilitation services in the past three years.

Further control variables were considered with sociodemographic (year of birth, sex, occupational class), work- (quality of leadership, own influence at work, work-privacy conflict, work-related stress, physical and environmental work exposures) and non-work-related factors (self-rated health and German language), referring to the current time of the survey in 2011. More details on the operationalisation of these variables can be found within the manuscript of this study in the appendix of this thesis.

Bivariate statistics with tests of independence and block-wise adjusted logistic regressions were applied to investigate differences between the groups. Furthermore, average marginal effects were calculated to be able to compare the adjusted models directly with each other. This was done for the outcome of rehabilitation in general (inpatient and outpatient) but also separately for inpatient and outpatient rehabilitation. Only in the subsample of EMB (n=1148) was a differentiation not possible due to limited power. Missing values in the data set were replaced by means of multiple imputation as there was missing data ranging from 0.05% to 20.0%.

2.2.3 Results

The majority of the considered sample had not used any rehabilitation in the last three years (87.2%). If they had, these were primarily inpatient services. In bivariate analysis no significant differences were examined between migrant groups and non-migrants, although G1 EMB showed quite low utilisation of outpatient rehabilitation (2.3%) compared to G2 EMB and non-EMB. However, further covariates showed significant associations with migrant background and detected differences between groups. Here, as in study I, G1 EMB mainly belonged to a lower occupational class, had higher physical work exposures, lower influence at their own work and poor health. Approximately one third of them reported frequently speaking another language than German at home.

In the adjusted logistic regression, when comparing utilisation of rehabilitation in general, G1 and G2 EMB showed no significant difference compared to non-EMB. The same result was observed for the outcome of inpatient rehabilitation. However, for outpatient rehabilitation services, G1 EMB showed a lower chance (fully adj. OR 0.42, 95% CI 0.22-0.82) and lowest probability (AME -3.8%-points) of utilisation than G2 EMB or non-EMB. These differences

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could not be fully explained after adjusting for sociodemographic, work- and non-work-related factors. Concerning G2 EMB, the results were generally closer to the results of non-EMB.

After analysing the subsample of EMBs for the second research question, it was found that foreign EMB had a non-significant, slightly lower chance of having utilised rehabilitation in general compared to German EMB.

2.3 Study III

Schröder CC, Breckenkamp J, du Prel J-B. Medical rehabilitation of older employees with migrant background in Germany: Does the utilization meet the needs? PLoS ONE. 2022; 17(2): e0263643. https://doi.org/10.1371/journal.pone.0263643

In study III, all authors worked together on the conceptualization and methodology of the manuscript. The formal analysis was done by CCS and JB and supervised by JP and JB. CCS performed the visualization and the writing of the original draft. All authors critically reviewed and edited the final manuscript before submission.

2.3.1 Research objective

As the pathway of Andersens "Behavioural Model of Health Services Use" (section 1.2.2) describes and other studies have confirmed (108, 109), the individual need is a prerequisite leading to the utilisation of health services like rehabilitation. So far, no uniform or standardised instrument exists in Germany to measure the objective need for rehabilitation (110). Previous studies on the utilisation of rehabilitation among people with a migrant background are only insufficiently able to take several kinds of influential factors into account as well as health differences prior to rehabilitation or further need factors (50). Mostly, health-related factors such as mental and physical health-related quality of life from the Short Form Health Survey (SF), Body-Mass-Index, pain intensity from the Chronic Pain Questionnaire or other subjective assessments of the individual themselves were used (in combination) as a proxy measure for the need for rehabilitation. However, studies on the work ability index have been shown to predict the need for rehabilitation (111) or disability pension (112), so that the need for rehabilitation is consequently connected to the individual work situation as well.

Many of the factors mentioned above are recommended by the northern German pension insurance (113) and were considered in research within a checklist to test the need for rehabilitation by physicians (29). Next to several health indicators and lifestyle risk factors, this checklist additionally considers work related factors, former sick leave and therapy options or personal motivation.

To identify such need for rehabilitation in a representative setting with the help of questionnaire responses, study III aimed to build an extensive score out of this checklist to measure need and to test if the subgroups of EMB show a different need for rehabilitation than non-EMB.

Secondly, the aim was to investigate if the utilisation of medical rehabilitation is diverging between the groups when the respective need is also considered as an influential factor prior to the rehabilitation.

2.3.2 Method

The data for this study was based on the first and second survey of the lidA cohort study. Again, everyone being employed for at least one hour per week was included in the analysis. As attrition analysis revealed significant loss to follow up among low educated participants and participants with a foreign nationality between the first and second survey, inverse probability weighting was performed to address this problem. Therefore, 3897 individuals constituted the final sample.

In this analysis, subgroups of employees with migrant background were again separated by generation. However, in contrast to study II, the first-generation was additionally divided by nationality, as we noticed in own further analyses (not shown), that there were remarkable differences between foreigners and Germans within the first-generation. Thus, four groups instead of three were examined in total: German G1 EMB (incl. dual nationality), foreign G1 EMB, and G2 vs. non-EMB as the rest.

For the need for rehabilitation, a summarising score was created with the questionnaire data combining 15 factors, which were most applicable to represent the categories of the checklist used by Deck et al. (29) and the northern German pension insurance.

These are listed here:

• Incidence of disease requiring treatment (in the last 12 months)

• declared handicap/disability

• poor physical health (lowest tertile of the SF-12 physical health scale)

• frequent limitation due to pain (in the last 4 weeks) in daily life or at work

• poor mental health (lowest tertile of the SF-12 mental health scale)

• BMI > 30, BMI = weight/(height*2)

• less/no sports or exercise in leisure time

• regular smoking at time of survey

• working hours that are unfavourable for therapy (e.g. shift work)

• lower work ability (8 < points, second dimension of the work ability index)

• high work stress (highest tertile of the effort-reward-imbalance ratio)

• more than one physical work exposure (e.g. heavy lifting and carrying)

• official sick leave > 30 days (in the last 12 months)

• officially declared reduced capacity to work or job-related incapacity

• indication of "prolonged illness" in the question about employment

The score correlated significantly with the self-reported single item for general health of the SF-12 by r_{pbis}= .568.

Utilisation of medical rehabilitation was measured in the same way as in study II, by self-reported responses from the questionnaire of the second survey.

With the help of descriptive and bivariate statistics (chi-square, F- and post-hoc tests) the need for and utilisation of medical rehabilitation were investigated. Additionally, stratified for each migrant group separately, logistic regressions and average marginal effects were calculated to assess the effect of need on the utilisation of rehabilitation (adjusted for year of birth, sex, educational level).

2.3.3 Results

In the used sample, the majority were non-EMB (82.4%), German G1 EMB and G2 EMB constituted about 7% each and foreign G1 EMB 3.3%. By using the summarising score to operationalise the need for rehabilitation, it was shown that foreign and German G1 EMB had the highest need (mean of 4.08 and 4.15 vs. 3.86 for G2 EMB and 3.69 for non-EMB) while on the other hand German G1 EMB and G2 EMBs showed the highest utilisation of rehabilitation in the descriptive analysis (about 17% each vs. 10.8% for foreign G1 EMB and 12.2% for non-EMB).

When examining the second research question, the adjusted logistic models showed significant positive associations between the need and utilisation of rehabilitation for all subgroups separately. With each unit increase of the need score, the chance for utilising medical rehabilitation increased likewise. Foreign G1 EMB had the highest odds (OR 2.02, 95% CI 1.40–2.91) and the highest probability (4.2% for each unit change).

Further in-depth bivariate analysis of the utilisation under consideration of the need (in tertiles) showed that under- and overuse co-existed in most groups, in the sense of no use despite need or use despite low need. Foreign G1 with lower need were the only group not having utilised rehabilitation at all. In all other groups rehabilitation was still used up to 10% despite the lowest level of need. However, at the same time, some degree of underuse (no use despite need) was found in all groups, regardless of the migrant status.

2.4 Summary of the significant results from all studies

Table 1. Summary of the significant results for the subgroups with migrant background compared to the group without migrant background

| | G1 EMB (11.1%*) | | G2 EMB | Study |
	German (7.4%**)	Foreign (3.7%**)	(7.2%*)	source
Socio-demographic factors	• more often medium and lower education	• more often lower education	• hardly any difference	• III (BA)
	• more un-/semi-skilled workers		• hardly any difference	• II (BA)
	• lower net household income		• hardly any difference	• I (BA)
	• one third speaks mostly another language at home		• no difference	• II (BA)
Occupational factors	• higher physical exposure		• slightly higher physical exposure	• I + II (BA)
	• lower personal influence at work		• no difference	• I + II (BA)
	• lower work stress		• no difference	• I (BA)
Health factors	• poorer physical health		• poorer physical health	• I (BA)
	• poorer self-rated general health		• slightly poorer self-rated general health	• II (BA)
Employment perspective	• higher planning to work until individual state pension age			• I (LRA)
Medical rehabilitation	• higher need	• highest need	• slightly higher need	• III (BA)
	• higher utilisation	• lower utilisation	• higher utilisation	• III (BA)
	• lower utilisation of outpatient rehabilitation			• II (LRA)

Notes. Non-EMB always serve as the reference group (n=5153, 81.8% of all participants in *first lidA survey). Only significant group differences are shown. BA= bivariate analysis, LRA=(adjusted) logistic regression analysis. ** own analyses, not shown in the publication.

3. General discussion

This doctoral thesis intends to fill research gaps with respect to the work-retirement transition of older employees with migrant background (EMB) in Germany. The three studies of the thesis compared subgroups of EMB to non-EMB in Germany regarding 1.) the personal employment perspective, 2.) the utilisation of outpatient and inpatient rehabilitation, and 3.) the need for rehabilitation and its subsequent utilisation. In the following third section, the summary and general discussion of the results are presented bringing all three studies together. Firstly, the results for the EMB-subgroups G1 and G2 are reviewed and further discussed in section 3.1. Secondly, an overarching view on the thesis will be given in 3.2. Subsequently, the strengths and limitations are presented in 3.3 and implications and possible approaches suggested for different stakeholders such as policy, employers, rehabilitation providers and research in 3.4. Finally, the thesis ends with a conclusion and an outlook in 3.5.

3.1 Older migrant employees in Germany

3.1.1 Differentiation by generations

The lidA-study provides the possibility to distinguish between the generations of migrants, which was used as the main definition of the subgroups of EMB in the studies included in this dissertation. This terminology firstly comprises of the actual immigrants (first-generation, G1), who are born abroad and have their own migration experience. They can either have foreign or German/dual nationality if they are naturalised. Additionally, the definition comprises the descendants of G1, who were born in Germany and do not have any own migration experience (second-generation, G2). The characteristics and differences of G1 and G2 were mainly analysed for this thesis and summarised in Table 1 (p. 27). Here, non-EMB always served as the reference group. After comparing several migrant group definitions, Fauser et al. consider the differentiation between generations to be the most suitable one for health services research in migrant groups (49). The reason is that G1 and G2 diverged more substantially in terms of sociodemographic factors and related health strain and health care use than other group comparisons. This is in line with our own results, as summarised below. The authors additionally call for more research which considers factors within those with migrant background e.g. country of origin or duration of stay (49). These migrant-specific parameters were not suitable to use in our analyses as these were only applicable to a limited subgroup of EMB (e.g. only G1 or foreigners) or/and did not reach sufficient case numbers.

When looking at those with migrant background at the beginning of the lidA study in the first survey, G1 constituted the larger group with 11.1% (see Table 1). This is close to results of

the German micro-census at that time in 2011, where G1 made 13%[2] of the working population aged 45 to 65 years (33). The majority of G1 in the lidA sample had German nationality (7.4%) and only the smaller proportion (3.7%) had other/foreign nationality. This cannot be compared with the micro-census, as this level of detail was not given in the available publications. However, the methodological report about the first baseline survey of the lidA study revealed that participants with foreign nationality were slightly underrepresented than Germans (103).

In contrast, G2 made up 7.2% of all employees of the baseline sample (see Table 1, p. 27). Compared to G1 they were the smaller group, which is in line with the results of the German micro-census in 2011. However, their proportion in the older working population (45 to 65 years old) at that time was only 0.4% (33), so that G2 might be slightly overrepresented at the lidA baseline survey. G2 are born in Germany and only have foreign born ancestors, so that effectively 100% of G2 in the lidA sample had German nationality.

In the lidA sample, the majority of G1 belonged to the group of unskilled and semi-skilled employees who have a lower net household income. This can be explained by the lower and medium educational level or possibly the lack of German skills, as a third of them still speak another language at home. Here, being naturalised was associated with a slightly better educational level than those with a foreign nationality. Along with the unskilled and semi-skilled job positions, G1 more frequently experienced higher physical exposures while having lower work stress and less influence on their work. Further analyses with data of the first survey revealed that a high proportion of German G1 can be found in manual jobs, even when they had a high level of education (114), which often applies to migrants e.g. due to discrimination (66). In addition to these occupational exposures, G1 of the lidA sample reported poorer general and physical health but not likewise poorer mental health (see Table 1). Further published analyses based on lidA data indicate that these poor health outcomes in G1 can be explained by the occupational exposures and sociodemographic factors in this group (115). So far, the described results concerning sociodemographic, occupational and health factors are in line with previous literature as presented in the introduction section 1.3.1, p. 12-13.

In contrast to G1, G2 showed almost no difference compared to non-EMB concerning sociodemographic and occupational factors (see Table 1), apart from slightly higher physical and environmental exposure at their workplace. In terms of health, G2 reported a slightly poorer self-rated general and physical health (SF-12) than non-EMB. This highlights a certain harmonisation with the native German working population and is in line with former research (65-67, 77).

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[2] According to the narrower definition of the German micro-census when only the information about the parents who also live in the same household is used. In lidA all information of the surveyed individuals themselves were used to identify subgroup, so that a direct comparison is not fully possible.

3.1.2 The subjective employment perspective

Despite their work and health situation in higher working age, a larger proportion of G1 still indicated that they plan to work until the individual state pension age (iSPA) when compared to G2 (25% vs. 16%) in bivariate analyses of study I. Additionally, this group had a higher OR and probability for the outcome of planning when compared to non-EMB, even in the fully adjusted model (with sociodemographic, health and work factors). This result for the intention and plan of G1 is in line with the few comparable studies about migrants as described in section 1.3.2, p. 14 (79, 80). For the other components of the employment perspective in study I, the personal motivation (willing) and ability (being able) to continue working, no significant differences were detected for older G1. However, the findings for planning could be helpful in future labour market considerations concerning older employees, since the outcome of planning has been proven as highly predictive for later actual retirement age (16, 85).

As in study I, health and several other variables were already considered as potential explaining variables in the regression analyses, further factors seem to play a role in G1. Further exploratory, descriptive results of the lidA data (not shown) revealed that the personal environment did not show the prevailing attitude to leave the labour market earlier, which was even less pronounced in foreign G1. In addition, G1, especially foreign G1, largely do not believe that they could financially afford to retire early from the labour force compared to G2 and non-EMB. These further factors might have influenced their plan on when to retire, but have not been considered in these analyses as covariates. Indeed, the current household income was taken into account in study I, but future income during retirement will be automatically lower.

These results are supported by analyses of different sources that have shown that PMB in Germany have a high risk for old-age poverty. The reasons are greater claims of disability pensions (with lower replacement rates than regular pensions) or receiving a lower regular retirement pension, old age security or no own pension at all while having no other sources of income (66, 70). The latter is attributed to interrupted and shortened employment histories and less contribution payments to the pension insurance because of low wages, higher rates of unemployment and incapacity to work, as well as the delayed payment into the pension insurance due to migration to Germany. Here, foreign pension entitlements, if they exist, usually cannot compensate for the low German pensions. However, within PMB, there are (again) great disparities between the groups of origin. Those with Turkish and Yugoslavian ancestries had the lowest pension rate, while resettlers are not so disadvantaged and PMB from states of the European union or the OECD (Organisation for Economic Cooperation and Development) have nearly the same pension rates as non-PMB (66, 70, 116).

From this, it can be assumed that the population of G1 analysed in our sample might just have a different inherent mind-set and/or feel more pressure to continue working to a higher age. They may have accepted their comparatively poorer health and still plan to work until the state pension age due to their disadvantaged financial situation although this might not correspond to their willing (15). This does not reflect a voluntary but a forced planning which could be driven by financial motives and was likewise found in other studies for groups with low socioeconomic status in Germany (16, 78, 117), but also other countries such as USA, France and the Netherlands (118–120). Likewise, people with financial responsibilities such as outstanding debts or dependent children, tend or plan to stay longer in employment (62, 119).

According to this, the current and future anticipated financial situation of older employees represents one important factor on the individual motivation to keep working and the decision when to leave employment (as shown in the lidA conceptual framework in section 1.2.1), because "financial well-being is a prerequisite for prolonged and active involvement in society and social integration" (121). As G1 face an insecure individual future, further work participation consequently serves as a prevention of old-age poverty, and at the same time, as an important component of continuing social participation and a "therapy that prevents aging" (118).

In G2, the results for the subjective employment perspective differ from this. Their proportions for willing, planning and being able to work until the iSPA were always slightly lower than those for non-EMB (study I). However, there were no significant differences detectable between G2 and non-EMB, only between G1 and G2 for the planning to work until iSPA in bivariate analyses (25% vs. 16% in G2). This might indicate the previously mentioned "early exit culture" that G2 grew up with in Germany, in contrast to G1 and which is still persistent in Germany. Further exploratory results of the lidA data (not shown) confirmed the prevailing attitude to leave the labour market earlier within the personal environment of G2. In general, the findings of study I represent the persistent culture of early retirement. In all groups the percentage of the willing was lower than the percentage for planning or the ability to continue working until the state pension age, which is similar to other research (122, 123).

Here, further contextual influences on the individual retirement timing can potentially explain these findings, as the lidA framework indicates (1). The constitution of retirement pathways cannot only be seen as an individual decision, but rather as a (joint) decision embedded in a society's culture, certain household contexts and social networks. The retirement plans and decisions of life partners, close friends and the family situation in general, play an important role if workers can, want and lastly continue working in older age. If personal surroundings do not support continued employment participation, the probability to continue working, especially beyond 65 years, is low (1, 46, 59, 124). Moreover, women leave work more frequently due to caring responsibilities, either for children, the partner or the parents care (62, 118, 125). Of

those participating in the lidA study first and second survey, there were no major differences noticeable between migrant groups concerning caring responsibilities or partner status (126). In our analysis, we adjusted for sex, but future research with potentially higher case numbers should consider stratified analyses to investigate sex differences for the employment perspective in older migrant groups.

3.1.3 The rehabilitative care

When analysing the overall utilisation of rehabilitation with the baseline data of the lidA study (study II), no significant differences in G1 or G2 were identified in comparison to non-EMB, which is in line with findings of Brzoska et al. (50). However, when separating for different types of rehabilitation such as inpatient and outpatient, logistic regression analyses showed a significantly lower chance for the utilisation of outpatient rehabilitation in G1 (fully adj. OR 0.42, 95% CI 0.22-0.82). This effect can be attributed to German G1, as they are proportionally higher represented in the lidA sample than foreign G1. When differentiating G1 by nationality, the results revealed that German G1 had a significantly lower OR (fully adj. OR 0.29, 95% CI 0.11-0.0.73), while foreign G1 had a non-significant OR close to 1 for the utilisation of outpatient rehabilitation (further unpublished analyses). With respect to the utilisation of inpatient rehabilitation, German G1 showed a slightly higher, but non-significant chance (fully adj. OR 1.32, 95% CI 0.88-1.98) compared to non-EMB. This utilisation behaviour of German G1 in favour of inpatient rather than outpatient rehabilitation can be explained by their poorer health and older age, as well as better German language skills, which might not require translational help when using health services. In comparison to inpatient rehabilitation, outpatient rehabilitation is more suited for younger patients with less severe ailments, where a rehabilitation institution is close to the place of residence or when an easier involvement of relatives (for e.g. translations), general practitioners or the everyday environment is needed or preferred (127–129). Furthermore, the outpatient medical rehabilitation was and still is an exceptional type of rehabilitation in Germany (130).

So far, other research has not investigated the utilisation of different types of rehabilitation while taking the migrant background into account. For the outcome of overall utilisation of rehabilitation, former research largely showed a significant lower chance for G1 and especially foreigners compared to the group without migrant background (see section 1.3.2). The results of study II have not shown significant differences in this respect. In our analyses, several predisposing and enabling factors according to the behavioural model of Andersen (section 1.2.2) were considered by adjusting for them in regression analyses. These were sociodemographic and work factors, but also the degree of spoken German at home. Additionally, self-rated health represented the need for rehabilitation. However, the temporal impact could not be investigated properly. The utilisation of medical rehabilitation was always

surveyed retrospectively for the last three years in lidA while some influential factors were reported for the current time of the survey in 2011 and therefore lying temporally after the rehabilitation. This circumstance and the specific sample of older socially insured employees could have produced these discrepancies with the other research results.

As the pathway of Andersen's "Behavioural Model of Health Services Use" (section 1.2.2) describes, next to the predisposing and enabling factors, the need is one of the major components leading to the subsequent utilisation of health services such as rehabilitation. In study III, the temporal influence of need on the utilisation was considered by combining data of the first and second surveys. Here, the need for rehabilitation was measured with the help of a summarising score, which combined several life aspects of the person affected (details in section 2.3.2, p. 25). This approach was chosen, as many of these factors are recommended by the northern German pension insurance (113) and were already considered in research within a checklist for physicians (29). Not all factors of the checklist could be considered, as these were not available within the lidA data. Still, next to several health indicators and lifestyle risk factors, the score additionally considers work ability, further work-related factors, former sick leave and declared incapacity or disability. Furthermore, the lidA framework indicates that the domain of health does not necessarily have a direct impact on the domain of retirement, but through the factors of work ability and motivation. It has been shown that work ability can predict the need for rehabilitation (111) or early retirement in form of disability pensions (or applications for it), but also retirement intentions (1, 8, 131).

By operationalising the need for rehabilitation as a score, foreign G1 showed the highest need (4.15) followed by German G1 (4.08) and G2 (3.86) which was expected for the respective groups based on the health and work-related circumstances. However, German G1 and G2 had the highest utilisation of rehabilitation (17%) while 10% of foreign G1 utilised some rehabilitation between 2011 and 2014. Significant differences between all groups appeared in bivariate analyses for the need as well as the utilisation. As the utilisation did not show the same pattern over all groups as the need score, additional bivariate analysis was done to get a deeper understanding of these contradictions. Hereby, the need score was divided into low, medium and high need (via tertiles) and the utilisation looked at in dependence of these need categories, separately for each group. It was found that in foreign G1 only 20% of those with higher need used rehabilitation compared to 28% in German G1. In G2, it was 30% while 7% of those with lower need still utilised a rehabilitation service. The results showed that the provision of rehabilitation was not meeting the needs of these employees in higher working age, so that overuse and underuse of rehabilitation were present at the same time when using our operationalisations for the analysis.

However, when analysing the association of need and utilisation separately for migrant groups by regression analyses (adjusted for sex, year of birth, education), it showed that each group

has used rehabilitation significantly when the need score increased, meaning the need was positively predicting subsequent utilisation of rehabilitation. Foreign G1 had the highest odds (OR 2.02, 95% CI 1.40–2.91) and the highest probability (4.2% for each unit change) for this association. These findings in the utilisation behaviour of migrant groups deviate from study II which can be due to several reasons: different data basis (here data of the first and second survey), stratification for each group and/or considering different determinants in regression analysis (e.g. the need with a more comprehensive approach than other former studies).

In summary, the results of study II and III confirmed the conclusions of a previous scoping review by Dyck et al. (26) that investigations of rehabilitation should firstly, not only be differentiated by nationality, but rather for more detailed migrant background and secondly for more detailed endpoints of rehabilitation such as e.g. inpatient and outpatient.

The underuse of rehabilitation in all groups but specifically in the group of foreign G1, can point to further group-specific resources or access barriers that are also included in the behavioural model by Andersen, but which could not be considered in these analyses with lidA data. As Fauser et al. have not found a significant difference in intention to apply between PMB and non-PMB they concluded that barriers may exist between the time points of personal intention and definite application (49). Qualitative research on potential migrant-specific barriers in rehabilitation access has identified further factors e.g. lack of knowledge (about rehabilitation in general, the application system or process within the rehabilitation measure), religious and cultural barriers and health beliefs, but also fears about discrimination or losing their workplace (101). The research team of Schwarz et al. additionally identified barriers on the side of the health services system, as e.g. lack of multilingual, culturally sensitive or target-group-specific assistance (e.g. information materials, forms and counselling services) and too bureaucratic and time-consuming application processes on the side of the rehabilitation providers (101). These person- and system-related barriers are partly migrant specific, but can also be independent of the migrant status and e.g. more problematic in terms of educational status and illiteracy in general. As the lidA study was only examined in German, a certain degree of alphabetisation and German skills of the lidA sample were assumed, so that only a selective sample of EMB could take part in the study (as discussed in the limitations in section 3.3). The specific health literacy was not measured in the lidA study until the third survey, describing coping with illness, so that it could not be taken into account for study II and III. However, education and the spoken language at home was used as a proxy for language skills in the analyses.

Furthermore, several studies have shown the importance of support by family and friends, but also by the treating physicians and therapists in the intention process before rehabilitation (132–134). The "expected support thereby increases awareness of rehabilitation as a possibility, and might make the application process seem more manageable" (134). This social

network is even more important in the population group of older migrants and their situation of social and health inequality. They mostly have intra-ethnic relations which accompany protective and compensation functions as they produce feelings of belonging and security in the host country. Such integration into ethnic networks provides self-help potential, but is also mediating possibilities for formal support services e.g. for access to health care (135). On the other hand, in some cases of strong ethnic networks like in the Turkish community, it is also preferred to stay in their own cultural infrastructures and religious organisations (136). Especially in the case of illness, the social networks and the close family orientation represent a coping strategy by ensuring care before external institutional help is sought (137). Illness is often somewhat "accepted" and the family member is supported, which can be a resource but also counteracts therapeutic and rehabilitative efforts. However, due to this, social contacts and relationships outside of the migrant-specific settings might not be necessary anymore and integration into the host countries society is aggravated. This might partly explain the retention in utilising health services in some groups of PMB, next to the other mentioned barriers (37). However, in another study with lidA data by Breckenkamp et al. the proportion of social support in general was the highest in non-EMB, not in one of the migrant groups, and showed no statistical significant effect on the utilisation of rehabilitation (126).

Further barriers for the rehabilitation application and utilisation identified by quantitative and qualitative investigations were strain due to household work (134) or childcare (126), showing that the respondents might not access rehabilitative programmes because they feel that they are needed at home and expect negative outcomes with their families or partners if they utilise rehabilitation (101, 132, 133). Other factors classified by Andersen et al. (2) as enabling are income and health insurance coverage. However, the original lidA sample only consisted of socially insured employees for whom the health insurance is automatically covered. Due to the social security system in Germany, rehabilitative services are mostly paid for by social insurance providers and do not have to be financed by the person themselves. The obligatory co-payment depends on the respective income situation and depending on that patients can be fully or partially exempted from this (138). However, further analyses with lidA data showed a significantly lower chance to utilise medical rehabilitation when the income from employment was below 800 € (126). This could be caused by lack of sufficient information concerning costs during utilisation of rehabilitation where further information and clarification could help.

The above mentioned enabling and predisposing factors could have played a role and hindered affected EMB to apply and utilise rehabilitation despite their need. However, the identified underuse in all groups in study III could likewise have been caused by the rejection of applications on the side of rehabilitation providers. Personal prerequisites such as the ability or motivation to utilise rehabilitation may not have been given (30) but also medical or insurance law reasons can be the cause (23)

3.2 The thesis context

The studies in this thesis and their previously discussed outcomes are embedded in the theoretical frameworks to be able to contextualise them on a higher level. The lidA conceptual framework (section 1.2.1) hypothesises that the work-retirement transition is in general complex (1). This applies even more when it comes to older migrant employees and their work and health situation as more influential factors accumulate over the life course until the older working age, e.g. for migrants and their health as presented in section 1.2.3. (55). Especially, the personal health status represents one of the most important factors influencing employment participation and retirement timing in older age (15, 27, 46). The health status in older age has been predominantly concluded as being highly predictive for leaving paid employment early, mostly into disability pension followed by unemployment or other early retirement (15, 27). To avoid these premature work exits caused by poor health and to maintain the work ability among those who will stay longer in work regardless of the reason, rehabilitation can be the method of choice, as it has the potential to improve, retain or prevent the worsening of disability and poor functioning (23, 27, 28). To understand the utilisation behaviour of rehabilitation by older German employees as a tertiary preventive measure and health service, the "Behavioural Model of Health Services Use" by Andersen (section 1.2.2) was likewise used for this thesis.

As the theoretical approaches show parallels in regard to factors/domains influencing the final outcome, they are visualised in combination in Figure 5 (section 1.2.4, p. 11) to allow an overarching view. Several factors on the individual level influence health, work ability and employment perspective which are set centrally in the lidA framework and likewise in this own illustration. These influencing factors were considered according to the frameworks and adjusted for in the three studies.

However, if the older employee's health and work ability to participate in the labour market is decreasing, not only the individual motivation and plans (employment perspective) to keep working might decrease. It can also lead to a reduced interest to sustain or improve health and work ability through medical rehabilitation. This motivation, however, is essential for the application for rehabilitation and also for the effectiveness of the rehabilitation afterwards (29, 30). Thus, among older employees not only the individual health and work ability, but also the individual motivation and intention may impact the utilisation patterns for health services like rehabilitation, their future employment participation and in the long run actual retirement age. The latter is shown by arrows from the motivation/employment perspective to the rehabilitation utilisation in Figure 5, p. 11, but was not examined in this thesis. The willing, planning and ability to continue working until the individual state pension age was only identifiable in the third survey. To measure the influence on the subsequent utilisation of rehabilitation future

research is needed, where lidA data from the fourth survey can potentially help. Likewise, the subsequent actual retirement entry and its influencing factors can be analysed with the fourth survey and future surveys of the lidA study.

Next to individual factors, contextual factors play a significant role in the lidA framework but also in Andersen's behavioural model. As mentioned before, factors at the contextual level could not be considered in the thesis analyses as these were not given in the lidA data. Thus, it had to be assumed that these are equal for the whole sample of each analysis. In regard to future employment participation towards retirement, these can include the current economic situation of each country and its labour market like the employment rate or the shortage of skilled manpower, but also changing policies and legislations regarding retirement and pensions including disability pension or unemployment benefits (59, 60). Related to this is the role of finances and legislation which is known to push older workers involuntarily or pull them voluntarily out of work, as e.g. access to early retirement programmes or occupational pensions lead to early exit from work (61–63). However, by now, the changed policies of several European countries restrict early retirement to a great extent which has slowly increased the older labour force and thus retirement age (60). Therefore, sufficient health care offers including rehabilitation have to be planned and provided in order to compensate for the increasing health limitations in the older (working) population, which represents an exemplarily contextual factor that is addressed in the model by Andersen (2). Further implications and possible solution approaches are described in section 3.4.

3.3 Strengths and limitations

Of course, this thesis has its strengths and limitations, of which parts were already mentioned in the discussion so far. All analyses were done with the data of the German lidA-study, a longitudinal cohort study, which provides the possibility to analyse different groups in higher working age and their transition into retirement. Specifically, the large sample size allowed for in-depth subgroup analyses while considering other factors at the same time. This was possible as the lidA study collected various work-related, as well as non-work-related (e.g. lifestyle factors) and health characteristics at each survey. The analyses of this thesis covered the quantitative evaluation of data from all three surveys, which is another advantage when it comes to time sequences from the outcome and influencing factors. However, the data was only available as self-reported questionnaire data measured every three to four years, so that data from the time in-between these years is missing. Additionally, these self-reported statements might contain e.g. recall or social desirability bias. Nevertheless, only self-reporting provides a special way of assessing preferences and intentions in answers.

Another strength of the lidA-study is its age-homogenous and representative sample through the focus on the workforce of the baby boomer generation in Germany and the

representativeness of socially insured employees of the two birth cohorts 1959 and 1965 (105). However, this results in limitations and lack of information in terms of population representativeness due to the original design of the study (investigation of cohort effects), as sworn civil servants, self-employed and family workers were not included in sampling. Persons with a migrant background and major language barriers could likewise not take part in the lidA study, as the interviews were only conducted in German.

Nonetheless, the lidA-study offered the possibility to give insight into a limited researched field, as it allowed to distinguish different migrant groups and thereby followed the recommendations for identifying migrant groups, not only by nationality like previous studies mostly did (38). In this way, the large group of PMB and EMB who have German citizenship can be recognised, which is a huge strength of this data. It is not only possible to identify the first-generation (with foreign or German nationality) but also the second-generation of PMB, of whom almost 100% have German nationality in lidA. On the other hand, not all possible subgroups could be investigated (e.g. defined by host countries) as the group of PMB became smaller across the lidA surveys due to loss to follow-up (105) and with the variety of host countries, no reasonable classification had been possible. The representation of foreigners was already quite low at the beginning of the study (103).

Additionally, as all analyses of this thesis were restricted to employees at the point of data collection, a possible selection bias could have been introduced through the healthy worker survivor effect. Participants might have left their work due to a lack of sufficient health and work ability, even before the start of the study. Thus, the results do not provide any indications for older unemployed people, as this was out of scope of this thesis.

Nevertheless, these limitations were compensated for by statistical methods: Inverse probability weighting (for educational level and migrant status) accounted for selection bias due to loss to follow-up (in study I and III) while multiple imputation increased the number of included cases in the analysis model (study II, first survey). Furthermore, for all three studies average marginal effects were calculated in the regression analyses which has the advantage of being able to compare results of nested models "that otherwise may be biased by unobserved heterogeneity" (24, 32, 139).

Another limitation is that the event "utilised rehabilitation" occurred relatively rarely which is a frequent problem in population-based studies. This might have reduced the statistical power of the analyses and selection effects cannot be excluded. Lastly, investigating PMB and the outcome rehabilitation was not the original purpose of the lidA study, so that various relevant factors were not recorded that presumably play a special role in this group and were discussed before. This would clarify why the variance explained (Nagelkerke R^2) in the regression models is often rather low. Additionally, this could have been caused by the made classifications and parameterisations of the used variables. E.g., the need for rehabilitation could only be

estimated approximately with the used operationalisation, which should be considered when interpreting the results.

In our analyses about the utilisation of rehabilitation, we examined for the first time both migrant groups and rehabilitation forms in a more detailed manner than earlier research. As the results show, this is a strength of the analyses. However, this also limits the comparability of the results with those of earlier studies. The same applies for the measurement of the need for rehabilitation, as a comprehensive score was used for the first time with survey data and no uniform operationalisation exists in Germany so far. Accordingly, the studies have contributed new findings on research gaps in Germany. Here, one advantage over previous studies was the wide range of topics within the lidA study so that the "Behavioural Model of Health Services Use" by Andersen could be applied. Although the lidA study was not originally developed with the aim of applying or confirming this model, information in the lidA study was and is available for several central factors represented in the model. Thus, predisposing, enabling and need factors as described in the behavioural model by Andersen could be considered in the analyses. However, due to the exclusive use of questionnaire data for the analyses of this dissertation, factors at the contextual level are lacking.

More detailed strengths and limitations concerning each of the three studies are included in the respective publication in the appendix.

3.4 Implications and possible solution approaches

Measures that support and secure work ability in higher working age, like medical rehabilitation, will become increasingly crucial as employees (must) work longer than in the past because of the demographic shift. Older employees are a valuable target group for these measures, as work ability and health are some of the most significant determinants of participation in the labour market and additionally the risk of health problems is growing with age (13, 140). Here, the heterogeneity of the older working population should be considered to avoid disadvantages and inequalities in the transition from work to retirement. The results of this thesis contributed to a better understanding for the group of older socially insured EMB, as the data of the lidA study made it possible to identify further subgroups in EMB and recognise certain risk groups which should be observed in the future. In the context of EWL, the unequal risks regarding finances, health, employment, and wellbeing should be kept in mind. These appear to be of central importance for social society and the national economy.

Especially the group of older G1 may have accumulated several risks during life and show poor health and work ability. The analysed population of G1 in our sample might have accepted their comparatively poorer health and still plan to work until the state pension age although they did not want to in the same degree. This likely reflects not a voluntary, but a forced and thus planned late exit from work, which could be driven by financial motives. Otherwise, the

alternative might be insufficient income in retirement and ending in old-age poverty. Consequently, this group has a high potential facing an insecure individual future in which work participation would imply continuing social participation. To assure this future participation, rehabilitation as an important component is needed (25, 141, 142).

Therefore, the research findings of this thesis in combination with other literature can give indications and possible solution approaches to enhance health, employment, and subsequent quality of life among older migrant groups, which can be of interest for several related actors and stakeholders such as employers, policy makers, health services and rehabilitation providers as well as future researchers.

3.4.1 Implications for employers and policy makers

In the continuing discussions about the future pension system in Germany and further adjustments, the most important approach would be that policy makers consider that there are social inequalities and connected costs for the social security system when prolonging working lives (121). It would help to develop other possible exit routes out of work and subsequent compensations for those groups whose work ability and health might no longer be sufficient anymore to work until the current fixed state pension age (12, 122). To ask employees for their individual employment perspective including the willing, planning and the ability to continue working can give insights to identify potential risk groups and think about possible solutions for these groups. For example, more flexible options can help to design the transition from work to retirement more individually (46).

Additionally, the findings of study I represent the persistent culture of early retirement and the attitude about the role of work in general in Germany, as in all groups the percentage of the willing is lower than the percentage for planning or the ability to continue working until the state pension age, which is similar to other research (122, 123). According to Hasselhorn, these findings can induce considerations on how to improve the role of work and its organisation in Germany (122). Improving the quality of work and its working conditions in general can positively influence the employment participation in older working life (143–145), which cannot be the task of the employer alone, but rather of the labour policy.

However, employers should likewise consider the heterogeneity and diversity in their own workforce and the individual needs that might come along (146). For older employees, several factors can and should be addressed to make it easier to stay with sufficient work ability and health at work if they want and/or need to. Here, one obvious starting point is the working environment itself as likewise work-related factors have been identified to push or pull employees out of work prematurely (46, 62). Therefore, work adjustments should be made for older employees e.g., by reducing the physical exposure time in physically demanding occupations, where especially G1 can largely be found (61). Other options to improve work for

older people would be to adapt the work tasks, working hours or work breaks, but also to provide qualification measures. Access to work-related training and continuing skill development represents an important factor for working longer and keeping up with the transformation of work (62, 124). In EMB, this improvement in human capital resources can likewise include language training to improve the German language skills so that communication and integration become easier (64).

The improvement of the individual work environment can be reached with a participatory design in form of dialogues (147, 148) to acknowledge individual wishes but also to get ideas how to improve the older employees work ability. Naturally, this requires an appreciating attitude from the leadership, which in turn has a positive long-term effect on the corporate communication and culture (147), but even more importantly on the will to work longer (124). In general, a positive and potential-oriented company culture in terms of occupational safety and health (OSH) is highly respected by the employee themselves, so that it is highly likely that the motivation and ability to continue working will rise (124, 149). However, when it comes to OSH, the diversity specific organisation and design can still be improved as the heterogeneity is not sufficiently recognised, especially in regard to EMBs (150). Explanations with pictures and pictograms, for example, can help to overcome language barriers (151, 152). In general, the development of intercultural competence builds an important basis for OSH to take cultural diversity into account (150).

In conclusion, the heterogeneity of the older working population should be considered to avoid disadvantages and inequalities in the transition of work to retirement. The group of older EMB and specifically G1 must not be ignored, as "failing to plan for the specific needs of a population subgroup can constitute a form of social exclusion" (153). Hereby, pension rules and individual circumstances provide the basic conditions for retirement, but employers can significantly influence the timing through their attitudes, norms and policies towards older employees. Therefore, policy initiatives cannot be limited to changing the financial constraints associated with work exit, but should address the organisational forces that push employees out of the labour market (85, 121).

3.4.2 Implications for health services and rehabilitation providers

Moreover, preventive measures to counteract poor health such as rehabilitation should be considered and advised about to ensure that employees can stay at work as long as needed or wanted. This would likewise realise the principle of "rehabilitation before retirement" of the German pension insurance (23, 154). The ongoing demographic change will ensure that there is a greater need for such adjustments and measures in the future, even among the group of comparatively young EMB (155). This is where the providers of medical and occupational rehabilitation with their individual counselling services are needed, which could be the statutory

health insurances, the Federal Employment Agency, the statutory accident insurance institutions, the statutory pension insurance or other welfare or integration organisations (154).

The results of the three studies have shown poorer health and work ability and thus a higher need for rehabilitation in G1 (study III). Additional exploratory analyses of study III showed that mostly foreign G1 used rehabilitation services when they really needed them, while the comparison groups also showed utilisation despite low need (overuse). At the same time, our results showed an underuse in all groups, i.e. that rehabilitation services were not utilised even though there was a need for them. Several reasons can play a role in this context, so that applications for rehabilitation have not been officially approved: Personal prerequisites such as the ability or motivation to utilise rehabilitation may not have been given (30), but also medical or insurance law reasons can be the cause (23). As already mentioned, other individual reasons and barriers such as missing information, language skills or support may even have contributed one step earlier when applying for rehabilitation (98, 49).

Health services and rehabilitation providers should think about improving their access and need-oriented utilisation of rehabilitation to avoid undersupply and oversupply. Here, an important element would be the timely and standardised identification of the need for rehabilitation and subsequent target group-specific information about different rehabilitation options, offers and its aims. All employees, but specifically G1 should be screened and counselled regarding rehabilitation needs to maintain their - often limited - opportunities to participate in society. This could be done via rehabilitation providers, general or specialist physicians and/or company doctors - where necessary with the help of translating services to break down language barriers. For employees, the work setting especially has the potential with the help of occupational health and safety specialists like the company doctors, to identify affected employees. Occupational health risk factors and further individual barriers should be identified in individual consultations and information about different rehabilitation options and offers provided. E.g., for those with childcare, outpatient rehabilitation and information about this could be a way to overcome this barrier. Currently, there are two counselling projects with a respective randomised controlled trial at the University of Lübeck. One is to evaluate an intervention including active approach, counselling, and individual case management in a sample with high risk of disability in the German pension insurance data (156). The second one will evaluate a diagnostic service to identify the further need for intervention in employees with poor health and limited work capacity who are approached by occupational health specialists (157).

In general, increased awareness and information about the specific rehabilitation options and needs should be improved, not only in the target population but also among medical practitioners. Among the latter rehabilitative knowledge and competences are often missing so that adequate counselling and support in rehabilitation application cannot be provided

although this constitutes an extremely important and helpful factor in the intention and application process for rehabilitation (133, 134).

Moreover, in the specific context of people with migrant background, it would be important to develop additional intercultural and diversity specific competences in medical staff with the help of training programmes or implementing it in the curricula of medical studies. These are currently lacking and building up further barriers in providing health care to PMB. In order to improve this situation, the "Teaching Network Migration and Health" was founded and is currently working on this issue (158). A lack of cultural openness and specific offers in healthcare services, including rehabilitation, was often cited as a system-related barrier that does not motivate PMB to utilise rehabilitation or to apply for it in the first place (98, 101). There are already ideas and concepts giving advice for the diversity management in health care, not only to improve the access to health services like rehabilitation for PMB, but rather to improve treatment satisfaction and subsequently success and sustainability in the long term. For example, the "DiversityKAT"-manual was developed to support rehabilitation facilities in implementing diversity-sensitive care (159). However, the implementation of such tools and a general intercultural opening will stay challenging in terms of limited human and financial resources (160).

In general, early intervention offers and treatment such as rehabilitation can help to counteract fixed retirement plans or considerations in form of disability pension (161). In those with poor health, disability pension is often considered or applied for instead of a rehabilitation first (134). If the health services, including aftercare and return to work are additionally designed in a diversity-sensitive and more need-oriented way, this could have positive effects in the long term on the quality of life and the respective employment perspective. Not only in the older working population in general (162), but especially in those with a migrant background. Furthermore, the integration of such approaches within community and group settings can amplify positive effects and is helpful for sustainable preventive and health-promoting effects (135),

3.4.3 Implications for future research

Firstly, a standardised definition and identification method of migrants, potentially across EU or even worldwide (163), should be implemented to improve the comparability of different studies investigating migrants. At the same time, the term "migrant/migration background" is criticised and "migration history" suggested instead, as this is also used by those who have a biographical connection to migration or fleeing (164). However, there still exists the need to differentiate subgroups because of the huge heterogeneity of the population with migrant background. Summarising them in one group can bias results (as in study II for G1).

Additionally, in the field of rehabilitation research, a standardisation, and a uniform understanding to define the need for rehabilitation should be strived for. To intensify the scientific investigation of this topic in quantitative rehabilitation research, it would help to have an instrument that enables a comparable assessment of rehabilitation needs, for example based on the "International Classification of Functioning, Disability and Health", ICF, of the WHO (165). Previous studies have shown that the ICF Generic 6 score is a reliable tool for assessing functioning in a variety of clinical contexts (166). Its operationalisation for survey studies and respective validation could be carried out using data from the fourth lidA survey.

Furthermore, future studies should take migrant-specific factors into account, if feasible. In our analyses a lot of factors could not be considered with the lidA data and the small values of Nagelkerke R^2 indicate that other factors must play a role next to the included ones. These could be, for example, migrant-specific characteristics of their life trajectories or the understanding of health but also other resources or barriers people might have in general in the rehabilitation utilisation, so that further factors of the Andersen model (2) or the life course view (55) should be evaluated and checked in this context. Other authors in migrant research likewise call for further research (49), while considering comprehensively living and working conditions in PMB e.g., discrimination (164, 167). Indeed, it poses a challenge to have reliable data available for several important aspects over the entire life and enough cases as the sample population.

To study this as a temporal process, further longitudinal analyses are needed. The lidA study has the potential to tackle some research gaps with repeating surveys, so that rehabilitation-oriented outcomes but likewise the realised retirement entry can be explored more. Here, e.g., the association of the subjective employment perspective with the subsequent actual exit behaviour can be investigated.

But also, qualitative approaches have helped in the past to explore different aspects in this field which should be incorporated into quantitative studies by building mixed methods approaches. However, recruiting migrants into larger quantitative or even population-based studies is a challenging task itself, so that they are often underrepresented as in the lidA study. There are initiatives, as e.g. the IMIRA-project at the Robert Koch Institute in Berlin (168, 169) which focus on improving the recruitment of migrants for studies and incorporating them even more in the health reporting system and/or in the German micro-census.

In general, there is a need for more research about the older working population with migrant background (62), which should be – in the best case – in an interdisciplinary and intercultural research team considering diversity within the research questions. However, the implementation of these ideal conditions poses some challenges and is not easy to realise.

3.5 General conclusion and outlook

In conclusion, the three studies within this dissertation have created a better understanding for the increasing group of employees with migrant background while transitioning from working life into retirement. The data of the lidA study made it possible to identify further subgroups in employees with migrant background (EMB) and recognise certain risk groups which should be focussed on in the future.

The results showed that in Germany today, older EMB of the second-generation are rather similar to non-EMB and have a better overall situation compared to the first-generation. This seems plausible as they did not have the migration experience itself and exposures of the country of origin compared to those who migrated themselves.

In contrast, older EMB of the first-generation (mostly foreigners) represent a risk group from social, work-related and health aspects. The proportion of low-skilled, semi-skilled and unskilled workers in this group is comparatively high. The working conditions are less favourable than for those without a migrant background or those in the second generation. Through the accumulation of several burdens, they might face an insecure future in older age and require increased attention.

Despite these work and health conditions, the first-generation plans to work until the individual state pension age to a higher degree than non-EMB, probably due to poor finances while being stuck in their adverse occupations. Due to these factors, they have an increased need for rehabilitation measures, but still do not utilise them accordingly.

Therefore, methods and strategies on behalf of the work organisation, but also health promotion and prevention should be adapted more closely to the needs and living conditions of these older people with a migrant background to maintain their wellbeing and participation in society. However, it is not only this group that should be recognised, but instead diversity-specific policies and work organisation as well as healthcare provision should be implemented overall. Regarding extended working lives, all groups in higher working age with a potentially higher need for rehabilitation should be targeted. In this way they will be able to stay longer and healthier in working life and are better prepared for older age after retirement too.

In summary, the continuing ageing of the population poses new challenges for the German social and welfare system which must not be neglected. Additionally, the number of older individuals who have migrated internationally and possess cultural distinctions from the host population will increase in the next decades. It has become increasingly necessary that the problems and structured disadvantages they encounter are addressed in a proactive manner.

The findings are important for the scientific community as, so far, the data had its limitations, especially regarding the identification of migrant subgroups. However, future research should build on this by considering further migrant specific factors from the life course e.g. as well as

standardising the operationalisation of migrant groups and the identification of the need for medical rehabilitation. Thus, further innovative, comprehensive, and interdisciplinary research is needed.

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Study I

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Subjective employment perspective among older workers with and without migrant background in Germany—Results of the lidA cohort study

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Abstract

Objectives: The aim of this study was to investigate the subjective employment perspective in higher working age for different employee groups with migrant background (EMB) and without (non-EMB), meaning willing, being able, and planning to work until the individual state pension age (iSPA).

Methods: A representative sample of socially insured employees born in 1959 or 1965 was surveyed in 2011, 2014, and 2018 with computer-assisted personal interviews. The current cross-sectional analysis is based on data from the third study wave (n = 3286) of the lidA cohort study. EMB were differentiated via generation (first generation, G1, vs second generation, G2) or nationality (German vs foreign). Applying bivariate statistics with the tests of independence and block-wise logistic regressions, group differences were investigated. Sex, age, educational level, net household income, health, and work factors were considered as covariates.

Results: When comparing subgroups of EMB, significant differences appeared in bivariate analyses for willing and planning to work. G1 were to a higher degree planning to work longer than G2 and those with foreign nationality were more willing and planning than those with German nationality. Multivariate analyses revealed significant differences of G1 and non-EMB for planning, being significant in the fully adjusted model, but not for willing.

Conclusion: The findings underline the need for differentiation of migrant groups in social research and policy. When it comes to extended working lives, the first-generation migrant group, as well as foreigners may constitute risk groups and require increased attention from a work, health, and economic point of view.

KEYWORDS

emigrants and immigrants, employee participation, finances, motivation, older workers, retirement

1 | INTRODUCTION

In many European welfare states the extension of working lives (EWL) is regarded as an instrument to maintain wealth and social stability in times of population aging. Thus, many European states have reduced pathways and incentives for early exit from work and raised official pension entitlement age.[1] Retirement research has addressed the issue of extending working lives by investigating determinants for early or late exit from employment and by identifying typical pathways from work to retirement. One group, however, has been virtually ignored by retirement research: those with migrant background.[2]

In general, migrants are a highly heterogeneous and diverse group with regard to their origin, culture, religion, and education.[3,4] On average, migrants may be assumed to be more vulnerable, compared to nonmigrants, from a social, employment, and economic perspective.[2,5] Regarding health status in migrants, it cannot be said that they are more or less healthy in general than nonmigrants. Findings are not consistent, as different definitions to identify migrants are used and migrant subgroups may differ in this respect. Additionally, observations substantially depend on the health outcome chosen.[6] It was observed that migrants usually are healthier than nonmigrants, resulting in better health and lower mortality in the target country ("healthy migrant effect"). However, this finding is mostly based on the fact that usually healthier people emigrate. With increased duration of stay, the observed benefits in terms of health are gradually reduced, partly due to adaption of health-related behavior and social status in the host country.[6]

In Germany, the proportion of employees with migrant background (EMB) is continuously growing, for example from 16.2% in 2010 to 23.9% in 2018.[7,8] The largest proportion of persons with migrant background are resettlers with German ancestry from Eastern Europe and the former Soviet Union, as well as persons of Turkish and Polish origin.[8] They are overrepresented in jobs affected by economic restructuring, such as manual and un/semi-skilled blue-collar work.[8-11] Employees with foreign nationality more frequently suffer from occupational accidents and diseases, as well as retire earlier in the form of disability pension, compared to employees with German nationality.[10,12] Such health risks may be attributed to more physically demanding work, but also to lower utilization of health services.[5,12,13]

In the coming years, large groups of EMB will reach pensionable age. In 2018, 3.7 million EMB were 45 to 64 years old. This accounted for 17.9% of all workers of that age group and 37.3% of all 10 million EMB in Germany.[8] Older EMB mainly work in blue-collar positions (55%), 32% in white-collar occupations, about 13% are sworn civil servants or self-employed; this pattern is found for all age groups in EMB. The average monthly net income of EMB is 1965 € compared to 2470 € among employees without migrant background (non-EMB).[8]

What generalized statements do not reflect, however, is the substantial variation within the group of EMB. In a recent empirically based summary report, the European Agency Eurofound records substantial differences in working conditions between EMB of first- and second generation and calls for differentiation between these groups in policymaking.[14] The first generation (G1 EMB) is born in another country than the host country, whereas the second generation (G2 EMB) has one or two parents who are foreign-born, but no own migration experience. Hence, Eurofound and others suggest that G2 EMB may be more similar to non-EMB due to adaptation processes while growing up in the host country, than G1 EMB.[14] In German representative surveys, older G1 EMB were found more frequently in unskilled blue-collar positions than older G2 EMB,[8,11] and to a higher extent exposed to adverse work factors with increased health risks, such as adverse work postures and low influence at work.[11] Mean monthly net income was lower (1904 €) for G1 EMB than for G2 EMB (2630 €), which is even higher than for non-EMB (see above).[8]

Such group differences may be of relevance for policymaking and organizations in the context of EWL, when interventions aimed to promote work participation are considered. Concerns have been brought forward that current EWL policies relocate additional health and social risks to different groups of older EMB.[15] The subjective employment perspective of EMB and non-EMB discussed here may represent an early indicator of employment participation in the coming years. A crucial question will be whether the subjective employment perspective of the G2 EMB resembles that of G1 EMB or non-EMB.

In our study, the subjective employment perspective is operationalized by willing, able, and planning to work until a certain age, to capture a range of indicators. Conceptual differences between these three outcomes may be assumed.[16,17] Planning as expected and willing as preferred retirement age were found to be good indicators for future retirement behavior.[18,19] The employment perspective is influenced by a wide range of factors during the process of retirement, such as personal factors and social and occupational contexts.[18,20] It was found that older employees in precarious job positions with low education and income, where for example G1 EMB might be part of, would like to retire earlier than they plan to, probably due to financial reasons.[20,21] The aspect of able to work is likewise essential, as EMB might not be able to work as long as they plan to or should, because of their working conditions which affect their health status.[16]

Research on the work-retirement transition considering migrant subgroups is rare. In a German study of older employees, G1 EMB were found to be significantly less willing to retire before the age of 65.[20] A Canadian study found

that immigrants (first generation) planned to retire later than native Canadians.[22] Representative studies systematically investigating the employment perspective in older employees with distinct differentiation of migrant background are largely lacking. Large quantitative studies on migrants' work, health, and/or employment in Germany often suffer from severe limitations when they are based on secondary data.[10,23] In most such datasets, migrant background is solely indicated by "nationality," thus not permitting a differentiation of migrant background and misclassifying about half of all people with migrant background as nonmigrants; as 9.7 million, of a total 19.6 million people with migrant background, were Germans in 2018.[8]

Instead, the third wave of the lidA study allows for differentiating distinct groups with migrant background among older workers and relating them to different aspects of the subjective employment perspective.

1.1 | Research question

The aim of this study was to investigate the subjective employment perspective in higher working age for different groups with and without migrant background, meaning willing, able to, and planning to work until the individual state pension age (iSPA). Group differences should be determined and the impact of sociodemographic, health, and work factors should be investigated.

2 | METHODS

2.1 | Study design and participants

The lidA (leben in der Arbeit) cohort study investigates work, health, and work participation in the older workforce in Germany. This study examines a representative sample of older employees, who were born in 1959 or 1965 and socially insured during sampling in 2009. Due to this sampling specification, sworn civil servants and self-employed were not included. The participants were interviewed at home for each assessment wave by computer-assisted personal interviews (CAPI), covering topics such as work, health, private life, and employment perspective. The baseline survey took place in 2011 (n = 6585), the second wave in 2014 (n = 4244), and the third wave in 2018 (n = 3586). A detailed description of the lidA cohort study and its sampling process can be found elsewhere.[24] The lidA datasets of the first and second wave are available as a Scientific Use File,[25] data from the third wave will be added by 2023.

Results of attrition analysis showed for all waves a widely selection-free realization of the sample in relation to the sociodemographic characteristics used in the analyses.[26-28]

However, attrition from the first to the third wave was 47% for the total sample, for low educational level it was 76% in G1 EMB compared to about 53% in non-EMB and G2 EMB. Since this report is based on data from the third study wave, we performed inverse probability weighting for subgroups of migrant status and educational level.

The sample was restricted to those being employed at least 1h/week. Due to the weighting, cases with missing values in migrant background or educational level were excluded as well. Consequently, the final sample consisted of 3286 individuals.

2.2 | Operationalization

2.2.1 | Outcomes

The main outcome of the analysis is the subjective employment perspective which was parameterized by three single outcomes: _willing, able,_ and _planning_ to work until the individual state pension age (iSPA). Participants were asked until what age they would like (_willing_), they think they would be able to (_able_), and they plan to work (_planning_). Responses given had to be _years of age_. For the analyses in this study, the answers were dichotomized into less than vs at least until the current iSPA in Germany, which is 66 years of age for the 1959-cohort and 67 years of age for the 1965-cohort. The outcomes have only been surveyed in such detail in the third wave so far.

2.2.2 | Migrant background

The lidA cohort study allows to distinguish between migrant groups by means of different specific indicators as proposed by Schenk et al.[29] EMB were defined based on the participants' self-reported country of birth and nationality and on the country of birth of each of their parents. Participants born in Germany, with German citizenship and with both parents being born in Germany constitute the reference group (non-EMB). To investigate the group of EMB, two different operationalizations were adopted: The first operationalization is based on a definition provided by the German Federal Statistical Office,[7,8] where EMB are separated by generation into first generation (G1 EMB) and second generation (G2 EMB), as described before. For some analyses, the group of G2 EMB was further separated into participants with one or two parents born outside Germany to investigate potential differences between unilateral and bilateral foreign descent. The second operationalization of EMB is based on nationality (German/dual vs foreign) to reflect the more detailed differentiation level in contrast to process data as indicated above.

TABLE 1 Characterization of study population, weighted and unweighted sample

	Weighted sample[d] (n = 3286)				Unweighted sample (n = 3324)			
	Non-EMB (n = 2703)	**G1 EMB (n = 346)**	**G2 EMB (n = 236)**	**P-value[a]**	**Non-EMB (n = 2828)**	**G1 EMB (n = 244)**	**G2 EMB (n = 252)**	**P-value[a]**
Sex [n (%)]								
Male	1228 (45.4)	184 (53.2)	105 (44.5)	**.021**	1274 (45.0)	125 (51.2)	112 (44.4)	.168
Female	1475 (54.6)	162 (46.8)	131 (55.5)		1554 (55.0)	119 (48.8)	140 (55.6)	
Year of birth [n (%)]								
1959	1214 (44.9)	155 (44.7)	94 (39.7)	.296	1265 (44.7)	110 (45.1)	101 (40.1)	.354
1965	1489 (55.1)	192 (55.3)	143 (60.3)		1563 (55.3)	134 (54.9)	151 (59.9)	
Combined education level [n (%)]								
High	551 (20.4)	74 (21.3)	51 (21.6)	**<.001**	620 (22.0)	70 (30.0)	60 (23.8)	**.003**
Medium	1505 (55.7)	148 (42.7)	118 (50.0)		1627 (57.7)	106 (45.5)	131 (52.0)	
Low	647 (23.9)	125 (36.0)	67 (28.4)		572 (20.3)	57 (24.5)	61 (24.2)	
Net household income [n (%)], m = 119								
>150% (>3374.00€)	303 (11.6)	15 (4.5)	32 (14.0)	**<.001**	328 (12.1)	11 (4.7)	35 (14.3)	**<.001**
<150% (2249.80€-3373.90€)	859 (33.0)	85 (25.3)	78 (34.1)		909 (33.4)	62 (26.3)	85 (34.8)	
<100% (1799.60€-2249.75€)	558 (21.4)	58 (17.3)	49 (21.4)		581 (21.4)	42 (17.8)	51 (20.9)	
<80% (1799.50€-1350.00€)	577 (22.2)	97 (28.9)	45 (19.7)		596 (21.9)	66 (28.0)	46 (18.9)	
<60% (<1349.90€)	305 (11.7)	81 (24.1)	25 (10.9)		306 (11.3)	55 (23.3)	27 (11.1)	
SF-12: physical health [M (SD)], m = 11	48.1 (9.2)	46.2 (9.4)	46.9 (8.5)	**<.004[b]**	48.2 (9.2)	46.6 (9.4)	47.1 (8.4)	**.008[b]**
SF-12: mental health [M (SD)], m = 11	51.8 (9.8)	51.4 (10.4)	52.2 (9.3)	.248[b]	51.7 (9.9)	50.7 (10.3)	51.9 (9.4)	.243[b]
COPSOQ: Influence at work [M (SD)], m = 3	37.4 (26.2)	32.9 (27.0)	37.9 (26.2)	**.002[b]**	37.5 (26.1)	34.0 (26.5)	37.8 (25.8)	.129[b]
Work stress, ERI [Mdn (IQR)], m = 24	0.50 (0.38)	0.42 (0.33)	0.50 (0.40)	**<.001[c]**	0.50 (0.38)	0.42 (0.30)	0.50 (0.39)	**.004[c]**
Cumulative physical work exposure								
No physical exposure	556 (20.6)	50 (14.5)	49 (20.7)	**.001**	597 (21.1)	37 (15.2)	54 (21.4)	**.03**
One exposure	963 (35.6)	102 (29.5)	73 (30.8)		1019 (36.0)	76 (31.1)	80 (31.7)	
Two exposures	586 (21.7)	105 (30.3)	52 (21.9)		607 (21.5)	69 (28.3)	55 (21.8)	
Three exposures	598 (22.1)	89 (25.7)	63 (26.6)		605 (21.4)	62 (25.4)	63 (25.0)	

Note: Bold print indicates significance, *P* < .05.

Abbreviation: EMB, employees with migrant background; G1, first generation; G2, second generation; IQR, Interquartile range; M, Mean; Mdn, Median; m, number of missing values due to respondents not responding to the item, from weighted results; SD, Standard deviation.

[a]Tested with chi-squared test if not otherwise specified.

[b]Tested with ANOVA.

[c]Tested with Kruskal-Wallis test.

[d]Weighting factors: for non-EMB/low 1.134, for non-EMB/medium 0.927, for non-EMB/high 0.896, for G1 EMB/low 2.229, for G1 EMB/medium 1.438, for G1 EMB/high 1.081, for G2 EMB/low 1.101, for G2 EMB/medium 0.907, for G2 EMB/high 0.869.

2.2.3 | Covariates

As the three outcome variables might be influenced by further factors besides the migrant background,[2] the following variables were considered as potential confounders. Year of birth (1959/1965), sex (male/female), education, and financial situation comprise the sociodemographic factors.

Education was parameterized with the help of a score combining educational and vocational training and then classified in three categories from high to low level.[30] To measure the financial situation, the net equivalent household income was used. It represents the mean net income of each person in a household weighted for the number and age of the persons living in the household. The square root scale of the OECD

was applied.[31] The net income variable was grouped into categories of < 60%, <80%, <100%, <150%, and >150% of the sample median (2249.75€), where <60% may indicate risk of poverty.[32]

Physical and mental health were considered as further covariates. These were assessed by two established scales of the SF-12 Health Survey[33] in an adapted German version.[34] The physical component summary scale (PCS-12) considers physical health and the mental component summary scale (MCS-12) considers the respondents' mental health; higher scores indicate better health.

Further control variables were added to adjust for different occupational exposures of potential relevance for the outcomes of interest.[18,20,35] Influence at work was assessed with three items (influence on with whom, what, and how much one works, COPSOQ II, middle version), with a mean ranging from 0 (no influence) to 100 (high influence).[36] Work-related stress was assessed with the effort-reward imbalance (ERI) scale which was used as a continuous measure. Imbalance was measured with the ERI ratio, the quotient of the effort and the reward scale by adding a weighting factor to adjust for the different numbers of items in the nominator and denominator. Values close to minimum of 0.2 express low work stress while values above 1.0 indicate a very high ERI imbalance, meaning higher personal work stress.[37]

For physical work load, a cumulative measure was drawn up from exposure to adverse postures, heavy lifting or carrying and one-sided movements at work. The answer categories corresponded to proportions of working time (never, up to one quarter, up to half, up to three quarters, (almost) always). Any exposure greater than "never" was counted as one "exposure" in total.[38]

2.3 | Statistical analysis

Due to group differences in attrition between the first and the third study wave, inverse probability weighting was done for subgroups of migrant status and educational level. All reported results are based on weighted analyses; however, in Table 1 additionally unweighted characteristics are presented for comparison. Descriptive and bivariate statistics including chi-squared and Kruskal-Wallis tests, as well as ANOVAs were used to characterize the full sample and specifically investigate differences between groups and the outcomes. To investigate potential differences between EMB and non-EMB, multivariate logistic regressions were performed while adjusting block-wise for sociodemographic, health, and work factors. For migrant background as the main independent variable, differentiation by migrant generation was chosen. Regressions were performed for each outcome, respectively, using complete-case analysis. In addition, average marginal effects (AMEs) were computed for all logistic regressions

with SAS 9.4. They allow us to compare the results of nested models that otherwise may be biased by unobserved heterogeneity. The AME shows for each variable in a regression model how much the event probability changes when the independent variable increases by one unit, or rather when a binary independent variable changes its level.[39]

In all statistical tests P-values (two-tailed) <.05 were considered to be statistically significant. Within the logistic regressions Nagelkerke's pseudo-R^2 was used as a measure for comparing competing models. All statistical analyses (other than AMEs) were performed using SPSS version 25.0 (IBM Corp.).

3 | RESULTS

3.1 | Descriptive and bivariate analysis

Baseline characteristics of all participants included in the analyses are given in Table 1, shown as weighted (n = 3286) and unweighted results (n = 3224). Due to deliberate oversampling, participants born in 1965 were overrepresented in all subgroups. The following summary of findings refers to significant and weighted results only. The proportion of men was higher in G1 EMB than in non-EMB or G2 EMB. The distribution of educational level differed between the three groups (P =< .001); the proportion of workers with low educational level was highest among G1 EMB (36.0%) compared to non-EMB or G2 EMB. But there were no significant group differences when comparing non-EMB with G2 EMB only (P = .202, chi-squared test, not shown). The distribution of income groups differed between the three groups (P =< .001), yet it was rather similar for non-EMB and G2 EMB. In G1 EMB, 53% had a household income below 80% of the median vs 34% in non-EMB and 31% in G2 EMB. The mean score for physical health was lowest for G1 EMB (46.2), followed by G2 EMB (46.9) and non-EMB (48.1, P = .004). G1 EMB had lower influence on their own work (32.9) than G2 EMB (37.9) and non-EMB (37.4, P = .002). However, concerning work stress, G1 EMB had lower work stress with a median of the ERI ratio of 0.42 and 0.5 for the other two groups (P=<0.001). Among the G1 EMB, 85% experienced at least one adverse physical exposure at work compared to 79% among the non-EMB and G2 EMB, respectively, P = .001).

Table 2 displays the outcomes by different subgroups. There were no significant group differences between non-EMB and EMB with respect to willing, able, and planning to work until one's iSPA. When comparing EMB subgroups, G1 were to a higher degree planning to work longer than G2 (25% vs 16%) and those with foreign nationality were more willing and planning than those with German nationality (18% vs 9% for willing, 29% vs 20% for planning). No differences, however, were found for able to work until iSPA.

The subdivision of the EMB G2 group into those with one or two parents of foreign origin did not indicate any significant differences between the two groups.

3.2 | Multivariate analysis for willing and planning

Throughout all models, G1 EMB exhibited higher and G2 EMB exhibited somewhat lower odds ratios (OR) for willing to work until iSPA than non-EMB. Nevertheless, these group differences were not significant, although when adjusting for health factors in model 3, the *P*-value for G1 EMB was closely above .05.

With respect to planning to work until iSPA (Table 3), significantly higher OR were found for G1 EMB than for non-EMB in the null model (OR = 1.34, 95%-CI 1.03-1.74). The probability for planning to work until iSPA was increased by 3.9%-points in G1 EMB. Adjusting for sex, age, physical and mental health even further increased significance as well as the probability up to 5.3%-points. When additionally considering further covariates in models 3 and 4, the probabilities and odds ratios declined, but were still significant. Between G2 EMB and non-EMB, no significant differences were found in any model. Respective findings for the outcome able to work were not shown or discussed as there were no statistically significant group differences.

Secondary findings within multivariate analyses indicated that the following covariates were significantly associated with willing and planning to work until iSPA (data not shown): Belonging to the 1959-cohort was associated with

higher OR for willing, while having less than 60% mean net household income showed higher OR (around 2) for both outcomes, willing and planning. In contrast, significantly lower OR for willing and planning were found for those with medium and low educational level. Also, the ERI ratio was significantly associated with willing to work until iSPA in the expected direction.

4 | DISCUSSION

In the present study, we analyzed the subjective employment perspective in higher working age for different groups of EMB and non-EMB, meaning willing, able to, and planning to work until the individual state pension age. For "able to work" no group differences were found. When comparing all EMB with non-EMB in bivariate analyses, no significant differences were observed for any of the three outcomes. However, when comparing migrant subgroups, significant differences appeared for willing and planning to work until iSPA. Among EMB, those with foreign nationality were, to a higher degree, willing and planning to work until iSPA than those of German nationality. Likewise, G1 EMB were more planning to work until iSPA than G2 EMB. Multivariate analyses revealed significantly higher odds ratios for planning among G1 EMB compared to non-EMB, even when considering potential confounders, while there were no significant group differences for willing.

In all groups considered in the analyses, the proportion of those "able" to work until iSPA was clearly higher than that of planning and finally, followed by willing. This is in line with findings from Sweden, where 54% of the

TABLE 2 Willing, able, and planning to work until individual state pension age by migrant status (n = 3286), weighted results

	Willing			Able			Planning			
	%	(95% CI)	*P*-value[a]	%	(95% CI)	*P*-value[a]	%	(95% CI)	*P*-value[a]	n
All EMB vs Non-EMB										
Non-EMB	10	(9-11)	.497	32	(30-33)	.097	21	(19-22)	.706	2703
EMB	11	(8-13)		28	(24-32)		22	(18-25)		583
EMB by generation										
First generation (G1)	12	(09-16)	.128	27	(22-31)	.387	25	(20-30)	.014	346
Second generation (G2)	8	(5-12)		30	(24-36)		16	(12-21)		236
EMB by nationality										
German or dual	9	(6-12)	.004	28	(23-32)	.564	20	(16-23)	.035	464
Foreign	18	(11-25)		30	(22-39)		29	(20-37)		119
EMB G2 by foreign descent										
Unilateral	9	(5-13)	.892	29	(22-35)	.399	17	(11-22)	.677	187
Bilateral	7	(0-15)		35	(21-49)		15	(5-25)		50

Note: Bold print indicates significance, *P* < .05.

Abbreviation: EMB, employees with migrant background; G1, first generation; G2, second generation.

[a]Tested with chi-squared test.

TABLE 3 Association for willing and planning to work until the individual state pension age with migrant status, weighted results

	Model 0:	Model 1:	Model 2:	Model 3:	Model 4:
				M2 + education,	M3 + physical work exposure,
	Crude	M0 + sex, age	M1 + health	net household income	work stress, influence at work
Willing (n = 3135/ n_events = 314)					
OR (95% CI)					
Non-EMB	Ref.	Ref.	Ref.	Ref.	Ref.
G1 EMB	1.30 (0.91-1.85)	1.30 (0.91-1.86)	1.42 (0.99-2.04)	1.29 (0.90-1.86)	1.26 (0.87-1.82)
G2 EMB	0.82 (0.51-1.35)	0.84 (0.51-1.37)	0.85 (0.52-1.40)	0.87 (0.53-1.43)	0.88 (0.53-1.45)
AME					
Non-EMB	Ref.	Ref.	Ref.	Ref.	Ref.
G1 EMB	+0.0236	+0.0234	+0.0332	+0.0208	+0.0199
G2 EMB	−0.0157	−0.0139	−0.0108	−0.0077	−0.0115
R^2	0.002	0.008	0.035	0.063	0.084
Planning (n = 3132/ n_events = 662)					
OR (95% CI)					
Non-EMB	Ref.	Ref.	Ref.	Ref.	Ref.
G1 EMB	**1.34 (1.03-1.74)**[*]	**1.35 (1.03-1.76)**[*]	**1.42 (1.09-1.86)**[**]	**1.38 (1.04-1.82)**[*]	**1.38 (1.04-1.82)**[*]
G2 EMB	0.76 (0.53-1.09)	0.76 (0.53-1.09)	0.76 (0.53-1.10)	0.77 (0.54-1.12)	0.78 (0.54-1.13)
AME					
Non-EMB	Ref.	Ref.	Ref.	Ref.	Ref.
G1 EMB	+0.0392	+0.0397	+0.0526	+0.0488	+0.0513
G2 EMB	−0.0473	−0.0487	−0.0450	−0.0425	−0.0392
R^2	0.004	0.006	0.018	0.071	0.074

Note: Bold print indicates significance.

Abbreviation: AME, average marginal effects; CI, confidence interval; M, Model; n_events, number of events where the outcome = 1 in the logistic regression; OR, Odds Ratio; P, P-value; Ref., Reference; R^2, Nagelkerke pseudo-R^2.

[*]$P < .05$,

[**]$P < .01$,

[***]$P < .001$.

workers aged 55-64 years stated that they "can" and 38% that they "want to" work until age 65 years or beyond.[16] The low prevalence for planning and willing is indicative of an "early exit culture" still prevailing in Germany.[40] The absence of significant group differences for able may reflect an even distribution of the individuals' perception of their mental and physical resources between the groups. However, the larger group differences found for willing and especially planning may be indicative of migrant status differences with respect to the older workers' subjective valuation of their last period of working life. The relatively high prevalence for willing among older workers with foreign nationality might thereby express a higher pressure felt to retire late among those financially less well off.[15] In Germany, workers of foreign nationality more frequently work in un/semi-skilled positions[11] and consequently, have lower income than German EMB (own results, data not shown). Hess[21] has found among older workers in Germany that financial needs were associated with a higher expected

retirement age. As "expected retirement age" and "planned retirement age" may be conceptually closely related, one may conclude that finances might also contribute to the higher prevalence for planning found among non-German EMB and G1 EMB. However, the significantly higher OR for G1 EMB for planning throughout all multivariate logistic regression models also imply inherent or further migrant status group differences. It is noticeable that in our study, the results for G2 EMB are more similar to non-EMB than to G1 EMB. This may indicate a high degree of social integration of this generation.

The scientific literature on migrant status and employment perspective and behavior, respectively, is scarce. We are not aware of any further study investigating the outcome "planning" among older workers with respect to migrant background. In the only study known to us, investigating the outcome willing among older employees, it was found that G1 EMB were significantly more willing to work longer than non-EMB.[20] This analysis was based on the same sample as

ours, but on an earlier study wave, which did not provide the possibility to compare the effects of the three outcomes of the employment perspective. Canadian research has identified that immigrants (first generation) intended to retire later than natives, which is in line with our findings. Concerning actual retirement, immigrants were found to be less likely to leave work early, except for involuntary early retirement such as disability pension due to poor health, which immigrants were more likely to receive than nonimmigrants.[22] In an earlier German study, it was observed that migrants retired significantly later compared to West-Germans when controlling for employment status at the age of 50 years and before retirement entry.[41] However, the operationalization of the migrant status was not mentioned in the study.

By considering migrant background when investigating the work-retirement transition, our study contributes to filling in the research gap, addressed in earlier reviews.[2] The findings confirm the necessity emphasized by Eurofound[14] to differentiate between migrant subgroups in the work force, as different subgroups do not experience the same problems in daily life and behave differently. One conclusion of their research was that policy should consider distinct approaches to meet the needs of different migrant subgroups. Unlike most other German datasets, the lidA cohort study has the potential to identify different migrant groups based on several indicators and not only by nationality, so that recommendations for mapping of migrant status could be followed.[29]

In retirement research, health is considered as a key determinant of early retirement.[42,43] In line with this, physical and mental health were found to be important factors in our analyses, influencing whether older employees are willing and planning to work until iSPA. When controlling for these aspects in multivariate analyses, effect estimates for G1 EMB increased for both willing and for planning to work until iSPA. This indicates that among older employees, G1 EMB were more likely to plan to work longer if they had a comparably good health status as non-EBM (cf. Table 1 for physical health).

Further important factors in our study seemed to be the household income and the educational level, as effect estimates were somewhat decreasing for G1 and G2 EMB when additionally adjusting for these two factors. However, concerning planning, significant differences remained after full adjustment. In previous research about these sociodemographic characteristics, EMB were found to be at a higher risk of becoming unemployed or having low-paid employment positions. During recruitment of so called "guest workers" to Germany from the late 1950s to the early 1970s, employees with low education and qualification were predominantly recruited, indicating lower income levels for G1 EMB in later life.[44] Likewise, in our weighted sample, a comparably high percentage of G1 EMB indicated lower education and reported poorer working conditions, such as physical exposures and lower income, than non-EMB.

Overall, not only migrants with foreign nationality, but also G1 EMB might constitute a special group to focus upon for the coming years until retirement in research and policy. In our weighted sample, this group has, on average, a lower educational level, lower household income, poor physical health, higher physical work exposures, but nonetheless reports fairly low work stress. Our findings indicate that in Germany in times of extending working lives, certain migrant groups approaching retirement age might constitute risk groups locked in lower working positions, poor health and economics where the "planning" does not reflect a choice, but a forced decision to work longer. To offset negative effects of extended working lives expected for vulnerable groups of older workers, scientists increasingly call for an improvement of work quality, job security, and also the promotion of lifelong learning as preconditions for policies aimed at extending working lives.[15] Phillipson[45] proposed work and retirement policies acknowledging the processes of cumulative advantage and disadvantage operating over the life course.

This study has several strengths. First, the use of a sample being representative for the socially insured employees of the considered two age cohorts. Socially insured employees cover about 80% of the German working population.[26] Second, the lidA cohort study has the potential to distinguish between different migrant groups.[29] Additionally, the lidA study questionnaire from the third wave allows for the differentiated assessment of the employment perspective. Another strength of this study is the consideration of different confounding sociodemographic, health, and work variables that may disguise differences in the outcomes between the investigated groups.

However, the present study also has limitations. The study design was cross-sectional and it remains an open question to what extent the willing, able, and planning to work until a certain age might be stable until retirement, not least in times of extended working life policies. Concerning migrant status, we were not able to differentiate further relevant migrant groups, such as labor migrants vs resettlers vs refugees. An additional limitation is a potential bias into participant selection, as the study was conducted in German and therefore EMB could potentially be excluded due to language problems. However, we assumed for these participants certain German language skills when working in socially insured positions. In addition, the lidA cohort study uses two birth cohorts and is sampled within socially insured employees, which excludes sworn civil servants and self-employed. As a result, the findings and conclusions drawn are limited to this group of older employees, only. Finally, the percentage of employees of G1 EMB was considerably lower than that in the first study wave. The latter could indicate a healthy worker survivor effect and selection bias, as individuals might have left the workforce due to poorer health and/or precarious job positions.

However, we used inverse probability weighting to adjust panel attrition in migrant groups and educational levels.

5 | CONCLUSION

Our findings underline the need for differentiation of migrant groups in social research and policy. When it comes to extended working lives, the first-generation migrant group and foreigners may constitute risk groups and require increased attention from a work, health, and economic point of view.

DISCLOSURES

Approval of the research protocol: Design and conduct of the lidA study have been approved by the Ethics Committee of the University of Wuppertal dated from 05/12/2008 and 20/11/2017.

Informed consent: Participants were fully informed about the aim and procedure of this study prior to giving consent to participate in this study. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Registry and the registration no. of the study/trial: N/A.
Animal studies: N/A.
Conflict of interest: The authors declare that they have no competing interests.

AUTHOR CONTRIBUTIONS

HMH had the idea for the study and developed the study design with CCS. CCS performed the analyses and wrote the first draft of the article. JB, HMH, and JP contributed with their expertise. All the authors critically reviewed and approved the final manuscript.

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Utilisation of rehabilitation services for non-migrant and migrant groups of higher working age in Germany – results of the lidA cohort study

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Abstract

Background: An ageing and a shrinking labour force implies that the prevention of a premature exit from work due to poor health will become more relevant in the future. Medical rehabilitation is a health service that aims at active participation in working life. The provision of this service will be relevant for an increasing part of the ageing labour force, namely, employees with a migrant background and their different subgroups. Thus, this study examines whether first- and second-generation employees with migrant background differ from non-migrants in their utilisation of rehabilitation services and whether within the subsample of migrant employees, those persons with foreign nationality differ from those with German nationality.

Methods: Socially insured employees born in 1959 or 1965 were surveyed nationwide in 2011 as part of the lidA cohort study (*n*=6303). Survey data of the first study wave were used to identify the dependent variable of the utilisation of rehabilitation (in- and outpatient), the independent variable of migrant status and the covariates of sociodemographic, work- and non-work-related factors. Applying bivariate statistics with tests of independence and block-wise logistic regressions, differences between the groups were investigated. Additionally, average marginal effects were computed to directly compare the adjusted models.

Results: The study showed that first-generation migrants had a significantly lower likelihood of utilising outpatient rehabilitation than non-migrants (fully adj. OR 0.42, 95% CI 0.22-0.82) and that average marginal effects indicated higher differences in the full model than in the null model. No significant differences were found between the first- or second-generation migrants and non-migrants when comparing the utilisation of inpatient rehabilitation or any rehabilitation or when analysing German and foreign employees with migrant background (*n*=1148).

Conclusions: Significant differences in the utilisation of outpatient rehabilitation between first-generation migrants and non-migrants were found, which could not be explained by sociodemographic, work- and non-work-related factors. Thus, further factors might play a role. The second-generation migrants resemble the non-migrants rather than their parent generation (first-generation migrants). This detailed investigation shows the heterogeneity in the utilisation of health services such as medical rehabilitation, which is why service sensitive to diversity should be considered.

Keywords: utilisation, rehabilitation, migrants, retirement, employee participation, cohort study

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Introduction

Demographic change affects many domains in industrialised countries, including the ageing and shrinking labour force. In Germany, as a countermeasure, the statutory retirement age was raised leading to prolonged working lives and a higher proportion of older employees [1]. Along with the ageing of the labour force, the risk of poor health and functioning elevates with increasing age, which often leads to a premature exit from working life and rising costs for social security systems [1–3].

An ageing labour force and an increasing number of employees with functional limitations imply that the prevention of premature exit from work due to poor health will become increasingly relevant in the future. Therefore, prevention, rehabilitation and reintegration will gain relevance in working life, especially medical rehabilitation aiming at continued work participation [4]. When the ability to work is at risk or if it is impaired due to poor health or functioning, rehabilitation can improve or restore work ability or inhibit its deterioration to prevent premature work exits [4–6]. In Germany, the system of rehabilitation is quite unique. The legal foundation is set by the social security system in Germany, where five statutory branches work independently from one another. These are the statutory health, pension, accident, unemployment and nursing care insurance. The membership for all employees (except civil servants and employees over a certain income threshold) is compulsory. The exempted people can decide whether they want to be statutorily or privately insured. Therefore, depending on the situation of the concerned person, different rehabilitation providers can be responsible, e.g., the pension, the accident or the health insurance. Briefly, the pension insurance takes over the costs when the person is employed, the accident insurance takes over when rehabilitation is needed because of an occupational accident and the health insurance takes over in most other cases. To obtain access, the person himself or herself has to apply for rehabilitation with the recommendation of a physician. As part of the rehabilitation, different interventions can be used, such as medical rehabilitation, which takes place in rehabilitation clinics, or occupational rehabilitation, which includes interventions at the workplace, or social rehabilitation, which includes several assistance services, e.g., those for mobility [4, 6, 7]. This study mainly focuses on medical rehabilitation. Overall, each year, approximately one million medical rehabilitation services are approved by the main provider, the pension insurance, mostly for musculoskeletal disorders, cancer or mental disorders. These programmes are (mostly) provided on an inpatient as well as outpatient basis, lasting on average 22 to 24 days or 28 days for mental disorders [4, 6].

In this context, it is important to note that the older labour force in Germany is heterogeneous. For example, the proportion of employees with a migrant background (EMB) is continuously growing, e.g., from 16.2% in 2010 to 23.9% in 2018 [8, 9]. The largest proportion of persons with a migrant background (PMB) in Germany are resettlers from Eastern Europe and the former Soviet Union, as well as persons of Turkish and Polish origin [9, 10]. Therefore, PMB constitute a heterogeneous group with regard to their origin, culture, religion and education [11, 12]. Concerning health, only certain health outcomes with different definitions of migrant background have been researched so far, so that further studies are required. According to the existing literature, it is not conclusive that PMB have poorer health in general than non-PMB, and there is a need to differentiate between subgroups and outcomes. Another limitation of previous studies is the lack of sociodemographic data on PMB, which often account for health status compared to non-PMB [13].

PMB comprise persons born outside of Germany (first-generation, G1) and persons born in Germany, but with one or both parents born abroad (second-generation, G2) [9, 10, 14]. PMB can either be German or foreign nationals, depending on their place of birth, making the criterion 'nationality' less suitable for identifying this group. When focusing on older employees, it must be considered that in Germany many PMB will soon reach the statutory retirement age themselves as 37.3% of them were over 45 years old in 2018 [9].

It is known that EMB, especially those with foreign nationality, more frequently suffer from occupational accidents and diseases and that they retire earlier with a disability pension compared to employees with German nationality [15, 16]. This difference could be attributed not only to poor health due to more physically demanding occupations and further social inequalities that this group experiences but also to lower utilisation of health services [13, 15, 17, 18]. Medical rehabilitation constitutes one of these health services that aims at active participation in working life. In Germany, persons with migrant background, especially those with a foreign nationality, are less likely to utilise rehabilitation services than non-migrants [19–21]. This is possibly due to barriers such as lack of information, language problems, illiteracy or cultural barriers [22–24].

However, current studies on migrants' utilisation of rehabilitation services in Germany have several limitations. Quantitative studies are often based on secondary data, such as process data from rehabilitation providers (e.g., pension insurance). In most such data sets, the migrant background is solely indicated by 'nationality", thus not permitting a differentiation in migrant backgrounds and misclassifying a large proportion of people, up to 48%

(9.4 million foreign nationals out of 19.3 million persons with a migrant background) [9]. Furthermore, the findings of the qualitative studies are not representative. Experts in the field have consequently identified a need for large-scale primary studies on migrants' utilisation of rehabilitation services in Germany [25].

To our knowledge, representative studies in Germany investigating the utilisation of in- and outpatient rehabilitative care in older employees with distinct differentiation between migrant backgrounds are missing. Additionally, there are no investigations as yet that would compare groups within PMB or EMB to identify possible contrasting behaviours such as first- and second-generation behaviours or behaviours related to nationality. Obtaining German nationality is accompanied by considerable simplifications in one's life and a higher willingness to integrate into German society [17], which may have a potential influence on the utilisation of rehabilitation. Thus, the consideration of the heterogeneity in persons with migrant background is essential as subgroups might act differently in the utilisation of health services and in terms of medical rehabilitation.

Therefore, the current study primarily investigates, whether first- and second-generation employees with migrant background differ from employees without migrant background in their utilisation of rehabilitation services. Second, the study investigates the subsample of migrant employees with foreign nationality as to whether they differ from those migrant employees with German nationality in their utilisation of these services. Moreover, the impact of different sociodemographic, work- and non-work-related factors is investigated to explain group differences.

Methods
Study design and participants
The lidA (leben in der Arbeit) cohort study examines the work, age, health and work participation of an ageing workforce in Germany. Two birth cohorts (1959 and 1965) were chosen as being part of the German 'baby boomer' generation, constituting the older labour force and moving towards retirement with less options for early retirement than earlier retirement cohorts. The age difference between the cohorts was set to investigate possible cohort effects other than age or time (period) effects, which can occur during follow-up in intervals. The lidA-study population was selected in a two stage sampling process from the 'Integrated Employment Biographies' (IEB) dataset, which is the data register from the German Federal Employment Agency. Within sampling, in the first stage, an area selection of 222 sample points was carried out; the points were drawn proportionally to the population and spread across the entire Federal Republic of Germany. The second

selection stage consisted of the selection of employees subject to social security contributions at each sample point. The dataset therefore contains all socially insured employees born in 1959 or 1965 in Germany who were employed on the reference date of 31 December 2009, which covers 80% of the German working population. The participants were interviewed at home for each assessment wave, based on computer assisted personal interviews (CAPI) covering topics such as work, health and private life [26, 27]. To date, three waves of assessment have been performed in 2011, 2014 and 2018. The lidA study was approved by the Ethics Committee of the University of Wuppertal (dated from 05/12/2008 and 20/11/2017, MS/BB 171025 Hasselhorn). The datasets analysed in the current study are available as a scientific use file at the Research Data Centre of the German Federal Employment Agency at the Institute of Employment Research [https://fdz.iab.de/en/FDZ_Individual_Data/lidA.aspx] [28].

For the present analysis, data from the first study wave in 2011 were used, where 6585 participants took part. At this point in time, the participants were 46 and 52 years old. Participants in full-time, part-time, irregular or marginally employed positions (at least 1h/week) in 2011 were included in the sample (n=6339). Due to the sampling specification, employees such as civil servants, self-employed persons and freelancers were excluded. As all interviews in the lidA study were performed in German, no interviews were realised with persons not able to communicate sufficiently in the German language. Further, 36 participants with undefined migrant status were excluded. As a result, the sample consists of 6303 individuals.

Measurements
The outcome of rehabilitation services
The primary outcome was 'utilised medical rehabilitation', which was self-reported with the questionnaire. Participants were asked to report whether they had utilised an in- or outpatient rehabilitation service in the previous three years. All outcomes were generated as a binary variable indicating general, in- or outpatient rehabilitation vs. no utilisation of rehabilitation, respectively.

Migrant background
The lidA cohort study allows distinguishing migrant groups by means of specific indicators, as recommended by Schenk et al. [29].

Migrant background was operationalised based on the self-reported country of birth, nationality of the participants and the country of birth of each of their parents. Participants with place of birth in Germany, German nationality and with both parents born in Germany, were the reference group (non-EMB). The first migrant

generation (G1 EMB) was defined according to the definition of the German Federal Statistical Office [8, 9] as persons who were born abroad and who had immigrated to Germany, meaning that their country of birth is not Germany. Participants with German citizenship not born in Germany and with both parents born in Germany were included in G1 EMB because of the strictly defined reference group.

The second migrant generation (G2 EMB) was classified as participants born in Germany with at least one parent born abroad. For the second group comparison, the subsample of employees with migrant background (EMB) was split into those employees with German/dual and foreign nationality (German and foreign EMB).

Covariates

Sociodemographic, work-related, and non-work-related factors were included as covariates in the analysis to describe group differences and to control potential confounders.

Sociodemographic factors As sociodemographic factors, the year of birth (1959/1965), sex (male/female) and occupational class were considered as covariates. As sex is an important determinant for health service utilisation, we tested for interaction effects between sex and migrant background, but this was neither significant for general, in- or outpatient rehabilitation, nor for sex and nationality in EMB.

Occupational classes as classified by Blossfeld were used, which are based on the German Classification of Occupation of the Federal Employment Agency in the 1988 version [30]. The occupational classes were operationalised from twelve groups into the three of categories highly qualified, qualified, and un-/semi-skilled in consideration of a validation study with data from the micro-census [31]. These groups may also indirectly represent educational qualifications, mostly a precondition for the later occupational class in Germany [32].

Work-related factors Specific physical and psychosocial work exposure variables that are known to be associated with poor health were selected [33, 34]. A range of such variables is considered in checklists recommended by the German pension insurance to assess the need for rehabilitation [35, 36]. These were included in our analyses to determine whether work-related factors could provide an additional explanatory power for the utilisation of rehabilitation services beyond the health aspect.

The following psychosocial work factors were considered: quality of leadership, own influence at work and work-privacy conflict, all based on the Copenhagen Psychosocial Questionnaire (COPSOQ II, middle version, only short version for the variable work-privacy conflict)

[37, 38]. Influence at work and quality of leadership were assessed with three items (including five categories each), while work-privacy conflict was measured with two items (with four categories each). Each item was measured categorically and, for analysis, each was transformed to a value range from 0 (minimum value, i.e., never ever) to 100 (maximum value, i.e., always). All three scales were built by the mean value of the single items included in each scale. The cut-off value for the dichotomisation in the categories low and high was set at 50 for influence at work and quality of leadership and at 67 for work-privacy conflict [37–39].

Work-related stress, another psychosocial work factor, was assessed and analysed with the long version of the effort-reward imbalance (ERI) questionnaire by Siegrist et al. [40, 41], which was implemented in the lidA questionnaire. Imbalance was measured with the ERI ratio formed as the quotient of the effort and the reward scales including a weighting factor for the different numbers of items in the nominator and denominator. The ERI ratio was calculated from the 17 items and could be used as a continuous measure or transformed into tertiles representing low, medium or high work stress. For bivariate statistics, the median and interquartile range were used to compare the groups with different migrant background, for further multiple analyses of the tertiles. Values close to zero express the preferable situation with low work stress while values above 1.0 indicate a very high ERI imbalance, meaning higher personal work stress [40, 41].

Occupational physical load was measured with two variables. First, the physical environmental factors, meaning the combination of variables comprising exposure to cold, heat, humidity and noise, and second, physical burdensome factors, such as working while leaning over, working on the knees, working one-sided or doing heavy lifting and carrying [42]. Participants were supposed to indicate with a graded answer scheme how much of the working time they are exposed to such work. Participants were classified as being exposed if they – in either variable – indicated exposure as more than half of their working time. This cut-off was chosen in accordance with the SF12 single item (see below), as people working more than half of their working time had increased poor health.

Non-work-related factors Self-rated health in general was parametrised by the single item Short Form-12 Health Survey (SF-12) [43], containing the following question: 'In general, would you say your health is…', with a 5-category Likert response scale of very good, good, satisfactory, poor or very poor. The categories satisfactory to very poor were summarised as poor, while the other categories presented good health according to

international procedures. Several studies showed that this widely used health indicator is a predictor of later morbidity and mortality [44, 45].

The second non-work-related variable was the main language spoken at home, which was categorised into mostly German and mostly another language. Here, this variable was not used to identify third-generation migrants (the persons themselves and with parents born in Germany but whose mother tongue was not German) but to account for possible differences between these migrant groups.

All mentioned items without any references were self-developed questionnaire items. The English translation of the items can be found in the attachment (see Additional file 1).

Statistical analysis

Descriptive and bivariate statistics including cross tables, Chi^2- and Kruskal-Wallis tests were used to characterise the full sample separated for the three groups of migrant background. To investigate whether these groups differed in terms of the utilisation of rehabilitation in the multivariate analysis, block-wise logistic regressions were performed while adjusting for sociodemographic, work-related and non-work-related factors. This was carried out separately for the outcome of general, inpatient and outpatient rehabilitation. Some variables had missing data (MD): the percentage of MD ranged from 0.05% (occupational physical load) to 20.0% (effort-reward imbalance). Up to 1900 cases were lost, depending on the variables included in the regression models. Consequently, missing data were replaced by the fully conditional specification method, a multiple imputation approach, to increase the power of the regression analysis and to reduce bias [41]. Using ten iterations, twenty datasets were created. The imputation model included all variables from the analysis model as introduced before and additional supporting variables on school and occupational education as well as quantitative demands. The imputed datasets were used for the hierarchical logistic regressions.

To answer the second research question, the sub-sample of employees with migrant background were additionally separated into employees with German or foreign nationality. Subsequently, descriptive and bivariate analyses were performed to compare these two groups (incl. Chi^2- and Wilcoxon-Mann-Whitney-test), as well as block-wise logistic regression to investigate differences between these two groups with respect to the utilisation of general rehabilitation. Separated analyses for in- and outpatient rehabilitation were not possible due to the small number of events (utilisation of rehabilitation) in German and foreign EMB.

Additionally, for all logistic regressions, average marginal effects (AMEs) were computed with SAS 9.4.

AMEs allow us to compare the results of nested models that are otherwise possibly biased by unobserved heterogeneity. The latter represents influences on the dependent variable by unobserved or unconsidered variables that can cause false interpretation in e.g. logistic regression as odds ratios also demonstrate unobserved heterogeneity. Therefore, the interpretation of the regression coefficient in models with a non-linear transformation (e.g., logit in logistic regression) is typically not as straightforwardly interpretable as in ordinary least-squares regression. The coefficient represents the influence of each variable on the linear scale of the outcome, not the probability scale of the observed outcome. AMEs are based on derivatives of the logistic probability distribution functions, which measure the average conditional effects. The AME shows for each variable in a regression model how much the event probability changes when the independent variable increases by one unit or rather when a binary independent variable changes its level [46, 47].

In all statistical tests, p-values (two-tailed) < 0.05 were considered statistically significant. For the logistic regressions, Nagelkerke's Pseudo-R^2 is presented as a measure for comparing competing models. All statistical analyses (except the average marginal effects) were performed using SPSS version 25.0 (IBM Corp., Armonk, NY).

Results

Descriptive and bivariate analysis

The baseline characteristics of the 6303 participants included in the analysis are given in Table 1. A total of 12.8% (n=808) of the participants had used any type of rehabilitation (primary outcome) in the last three years. These were mainly inpatient services rather than outpatient services. No significant differences in utilisation were found between the three groups of non-EMB, G1 EMB and G2 EMB. However, a comparatively low proportion of outpatient rehabilitation (2.3%) among G1 EMB was observed. Significant differences were found for covariates, e.g., occupational class, where G1 EMB exhibited considerably lower occupational levels than the other two groups. Additionally, in comparison, G1 EMB significantly more often reported low influence at work (62.4%), were more often exposed to physical work exposures (39.0 and 37.7%), reported poor health more frequently (50.1%) and fairly more frequently spoke a language other than German at home (36.4%) than the other groups investigated.

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Table 1 Characteristics of the study sample of socially insured employees, as specified by migrant background (n=6303)

	Non-EMB (*n*=5153)	G1 EMB (*n*=699)	G2 EMB (*n*= 451)	*p*-value[a]
Utilisation of rehabilitation services [n (%)], m=3				
None	4485 (87.1)	617 (88.3)	390 (86.5)	0.612[b]
Yes	665 (12.9)	82 (11.7)	61 (13.5)	
Inpatient	440 (8.5)	66 (9.4)	43 (9.5)	0.109[c]
Outpatient	225 (4.4)	16 (2.3)	19 (4.0)	
Year of birth 1959 [n (%)]	2291 (44.5)	292 (41.8)	188 (41.7)	0.244
Female sex [n (%)]	2743 (53.2)	345 (49.4)	255 (56.5)	**0.047***
Occupational class [n (%)], m=63				
Highly qualified	1001 (19.6)	77 (11.2)	89 (19.9)	
Qualified	2238 (43.9)	189 (27.4)	194 (43.3)	**< 0.001***
Un-/semi-skilled	1863 (36.5)	424 (61.4)	165 (36.8)	
Low quality of leadership [n (%)], m=472	1479 (31.0)	194 (30.4)	139 (33.3)	0.558
High work-privacy conflict [n (%)], m=63	1182 (23.1)	155 (22.6)	103 (23.1)	0.944
Low influence at work [n (%)], m=1058	2430 (55.7)	313 (62.4)	202 (53.0)	**0.008***
Work stress, ERI [Mdn (IQR)], m=1238	0.45 (0.25)	0.44 (0.24)	0.46 (0.24)	0.758[d]
Exposed to physical environmental factors [n (%)], m=3	1417 (27.5)	272 (39.0)	137 (30.4)	**< 0.001***
Exposed to physical burdensome factors [n (%)], m=3	1613 (31.3)	263 (37.7)	139 (30.8)	**0.003***
Poor self-rated health [n (%)]	2292 (44.5)	350 (50.1)	213 (47.2)	**0.014***
Home language mostly German [n (%)]	5147 (99.9)	445 (63.6)	448 (99.4)	**< 0.001***

m number of missing values due to respondents not responding to the item, *Mdn* median, *IQR* interquartile range; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[a]tested with Chi²-test if not otherwise specified
[b]testing dichotomous variable of utilisation of rehabilitation (yes/no)
[c]testing trichotomous variable of utilisation of rehabilitation (no/inpatient/outpatient)
[d]tested with Kruskal-Wallis test

Association between utilisation of either general, outpatient or inpatient rehabilitation and migrant background in 2011

Comparing the general utilisation of rehabilitation services in the logistic regression model, G1 EMB had a somewhat lower and G2 EMB had a slightly higher odds of utilisation than non-EMB, when considering all explanatory variables (G1 EMB: OR 0.91, 95% CI 0.68-1.23; G2 EMB: OR 1.05, 95% CI 0.79-1.39). Nevertheless, utilisation did not differ significantly from that among non-EMB, neither for G1 nor for G2 EMB (see Table 2). Further adjusting the models with sociodemographic and work-related variables first decreased the probability of the utilisation of rehabilitation (see AMEs) for G1 EMB (to 1.7%-points) and then increased the probability for G2 EMB (to 0.72%-points), while holding the covariates at a constant value. However, in the final model 3 the probabilities declined again.

For the utilisation of inpatient rehabilitation, no significant differences between the migrant groups were observed in the analysis. However, higher odds ratios for the utilisation of inpatient rehabilitation were detected for both EMB groups compared to non-EMB (G1 EMB: fully adj. OR 1.16, 95% CI 0.84-1.60; G2 EMB: fully adj. OR 1.10, 95% CI 0.79-1.54). Average marginal effects

showed the highest/lowest probability for inpatient rehabilitation in model 3 while the odds ratios did not indicate a large difference.

Analysing the utilisation of outpatient rehabilitation, G1 EMB had significantly lower odds of receiving outpatient rehabilitation than non-EMB in the null model. When adding all explanatory covariates, the direction of the effect for G1 EMB remained the same (OR 0.42, 95% CI 0.22-0.82). Throughout all models, G2 EMB had somewhat lower odds ratios of utilising outpatient rehabilitation. The average marginal effects showed the lowest probability for inpatient rehabilitation in model 3. The difference in the AMEs between the null and the final model indicated an increase of the effect by 60%.

Subsample analysis of employees with migrant backgrounds stratified by nationality

The analyses of the second research question were performed by separating EMB into those persons with German and foreign nationality. The results are shown in Tables 3 and 4. In the descriptive and bivariate analysis (Table 3), significant group differences were found for year of birth, sex, occupational class and main language spoken at home. The group of participants with foreign EMB were more often younger (67.9%), male (54.9%),

Table 2 Association between utilisation of rehabilitation services (general/ outpatient/ inpatient) and migrant background in 2011

	Model 0	Model 1[a]	Model 2[b]	Model 3[c]	Reduction[d] (%)
General rehabilitation services (*n*=6303/ n_{events}=808)					
OR (95%-CI)					
Non-EMB	Ref.	Ref.	Ref.	Ref.	
G1 EMB	0.90 (0.72-1.11)	0.86 (0.67-1.10)	0.86 (0.67-1.10)	0.91 (0.68-1.23)	-1.11
G2 EMB	1.06 (0.91-1.22)	1.06 (0.92-1.23)	1.07 (0.80-1.41)	1.05 (0.79-1.39)	0.94
AME					
Non-EMB	Ref.	Ref.	Ref.	Ref.	
G1 EMB	-0.0122	-0.0168	-0.0169	-0.0104	14.75
G2 EMB	0.0060	0.0068	0.0072	0.0047	21.67
R^2	0.000	0.006	0.017	0.057	
Inpatient rehabilitation services (*n*=6044/ n_{events}=549)					
OR (95%-CI)					
Non-EMB	Ref.	Ref.	Ref.	Ref.	
G1 EMB	1.09 (0.82-1.45)	1.04 (0.79-1.37)	1.04 (0.78-1.37)	1.16 (0.84-1.60)	-6.42
G2 EMB	1.12 (0.95-1.33)	1.14 (0.84-1.53)	1.14 (0.82-1.58)	1.10 (0.79-1.54)	1.79
AME					
Non-EMB	Ref.	Ref.	Ref.	Ref.	
G1 EMB	0.0071	0.0027	0.0031	0.0118	-66.20
G2 EMB	0.0096	0.0104	0.0104	0.0075	21.88
R^2	0.000	0.012	0.028	0.078	
Outpatient rehabilitation services (*n*=5754/ n_{events}=259)					
OR (95%-CI)					
Non-EMB	Ref.	Ref.	Ref.	Ref.	
G1 EMB	**0.52 (0.31-0.85)***	**0.51 (0.30-0.85)***	**0.50 (0.30-0.84)****	**0.42 (0.22-0.82)***	19.23
G2 EMB	0.92 (0.59-1.44)	0.92 (0.56-1.53)	0.93 (0.57-1.53)	0.91 (0.56-1.50	1.09
AME					
Non-EMB	Ref.	Ref.	Ref.	Ref.	
G1 EMB	-0.0238	-0.0292	-0.0302	-0.0382	-60.50
G2 EMB	-0.0035	-0.0033	-0.0028	-0.0037	-5.71
R^2	0.004	0.006	0.012	0.023	

OR Odds Ratio, *CI* confidence interval, *Ref.* reference, *AME* Average marginal effect, R^2 Nagelkerke pseudo-R^2; * $p < 0.05$, ** $p < 0.01$
[a]adjusted for year of birth, sex, and occupational class
[b]further adjusted for the quality of leadership, influence at work, work-privacy conflict, work stress (ERI), and phys. environmental and burdensome factors
[c]further adjusted for self-rated health and language at home
[d]reduction of effect size between model 0 and 3

mainly belonging to a lower occupational class (63.9%) and more often speaking another language at home than German EMB (47.6%).

Block-wise logistic regression modelling utilisation of rehabilitation in general was performed to investigate differences between these two groups, as shown in Table 4. This implicated a minor lower OR for foreign EMB compared to German EMB, though there were no significant group differences (fully adj. OR 0.91, 95% CI 0.57-1.46). After further adjusting the models, the probability of rehabilitation (AMEs) for foreign EMB (to

-1.66%-points) decreased while holding the covariates at a constant value. However, in the final model 3, the probability declined again.

Secondary findings revealed that certain covariates had a significant association with the utilisation of rehabilitation. For all outcomes of rehabilitation, having poor health was associated with higher odds. Having a work-privacy conflict was associated with lower odds for the utilisation of outpatient rehabilitation while having low influence at work showed higher odds of using a rehabilitation in general. Further predictive factors with

Table 3 Characteristics of employees with migrant background, specified by nationality, *n*=1148

	German EMB (*n* = 902)	Foreign EMB (*n* = 246)	*p*-value[a]
Utilisation of out- or inpatient rehabilitation [n (%)]	115 (12.7)	28 (11.4)	0.565
Year of birth 1959 [n (%)]	400 (44.3)	79 (32.1)	**< 0.001***
Female sex [n (%)]	488 (54.1)	111 (45.1)	**0.012***
Occupational class [n (%)], m=12			
Highly qualified	140 (15.7)	26 (10.7)	**< 0.0005***
Qualified	321 (36.0)	62 (25.4)	
Un-/semi-skilled	431 (48.3)	156 (63.9)	
Low quality of leadership [n (%)], m=94	266 (31.9)	65 (29.7)	0.537
High work-privacy conflict [n (%)], m=17	206 (23.2)	52 (21.4)	0.554
Low influence at work [n (%)], m=266	405 (57.6)	109 (60.9)	0.426
Work stress, ERI [Mdn (IQR)], m=301	0.45 (0.25)	0.43 (0.23)	0.260[b]
Exposed to physical environmental factors [n (%)], m=1	327 (36.3)	81 (33.1)	0.355
Exposed to physical burdensome factors [n (%)], m=1	308 (34.1)	92 (37.6)	0.321
Poor self-rated health [n (%)]	449 (49.8)	112 (45.5)	0.237
Home language mostly German [n (%)]	764 (84.7)	129 (52.4)	**< 0.0005***

m number of missing values due to respondents not responding to the item, *Mdn* median, *IQR* interquartile range; * *p* < 0.05, *** *p* < 0.001
[a] tested with Chi²-test if not otherwise specified
[b] tested with Wilcoxon-Mann-Whitney-test

higher odds in several models were born in 1959, having medium work stress and having qualified or unskilled positions.

Discussion

In the present study, we analysed the utilisation of medical rehabilitation and its subtypes (in- and outpatient) for subgroups of employees in relation to their migrant background. In the following, the main findings will be summarised. Subsequently, the results for the first research question comparing G1 und G2 EMB with non-EMB concerning their utilisation of general, inpatient and outpatient rehabilitation respectively will be discussed in chronological order. A discussion about the

second research question, contrasting persons with foreign and German nationality with migrant employees will follow, as well as aspects about associated covariates to complete with the strengths and limitations of the present study.

Comparing G1 and G2 EMB with non-EMB, no significant group differences were found for the utilisation of general and inpatient rehabilitation. With respect to the utilisation of outpatient rehabilitation, however, G1 EMB had a 58% significantly lower chance than non-EMB when considering all explanatory covariates. The findings for G2 EMB were usually closer to those for non-EMB than to those for G1 EMB. Moreover, within EMB, foreign EMB showed a slightly lower but non-

Table 4 Association between utilisation of general rehabilitation services and nationality in employees with migrant background

	Model 0	Model 1[a]	Model 2[b]	Model 3[c]	Reduction[d] (%)
Rehabilitation services in general (*n*=1148/ *n*_{events}=143)					
OR (95%-CI)					
German EMB	Ref.	Ref.	Ref.	Ref.	
Foreign EMB	0.88 (0.57-1.36)	0.87 (0.57-1.35)	0.86 (0.55-1.35)	0.91 (0.57-1.46)	-3.41
AME					
German EMB	Ref.	Ref.	Ref.	Ref.	
Foreign EMB	-0.0141	-0.0147	-0.0166	-0.0105	25.53
R^2	0.001	0.005	0.018	0.026	

OR Odds Ratio, *CI* confidence interval, *Ref.* reference, *AME* Average marginal effect, R^2 Nagelkerke pseudo-R^2
[a] adjusted for year of birth, sex, and occupational class
[b] further adjusted for the quality of leadership, influence at work, work-privacy conflict, work stress (ERI), and phys. environmental and burdensome factors
[c] further adjusted for self-rated health and language at home
[d] reduction of effect size between model 0 and 3

significant chance of using medical rehabilitation at all compared to German EMB.

To date, there are no other German studies investigating the utilisation of medical rehabilitation and its subtypes while differentiating migrant background, as detailed as in the presented study. Therefore, the following comparison to other German studies is only possible to a certain degree.

In other studies, where the differentiation in migrant background with large representative cohort data is not solely possible given the indicator of nationality but also other indicators, the results are as follows: Voigtländer et al. [20] analysed data from the Socio-Economic Panel (2002-2004) for Germany with the result that even after adjustment (e.g., for age, sex and socioeconomic status), the chance of using medical rehabilitation significantly decreased by 40% in persons with migrant background, compared to non-migrants, as well as for foreign nationals compared to Germans. Here, the authors defined migrant background slightly differently: more precisely as having a foreign nationality, being born abroad or with one parent born abroad, having double nationality or given German nationality after birth. Recent analyses by Brzoska with data from the Sociomedical Panel using differentiated indicators for migrant background independently of nationality (e.g. place of birth of the examined person and the parents, as well as the mother tongue) show a less frequent utilisation of rehabilitation among persons with migrant background, also after adjusting for covariates [25]. Finally, findings from a German telephone survey in 2002-2003 found that migrants who were born outside of Germany or who were born as non-German, had a lower utilisation rate of rehabilitation [48]. In contrast, for the first research question of our study, there were no differences found between G1 or G2 EMB compared to non-EMB for utilisation of rehabilitation in general. However, the distinction between G1 and G2 cannot be found in other studies on rehabilitation.

Concerning inpatient rehabilitation, the results of the lidA-study show that there are no significant group differences. However, we found 16% and 10% higher chances of using inpatient rehabilitation for G1 and G2 EMB, respectively, than for non-EMB. In the full model, the average marginal effects showed a larger difference in the probability of utilisation of inpatient rehabilitation between G1 EMB and non-EMB than between G2 EMB and non-EMB

Findings of higher utilisation for rehabilitation in EMB than in non-EMB have only been found for psychosomatic rehabilitation, including depression and somatisation, where foreign nationals, especially Turkish nationals, had a higher utilisation rate of psychosomatic rehabilitation than Germans [49–51]. However, these

results are related to specific indications, and the data source only allows differentiation by nationality, making it not possible to compare the results.

Focusing on outpatient rehabilitation, G2 resembled non-EMB rather than G1 EMB, which might indicate the successful integration of the second-'children'-generation of migrant employees in Germany. Most importantly, a significantly lower chance for G1 EMB to utilise this type of rehabilitation than non-EMB, even in the fully adjusted model, was detected.

The included covariates did not fully explain the differences in the model, while the difference in the AMEs between the null and the final model displayed an increase in the effect by 60%. Therefore, our findings indicate that these differences have to be attributable to factors other than sociodemographic, work- and non-work-related variables. These factors might be related to the rehabilitative care system and/or migrant-specific characteristics or understandings of health that go beyond differences in the considered patterns.

Thus far, research on possible barriers to the utilisation of medical rehabilitation for EMB has addressed access to barriers and barriers within medical rehabilitation. In particular, the lack of knowledge about the rehabilitation system and its possibilities are the main barriers to access, not only for EMB but also for general practitioners who recommend rehabilitation. At the same time, diverse treatment concepts that are sensitive to religion, culture and gender are missing. Discrimination and miscommunication, due to language barriers and illiteracy, are also barriers to the utilisation of rehabilitation by EMB [22–24].

No equivalent to the finding that G1 EMB have lower odds of using outpatient rehabilitation can be found in the existing studies. Only one review investigating inequalities in health care utilisation among migrants found that first-generation migrants have a lower utilisation of outpatient care, such as specialist consultations and physical therapy [52].

Most studies do not consider both, in- and outpatient medical rehabilitation separately. In Germany, comparable research has mainly focused on medical rehabilitation in general, summarising all types of rehabilitation. This may be due to lacking information about the different rehabilitation types in the data sets or to the lower number of cases not allowing for stratification. The latter is the result of a generally lower utilisation of outpatient medical rehabilitation services by adults compared to the utilisation of inpatient medical rehabilitation (ca. 80%) [4], which dominates in Germany [6]. Relevant characteristics of the rehabilitation systems differ substantially between countries. While in Germany, medical rehabilitation is dominated by inpatient rehabilitation, often far away from home, in other European

countries the opposite is true: most rehabilitation services are outpatient services close to the persons' homes. Such differences make it difficult to compare data on rehabilitation utilisation between various countries. Additionally, not only in Germany, but throughout Europe, an insufficient differentiation of persons with migrant background by migrant characteristics in routine data can be observed [53]. Positive exceptions are, e.g., the Netherlands and Norway, where information on nationality, country of birth and the parents' country of birth (in the case of the Netherlands) are collected in process data [6, 54].

The results concerning the second research question comparing German and foreign nationals within the subsample of migrant employees are partly comparable to other studies. The findings are in line with previous results showing that foreign nationals utilise rehabilitation less often than Germans [19, 21, 55, 56]. Nevertheless, our analyses excluded persons without any migrant background from the group of German citizens, while other studies still include these persons, because of differentiating simply by nationality. Hence, the effect might be diluted and is clearly not the same as in our results, where EMB of foreign nationality had a lower but non-significantly different chance of rehabilitation compared to a German EMB. Separated analyses for inpatient and outpatient rehabilitation were not possible due to limited power. Even in the case of the utilisation of general rehabilitation (inpatient and outpatient combined), the number of events was fairly low in foreign EMB, which possibly contributed to our non-significant finding (Table 3).

Secondary findings revealed that certain covariates had a positive association with the utilisation of rehabilitation. Having poor health was associated in all models, while having a work-privacy conflict was only associated with outpatient rehabilitation. Further predictive factors were being born in 1959, having medium work stress, low influence at work and holding qualified or unskilled positions. All of them seem plausible, as they are congruent with reported findings so far [4–6, 19, 20, 23, 33].

Furthermore, this study has several strengths. First, the use of a national sample presents high representativeness for the population of socially insured employees of the considered two age cohorts [27]. Second, unlike other studies, the lidA cohort study has the ability to separate different migrant groups with several indicators and not only by nationality, so that recommendations for mapping migrant status can be followed [29]. The indicators used consisted of the participant's country of birth, nationality and country of birth of each parent. Another strength of this study is the consideration of different confounding sociodemographic, work and individual variables that may disguise differences in the outcomes

between the investigated groups. These should be considered in future studies, as it was found that EMB do not have the same levels of psychosocial resources as non-EMB [17], which are ultimately the important predictors of workability and rehabilitation. We still adjusted for language mainly spoken at home, as lacking knowledge of German was identified as a barrier to rehabilitation services and EMB might still have problems with the application process, although they were able to answer (part of) the interview questions. Furthermore, the usage and reporting of average marginal effects allows for direct comparisons between models of the same sample [46, 47]. Finally, the usage of multiple imputation by the fully conditional specified method presents another positive aspect of the analysis as the number of complete cases and statistical power could be increased, as well as bias due to missing values in certain of the variables reduced.

Despite these merits, there are some limitations of our study. The lidA cohort study uses two birth cohorts sampled within socially insured employees, which excludes civil servants, most self-employed persons as well as freelancers. As a result, the sample is limited regarding its representativeness of older employees in terms of age variety and occupational class. An additional restriction might have introduced a bias into participant selection, as the study was conducted in German and therefore EMB could be potentially excluded due to language problems. However, we assumed for these a certain knowledge of German when working in socially insured positions. Another possible weakness is the usage of the self-rated health status (SF-12) serviced after the potential rehabilitation, as health status prior to rehabilitation was unavailable to adjust as a covariate. Accordingly, the current health status was used as a proxy for the initial status, while assuming a similar health change for everyone who had used rehabilitation services so that the influence of the initial health status on rehabilitation utilisation would have been adequately adjusted for in the regression model. Last, the number of events (utilised rehabilitation) within the migrant groups included in the logistic regression analyses in relation to the number of events in the reference group was fairly low (e.g., 19 events in G2 EMB compared to 225 in non-EMB for outpatient rehabilitation), which should be considered when regarding the results.

Conclusion

Our study has found that migrant employees of the first-generation utilise outpatient rehabilitation significantly less often than non-migrant employees. These findings are partly attributable to differences in sociodemographic, work- and non-work-related factors between these population groups. Other factors may play a role,

possibly related to the rehabilitative care system, migrant-specific characteristics or understandings of health. Additionally, no significant differences between migrant employees of the first- or second-generation and non-migrant employees when comparing the utilisation of inpatient rehabilitation or any rehabilitation in Germany have been detected. The same was observed when analysing differences between German and foreign nationals within migrant employees. However, the migrant employees of the second-generation rather resemble the Germans than their parent generation (first-generation), which is an important fact regarding integration. Our distinct investigation contributes to the knowledge on the heterogeneity and different behaviours in the utilisation of health services such as medical rehabilitation. These results highlight the growing need to consider diversity sensitive services that are important for social-political decision makers to ensure equal opportunities and work participation. Further research should also consider the actual need for rehabilitation in employees with migrant background, as this could influence the utilisation patterns of rehabilitation and provide insights into their perceptions and coping with diseases.

Supplementary information

Supplementary information accompanies this paper at https://doi.org/10.1186/s12913-019-4845-z .

Additional file 1. English version of self-developed questionnaire items used for analysis. The additional file contains the English translation of the self-developed questionnaire items used for analysis.

Abbreviations
AME: Average marginal effect; CAPI: Computer Assisted Personal Interviews; EMB: Employees with migrant background; ERI: Effort-Reward-Imbalance; G1: First migrant generation; G2: Second migrant generation; lidA: 'Leben in der Arbeit'; MD: Missing data; non-EMB: Employees without migrant background; non-PMB: Persons without migrant background; PMB: Persons with migrant background

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Authors' contributions
All authors contributed to developing the idea and study design. CCS performed and interpreted the analyses while JP and HMH were supervising. JB supported the analysis in SAS. CCS, JP and HMH have written the first draft of the article, while MD helped with the literature search. All authors critically reviewed the manuscript and approved the article.

Author's information
Not applicable

Availability of data and materials
The same datasets as analysed in the current study are available as a scientific use file at the research data centre of the German Federal Employment Agency at the Institute of Employment Research, which can be found here: https://fdz.iab.de/en/FDZ_Individual_Data/lidA.aspx and does not issue datasets with DOIs [28]. Additional information regarding the study as well as data documentation (data report and method report) are also available [27, 57, 58]

Ethics approval and consent to participate
All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed verbal consent was obtained from all individual participants included in the study after informing about study content, procedures and data protection in writing, according to good epidemiological practice. This procedure has been approved by the Ethics Committee of the University of Wuppertal (dated from 05/12/2008 and 20/11/2017, MS/BB 171025 Hasselhorn).

Consent for publication
Not applicable

Competing interests
The authors declare that they have no competing interests.

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Study III

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Medical rehabilitation of older employees with migrant background in Germany: Does the utilization meet the needs?

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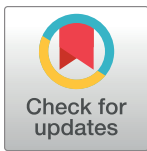
Abstract

Due to demographic change with an ageing workforce, the proportion of employees with poor health and a need for medical rehabilitation is increasing. The aim was to investigate if older employees with migrant background have a different need for and utilization of medical rehabilitation than employees without migrant background. To investigate this, self-reported data from older German employees born in 1959 or 1965 of the first and second study wave of the lidA cohort study were exploratory analyzed (n = 3897). Subgroups of employees with migrant background were separated as first-generation, which had either German or foreign nationality, and second-generation vs. the rest as non-migrants. All subgroups were examined for their need for and utilization of medical rehabilitation with descriptive and bivariate statistics (chi-square, F- and post-hoc tests). Furthermore, multiple logistic regressions and average marginal effects were calculated for each migrant group separately to assess the effect of need for utilization of rehabilitation. According to our operationalizations, the foreign and German first-generation migrants had the highest need for medical rehabilitation while the German first- and second-generation migrants had the highest utilization in the bivariate analysis. However, the multiple logistic model showed significant positive associations between their needs and utilization of rehabilitation for all subgroups. Further in-depth analysis of the need showed that something like under- and oversupply co-exist in migrant groups, while the foreign first-generation migrants with lower need were the only ones without rehabilitation usage. However, undersupply exists in all groups independent of migrant status. Concluding, all subgroups showed suitable use of rehabilitation according to their needs at first sight. Nevertheless, the utilization does not appear to have met all needs, and therefore, the need-oriented utilization of rehabilitation should be increased among all employees, e.g. by providing more information, removing barriers or identifying official need with uniform standards.

Introduction

Due to the demographic change and prolonged working lives, the proportion of older employees is increasing in Germany [1, 2] and other European countries, and thus also the number of employees with poor health and functional limitations [3]. Therefore, one major public health goal in the next years and decades should be to avoid premature work exits due to poor health with the help of primary prevention, rehabilitation and occupational re-integration. These will gain relevance in working life, as e.g. medical rehabilitation is aiming at continuous active participation in working life [4]. Additionally, medical rehabilitative services were implemented within several guidelines in Germany over the years, e.g. for coronary heart disease [5]. Consequently, there is a strong expectation that the needs and demands for rehabilitation will increase in the future.

In Germany, in order to be eligible for medical rehabilitation, the objective need must be assessed first. The need for rehabilitation is not automatically officially acknowledged by the psychological or physical impairment, but mainly from the continuing or expected impairment of participation in social and working life [6–8].

The concerned person must submit an application himself, so that individual need can be proven. The validation is jointly done by the rehabilitation providers (e.g. the pension, accident or the health insurance), who coordinate their responsibilities among themselves. Within an objective socio-medical evaluation, information provided by the applicant, doctors, psychological psychotherapists and other therapeutic professions in social work and care are taken into account. However, no uniform procedure to assess the objective need for rehabilitation [9] exists and even the socio-medical evaluations seem to have only limited reliability [10]. Within rehabilitation research several more standardized assessment procedures were suggested to support the identification of the need [7, 11], such as the "Luebecker algorithm" [8], the "Work Ability Index" [12, 13], the "risk index for disability pension" [14, 15] or a "checklist to identify the need for medical rehabilitation by general practitioners" [16, 17]. By now, the latter is also recommended by the northern German pension insurance and provided to general practitioners [17]. Within these assessments, working conditions and exposures and thus the workability are linked to the need for rehabilitation. This is due to certain work exposures increasing the risk of early retirement and disability pension which should be prevented with the help of rehabilitation [18–21]. Therefore, the need for rehabilitation is related to the individual workload.

In particular, groups of employees who have worked as factory workers are burdened by monotonous, repetitive work and physically demanding tasks [18, 19, 21]. In addition, psychosocial workloads (e.g. low scope in decision-making, job insecurity, conflicts at work, time pressure) are suspected to have an influence on the short and long-term probability of early retirement due to illness [20].

Compared to those without a migrant background (non-EMB), employees with a migrant background (EMB), especially foreign nationals, are more frequently exposed to such health-endangering working conditions which our own data has also shown [22–25]. Compared to non-EMB, EMB more often work as manual workers (semi-skilled and unskilled workers), i.e. they often work in low-skilled occupations and have less completed vocational training [22, 24]. Additionally, EMB are more frequently exposed to psychological workloads like lower influence at work which all in all results in lower workability, significantly longer periods of sick leave, more frequent occupational accidents and diseases (e.g. noise-induced hearing loss) [22, 23, 25]. Additionally, when these unfavorable working conditions accumulate over working life, employees in higher working age might even be at higher risk for negative health outcomes [18, 26]. However, the mentioned results mainly apply to foreigners or first-generation

migrants, as we found in former analyses, second-generation migrants seem close to natives [22, 25, 27]. Former research in this field likewise showed that descendants of immigrants have fewer differences to the native population, probably due to adaption and different coping processes while growing up in the host country. Reasons might be e.g. that they were not exposed to the whole migration process themselves and have a higher utilization of social network as a coping method compared to first-generation groups [22, 28–30].

The group of EMB comprises employees born outside of Germany (first-generation, G1) and employees born in Germany, but with one or both parents born abroad (second-generation, G2) [2]. They can have German or foreign nationality, although the second-generation mainly has German nationality. Their proportion in the working population is continuously increasing and has risen from 16.2% in 2010 to 24.4% in 2019. From these working EMB, 37.4% were > 45 years old in 2019, so part of the older working population [1, 2].

Based on these circumstances for foreigner, which are mostly G1 EMBs, one would assume that they are likely to have a higher need for rehabilitation. So far, there are no studies investigating this issue in EMBs or generally in the working population in Germany, as there is no gold standard to assess the need for rehabilitation in Germany, yet.

Those with foreign nationality, are more likely to retire earlier due to disability, compared to employees with German nationality [23]. Such differences may be attributed to occupational and health factors, but also to lower utilization of health services such as medical rehabilitation. Until 2018, studies showed that people with a migrant background are less likely to utilize medical rehabilitation compared to those without (non-EMB) [27, 31–33], possibly due to barriers such as lack of information, language problems, illiteracy, cultural aspects etc. [33–35]. However, there were no differences found in studies published in 2018 or later, so findings are inconsistent and often lack information about the second-generation, because of the limited differentiation of migrant background [33].

This lacking differentiation is a major limitation of other previous studies on migrants' work, health or utilization of rehabilitation services in Germany. This is because quantitative studies are often based on the analysis of secondary data such as process data. In such data sets, it is mostly the feature "nationality" that allows for the differentiation of the migrant background. Yet, in Germany, such a definition leads to the misclassification of about half of all people with a migrant background as non-migrants, as 11.1 million of a total 21.2 million people with a migrant background, had German nationality in 2019 [2]. Additionally, primary studies often do not make any further differentiation between migrant groups, even when other operationalizations than nationality are used [33]. However, EMB are a heterogeneous group and should be investigated in more detail.

To our knowledge, even representative studies in Germany investigating the need for rehabilitation in older employees are missing and likewise for subgroups with migrant background. Furthermore, it is highly important to investigate the utilization of rehabilitation depending on the need, to assess if the provision of health services like medical rehabilitation meets the needs and demands in general.

Therefore, the current study aimed to primarily investigate if subgroups of EMB have a different need for rehabilitation than non-EMB and secondly, if they use rehabilitation divergently when considering their respective need for rehabilitation.

Materials and methods

Study design and participants

The prospective lidA (leben in der Arbeit) cohort study investigates work, health and employment in older employees of two age cohorts (1959, 1965) as part of the "babyboomer

generation" in Germany. This study is based on a representative two-stage random sample of all socially insured employees of these cohorts in Germany in 2009. Due to the sampling specification, sworn civil servants and self-employed were not included. The participants were interviewed at home for each assessment wave by computer assisted personal interviews (CAPI), including a variety of questions about health, private life and work, as the participants get closer to retirement. The baseline survey took place in 2011 (N = 6585), the second wave in 2014 (N = 4244) and the third wave in 2018 (N = 3586).

All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed verbal consent was obtained from all individual participants included in the study after informing about study content, procedures and data protection in writing, according to good epidemiological practice. This procedure has been approved by the Ethics Committee of the University of Wuppertal (dated from 05/12/2008 and 20/11/2017, MS/BB 171025 Hasselhorn). The ethics approval refers to the whole lidA cohort study, not only this partial study. All the lidA data was anonymized before starting analyses. A more detailed description of the lidA cohort study including power calculation etc. can be found elsewhere [36].

Results of attrition analysis showed an almost selection-free realization of the sample in relation to the sociodemographic characteristics used in the cited analyses [37–39] for all waves. However, a more differentiated analysis revealed attrition of 65% for low educational level in foreign and 63% in German G1 EMB compared to about 42% in non-EMB and 43% in G2 EMB. Since this analysis included data from the first and second study wave, we performed inverse probability weighting for subgroups of migrant status and educational level. The sample was restricted to those employed at least 1h/week in both study waves (N = 3961, unweighted). Due to the weighting, cases with missing values in migrant background or educational level were also excluded. Consequently, the final sample consisted of 3897 individuals.

Operationalization

Dependent variable. The outcome of the study was the self-reported "utilization of medical rehabilitation" indicated in the second study wave. Participants were asked to report whether they had utilized an in- or outpatient rehabilitation service in the previous three years. The answers for in- and outpatient services were summarized vs. no utilization of rehabilitation, generating a binary variable.

Independent variable. The counterpart and other aspect of rehabilitation was the "need for medical rehabilitation", which we operationalized with the help of a summarizing score taking different relevant aspects of life into account. A range of such variables was considered in a checklist in a study by Deck et al. and is now recommended by the northern German pension insurance for general practitioners to assess the need for rehabilitation [16, 17]. This checklist provided the basis for the summarizing score, so that representative and appropriate variables of the lidA study were assigned to each category of the checklist (see Table 1). All those self-reported variables were taken from the first study wave to consider need for and utilization of rehabilitation consequentially over the course of time. If any of the mentioned variables applied to a person, then the item got the coding 1. At the end, there was a possible range of values from 0 to 15, while summing up at least 10 valid items and allowing 5 missing items. The score correlated significantly with general health, the single item Short Form-12 Health Survey (SF-12) [40], by r_{pbis} = .568.

Migrant background. The lidA cohort study allows to distinguish between migrant groups by means of different specific indicators as proposed by Schenk et al. [45]. EMB were

Table 1. Variables used in the lidA study, categorized according to the checklist of Deck et al. [16].

Original category of the checklist	Assigned variables of the lidA-study (self-reported)
Indication of rehabilitation: disease requiring treatment, chronification of disease, comorbidities	• Incidence of disease requiring treatment (in the last 12 months)
	• declared handicap/disability
Functional limitations: impairments in daily or working life	• poor physical health (lowest tertile of the SF-12 physical health scale, version of the socio economic panel survey) [40, 41]
	• frequent limitation due to pain (in the last 4 weeks) in daily life or at work
Accompanying psychological symptoms: depressiveness, anxiety, exhaustion	• poor mental health (lowest tertile of the SF-12 mental health scale, version of the socio economic panel survey) [40, 41]
Influenceable risk factors: nicotine abuse, alcohol, lack of exercise, obesity, dyslipidemia	• BMI > 30, BMI = weight/(height*2)
	• less/no sports or exercise in leisure time
	• regular smoking at time of survey
Therapy: outpatient therapy not sufficient or not available nearby, intensification required, unfavorable working hours	• working hours that are unfavorable for therapy (such as shift work, especially night and alternating shifts)
Adverse influences in work, profession and everyday life: significant physical or environmental work exposure e.g. heavy lifting, noise etc., psychological stress	• lower workability in relation to physical and mental job demands (second dimension of the workability index, >8 points: normal work ability, <8 points: low work ability) [42]
	• high work stress (highest tertile of the effort-reward-imbalance ratio, indicating high efforts but low rewards [43, 44]
	• more than one physical work exposure (e.g. heavy lifting and carrying; for at least half of the working time)
Disability: current or threatened incapacity for work, long or repeated sick leave in the last 2 years	• official sick leave > 30 days (in the last 12 months)
	• officially declared reduced capacity to work or job-related incapacity
	• indication of "prolonged illness" in the question about employment
Motivation and disease management: motivation to participate and to change own lifestyle is present, own disease management strategies are insufficient	no variables from the first or second wave of the lidA-study can be assigned

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defined based on the participants' self-reported country of birth and nationality and on the country of birth of each of their parents. Participants born in Germany, with German nationality and with both parents being born in Germany constitute the reference group (non-EMB). The group of EMB was divided in three subgroups to investigate potential differences. Firstly, they were separated in generations, based on a definition provided by the German Federal Statistical Office [1, 2], so into first-generation (G1 EMB) and second-generation (G2 EMB), as described before. Secondly, G1 EMB were divided into those with German and foreign nationality, as in own (unpublished) pre-analyses, differences between these groups were detected. In G2 EMB nearly all participants had German nationality, so these weren't differentiated any further. In the end, there were four groups: non-EMB vs. German G1 EMB, foreign G1 EMB and G2 EMB.

Covariates. To control for sociodemographic differences, the following variables were considered as potential confounders when comparing groups with different migration background regarding the association of their need for and utilization of rehabilitation: Year of birth (1959/1965), sex (male/female), and education. Education was operationalized with a score combining school and professional education according to the recommendations of the German Society of Epidemiology for the measurement and quantification of sociodemographic characteristics in epidemiological studies [46]. Accordingly, values from 1 (= not any graduation) to 8 (= school leaving examination and graduation from college) were calculated for each combination of school and professional education. For ease of interpretation the score was classified in three categories: high, medium and low level education.

Statistical analysis

Due to group differences in attrition between the first and the second study wave relating to migrant status and educational level, basic inverse probability weighting was used to account for potential non-response bias. Inverse probability weighting is a method, where the data is standardized on a certain population, which is different from the one, in which the data was collected [47]. In our case the data was standardized on the population of the lidA baseline assessment in 2011. For each subgroup the equation was: weight = percentage in wave 1/percentage in wave 2, so e.g. for the group of non-EMB with low education: 19.71%/17.89% = 1.1017. Simultaneously, the weighting factors were calculated for all other subgroups, which can be found in S1 Table. All reported results are based on weighted analyses; however, in the S2 Table unweighted characteristics are additionally presented for comparison.

Descriptive and bivariate statistics including chi-square tests, F-tests within analyses of variance (ANOVA) and a Tukey post-hoc test were used to characterize the full sample and specifically investigate differences between groups. For the multiple logistic regression analyses, possible multicollinearities were determined as a pre-check using linear regression models of the independent variable, utilization of rehabilitation. The results of the linear regression analyses are not shown because no statistical evidence of multicollinearity was found. The inflation of variance for all variables was ≤ 1.09. Tests for possible interactions of the need with the sociodemographic covariates were done, which were all not statistically significant. Finally, multiple logistic regressions were performed to investigate the influence of the need for the utilization of medical rehabilitation for each migrant group separately. To further control for sociodemographic differences, the logistic regressions were adjusted for sex, year of birth and education in the full model.

In all statistical tests p-values (two-tailed) <.05 were considered to be statistically significant. These statistical analyses were performed using SPSS version 25.0 (IBM Corp.).

In addition, average marginal effects (AMEs) were computed for all logistic regressions with SAS 9.4. They allow to compare the results of nested models that otherwise may be biased by unobserved heterogeneity. The AME shows for each variable in a regression model how much the event probability changes when the independent variable increases by one unit, or rather when a binary independent variable changes its level [48]. All multiple analyses were done as complete case analyses.

For interpretational purposes additional exploratory analysis were done to examine the utilization depending on the need in more detail for each subgroup separately on bivariate level.

For this, the need score was divided into tertiles, in order to see the percentage of utilization in people with lower, medium or higher need.

Results

Descriptive and bivariate analysis

In Table 2 the characteristics of all participants included in the analyses are presented, shown as weighted results (n = 3897). Most of the participants were non-EMB (82.4%), around 7% each German G1 EMB and G2 EMB, and the smallest group was foreign G1 EMB with 3.3%. Due to deliberate oversampling, participants born in 1965 were overrepresented in all subgroups. The same applied to female sex in all groups, the proportion of women was always higher than for men. The distribution of educational level differed significantly between the groups (p<.001), nearly half of foreign G1 EMB had low educational level (45.4%) while the other groups had percentages between 23.7% (non-EMB) and 30.4% (German G1 EMB).

Table 2. Characterization of study population (weighted sample[a], n = 3897).

	Non-EMB (n = 3211)	German G1 EMB (n = 276)	Foreign G1 EMB (n = 130)	G2 EMB (n = 280)	p-value[b]
Sex [n (%)]					
Male	1481 (46.1)	129 (46.7)	61 (46.9)	121 (43.2)	.800
Female	1729 (53.9)	147 (53.3)	69 (53.1)	159 (56.8)	
Year of birth [n (%)]					
1959	1458 (45.4)	135 (48.9)	50 (38.5)	117 (41.8)	.152
1965	1753 (54.6)	141 (51.1)	80 (61.5)	163 (58.2)	
Education level [n (%)]					
High	663 (20.6)	55 (19.9)	33 (25.4)	61 (21.8)	< .001
Medium	1787 (55.7)	137 (49.6)	38 (29.2)	141 (50.4)	
Low	761 (23.7)	84 (30.4)	59 (45.4)	78 (27.9)	
Utilization of rehabilitation [n (%)], m = 3					
Yes	390 (12.2)	48 (17.4)	14 (10.8)	48 (17.1)	.009
No	2818 (87.8)	228 (82.6)	116 (89.2)	233 (82.9)	

EMB, employees with migrant background; G1, first-generation; G2, second-generation; m, number of missing values due to respondents not responding to the item, from weighted results.

[a] Total case numbers of each variable vary slightly because of rounding after weighting.

[b] tested with Chi^2-test.

However, they also had the highest proportion of high educational level with 25.4% compared to the rest with around 20%.

Concerning the outcome of utilized rehabilitation, significant differences were likewise observed (p = .009). The highest utilization was reported by German G1 EMB and G2 EMB (around 17% respectively) and the lowest by foreign G1 EMB (10.8%) and non-EMB (12.2%).

In contrast, foreign G1 EMB showed the highest need for rehabilitation when comparing means of the need score (Fig 1). The mean values differed significantly between the four groups as determined by one-way ANOVA [F(3, 3978) = 5.91, p < .001, η^2 = 0.004]. A post-hoc test revealed that the need for rehabilitation was statistically higher for German G1 EMB (4.14 ± 2.48, p = 0.006) and foreign G1 EMB (4.23 ± 2.63, p = 0.043) compared to non-EMB (3.66 ± 2.25). There was no statistically significant difference between G2 EMB and non-EMB (p = 1.0).

Multiple logistic regressions

To answer the second research question, logistic regressions were conducted separately for each migrant group to investigate further behavioral or migrant-group-specific differences (see Table 3). In bivariate analyses, foreign G1 EMB showed the highest need for rehabilitation (see Fig 1), but the lowest utilization of rehabilitation (see Table 2). To examine the association for each group, the odds and the probability for using rehabilitation were calculated depending on the need score. In all models, the need was positively associated with the utilization of rehabilitation in each group: the higher the need, the more likely the utilization.

In the model adjusted for sex, year of birth and education, foreign G1 EMB had the highest odds (OR 2.02, 95% CI 1.40–2.91) and the highest probability (4.2% for each unit change) to utilize medical rehabilitation when the need increased. The other groups showed ORs from 1.25 to 1.30 each. When testing narrowed models, in detail only one sociodemographic control variable at a time to follow the "one in ten rule", nearly no change in the coefficients was detected.
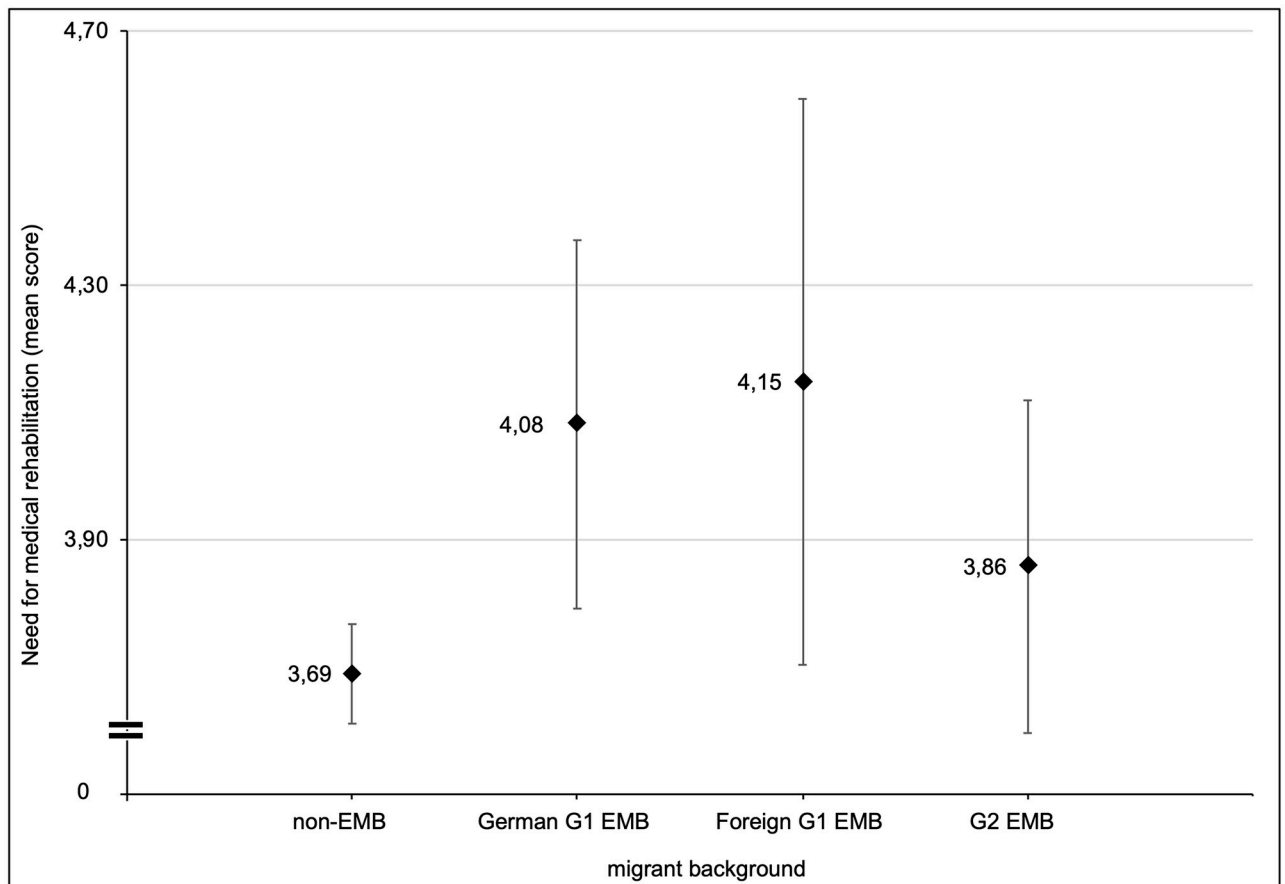
Fig 1. Arithmetic mean values and 95%-confidence intervals of the need score for rehabilitation in migrant groups (weighted results, n = 3897).

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Additional exploratory analysis for interpretation

Our bivariate analyses revealed that foreign G1 EMB have a higher need but lower utilization (Tables 1 and 2), which was presumed before analysis. To be able to interpret this apparent contradiction, we examined the utilization depending on the need in more detail for each subgroup separately on bivariate level (Table 4). Hereby, undersupply for all subgroups independent from migrant background was detected to the extent that over 70% of the people with higher need are not utilizing rehabilitation services. However, in three groups there are still 7–10% of those with lower need that have used rehabilitation in the past. Only in foreign G1 EMB those with lower need have not used rehabilitation at all.

Discussion

In the present study, we analyzed the need for and respective utilization of rehabilitation for employee groups with and without migrant background. For the primary research question, we identified that foreign and German G1 EMB had the highest need for rehabilitation when measuring with our need score. The highest utilization of rehabilitation was reported by German G1 EMB and G2 EMB with 17%, while foreign G1 EMB showed the lowest with 11%. Secondarily, when considering the respective need in multiple logistic regressions, significant

Table 3. Stratified logistic regressions for the utilization of rehabilitation services depending on the need for rehabilitation and further sociodemographic variables (weighted results).

	Crude model: need	Full model: need + sex, year of birth, education
Non-EMB (n = 3208/ n_events = 390)		
OR (95% CI)	1.24 (1.19–1.30)***	1.25 (1.19–1.31)***
AME	+0.0228	+0.0234
R²	0.052	0.054
German G1 EMB (n = 276/ n_events = 48)		
OR (95% CI)	1.22 (1.08–1.38)***	1.25 (1.10–1.43)***
AME	+0.0273	+0.0289
R²	0.058	0.084
Foreign G1 EMB (n = 127/ n_events = 14)		
OR (95% CI)	1.65 (1.27–2.13)***	2.02 (1.40–2.91)***
AME	+0.0318	+0.0421
R²	0.276	0.353
G2 EMB (n = 279/ n_events = 48)		
OR (95% CI)	1.27 (1.11–1.46)***	1.30 (1.12–1.50)***
AME	+0.0310	+0.0327
R²	0.070	0.087

* $p < .05$,

** $p < .01$,

*** $p < .001$.

AME, average marginal effects; CI, confidence interval; M, Model; n_events, number of events where the outcome = 1 in the logistic regression; OR, Odds Ratio; p, p-value; Ref., Reference; R², Nagelkerke pseudo-R².

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positive associations with the utilization were found for each subgroup. Foreign G1 EMB showed the highest association between need and utilization.

However, the results of foreign G1 EMB have to be carefully interpreted as the case number of this group was quite low (Table 3), as well as the number of "utilized rehabilitation" within multiple logistic regression. This is due to loss-to-follow up between the first and second study wave, which was weighted for, but also due to lower participation rate among foreigners in general in the first study wave. If the case numbers had been higher, also for German G1 EMB and G2 EMB, differences between confidence intervals (CI) of the four groups would probably have been more precise, as the CI would get narrower. However, based on the confidence interval of the OR in the adjusted model, our study only showed significant differences between foreign G1 EMB and non-EMB while foreign G1 EMB have higher probability to utilize medical rehabilitation than non-EMB when the need increased.

This analysis is the first in Germany to identify the need for rehabilitation in different migrant groups compared to non-migrants. The findings of a higher need for rehabilitation in G1 EMB and especially in foreign G1 EMB match our assumptions before analysis as this group often experience unfavorable working conditions, as mentioned in the introduction. Our results showed, when assessing need with the help of our need score: the higher the need, the higher the utilization of rehabilitation for all groups. However, further barriers for instant utilization of healthcare and rehabilitation e.g. language problems, illiteracy or cultural aspects might exist for foreign G1 EMB due to own migration experiences and potential different health beliefs within their cultural background. Hence, when assessing need for medical rehabilitation with our need score, this group showed zero utilization of rehabilitation when having

Table 4. Utilization of rehabilitation services depending on the need for rehabilitation (separated for each group, weighted results, row percent, n = 3894).

	Need (tertiles)	Utilization		p-value[a]
		No	**Yes**	
Non-EMB(n = 3208)	Lower	92.4%	7.6%	< .001
	Medium	90.4%	9.6%	
	Higher	80.5%	19.5%	
German G1 EMB (n = 276)	Lower	89.2%	10.8%	.001
	Medium	89.0%	11.0%	
	Higher	71.6%	28.4%	
Foreign G1 EMB (n = 130)	Lower	100%	0%	.011
	Medium	90.5%	9.5%	
	Higher	80.0%	20.0%	
G2 EMB (n = 280)	Lower	92.8%	7.2%	.009
	Medium	82.7%	17.3%	
	Higher	75.8%	24.2%	

EMB, employees with migrant background; G1, first-generation; G2, second-generation.

[a] tested with Chi^2-test.

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low need, compared to the other groups in Table 4. They might only utilize rehabilitation when really necessary and their health situation is worsening.

In more detail, our additional analysis for interpretational purposes detected that over 70% of the people with higher need did not utilize rehabilitation services but instead 7–10% of those with lower need used rehabilitation in the past. Only those with lower need did not use rehabilitation at all in foreign G1 EMB. This raises the question as to whether health services like medical rehabilitation are truly authorized according to the need in Germany. Especially in older working age, health services like medical rehabilitation should be provided depending on the existing need. Only in this way, equal opportunities to stay healthy and actively in work and prevent early exit can be assured and unnecessary costs avoided. While there have been some projects in Germany in the past, aiming at improving the information about and access to medical rehabilitation where needed [e.g. 49], according to our result further efforts would be worthwhile. The accessibility to medical rehabilitation in general might be improved by further information campaigns or reducing formal access barriers (e.g. application process, waiting times, travel distances or charges for those with lower/no income) with diversity in mind. More migrant-specific strategies to reduce language or cultural barriers would be important as well.

However, the main dependent factor is, of course, the instrument to assess the need for rehabilitation, as the term "need" is not distinct and results are highly dependent of the chosen instrument. As described before, there are several operationalizations within rehabilitation research in Germany suggested to support the identification of need. In the presented study, we decided to orientate the operationalization towards the checklist of Deck et al. [16], as it covers various life aspects of the person affected: Incidence of disease, functional limitations, psychological factors, other risk factors such as smoking, motivation and coping with the disease, therapy, inability to work and impairments in work and everyday life. It convinced us that the checklist is nowadays recommended by the northern German pension insurance for general practitioners to assess the need for rehabilitation [17]. In our case however, the items of the need score were based on subjective information of the study participants and not on an objective assessment of the need for rehabilitation. Nonetheless, the items were collected

independently and without the purpose of assessing the need for rehabilitation. Such a check-list or scoring not only helps general practitioners to screen their patients, but could additionally help the official need assessment within the socio-medical evaluation,

In the future, the operationalization should definitely be standardized and so we are calling for a harmonization of the assessment procedure for the need of rehabilitation as other rehabilitation researchers [7, 8]. As rehabilitation is oriented towards the biopsychosocial model of illness and health, which is the basis of the International Classification of Functioning, Disability and Health (ICF) [50, 51], this could be another approach for a standardized need assessment. It is already stated in the social code IX in Germany that the determination of the need for rehabilitation should be carried out by an instrument that is based on the ICF, while also considering different life aspects e.g. mobility, domestic life, communication etc. [52]. Besides, research has already found out that the ICF Generic 6 score is a valid tool to assess functioning in several clinical settings [53], so this could be another possible instrument to use for need assessment. To our knowledge, further research is still going on to implement the ICF in other settings and test its practicability and reliability there [e.g. 54–57].

Another important aspect, especially for the further outlook, constitutes the timing of needs assessment, as people with need should be identified and allocated early enough to medical rehabilitation. Schlöffel and colleagues [58] tested an intervention of a web-based self-test to identify need for rehabilitation and subsequently the effectiveness on the application rate. The self-test was based on WAI and IMET ("Index to measure restrictions of participation"). Though, this intervention showed no significant effect as the only means, as Spanier and Bethge also investigated [49, 59]. A solution could be to combine different means. Bethge and his team already proposed in 2012 [12] a 3-staged procedure with screening of register data using a validated risk index at first [15], then postal screening with WAI for persons with high risk in the first step and lastly giving them consultation and information for the application for rehabilitation. This procedure would be more likely to improve application rates [58] and the utilization of rehabilitation according to personal need in the long run. However, this procedure is not implemented yet within the German pension insurance or other rehabilitation providers, as far as we are informed.

Strengths & limitations

Our study has several strengths. First, the sample is representative for the German population of socially insured employees of the considered two age cohorts [37, 38]. Second, the lidA study has the strength to differentiate more detailed subgroups with migrant background. Different indicators to map migrant status are used as recommended by Schenk et al. [45], not only nationality. Another strength is the variety of the study characteristics, so that several important factors to measure the need of rehabilitation could be taken into account. Here, validated instruments like WAI or SF12 were used to represent the different areas of life which are considered in the checklist of Deck et al. [16]. In earlier rehabilitation research these were already associated with the need for rehabilitation, however it remains an open question whether the summing score to assess the objective need for rehabilitation is the right instrument, as there is no gold standard in Germany so far. Another advantage was the ability to consider the need for and utilization of rehabilitation in logical time order, as the need was assessed from the first study wave and the utilization in the second study wave. Of course, no causality can be proven in a study like this.

Despite these strengths, the study also has its limitations. First, there is no gold standard for the assessment of the need for medical rehabilitation in Germany. So, we could not test the validity of our assessment instrument derived from the check list suggested by Deck et al.

(2009) for general practitioners more comprehensively. Furthermore, certain aspects which influence the official need were discussed in previous rehabilitation research, but could not be considered, as there were no suitable items within the first and second lidA study wave assessed. These include the overall rehabilitation prognosis, the participant's motivation and therapy options, such as the local infrastructure for rehabilitation. Yet, these factors might be more relevant in estimating the long-term success of medical rehabilitation and to a lesser degree in assessing the actual need for rehabilitation, which was the focus of our investigation. Overall, the items of the need score were based on subjective information of the study participants and not on an objective assessment of the need for rehabilitation. Nonetheless, the items were collected independently and without this purpose. Another limitation is the restriction to two age cohorts within socially insured employees due to sampling, where the lidA study does not include sworn civil servants and self-employed persons. While the majority of employees in Germany are socially insured [2, 36], employees with migrant background are underrepresented in the group of civil servants and overrepresented in the group of self-employed. So, the health status of migrants and non-migrants could be different if civil servants and self-employed were included. Consequently, the findings of this study are limited to socially insured employees born in 1959 or 1965. Yet, overall there are at least comparable percentages of different migrant backgrounds in the lidA-study in comparison to the German microcensus [2]. Further restriction to generalizability could have been introduced by language bias through the conduction of the study in German, where EMB were potentially excluded when having language problems. Finally, as mentioned before, the case number of foreign G1 EMB was quite low so that the results for this group have to be interpreted carefully.

Conclusions

According to our results and operationalizations, all subgroups showed suitable use of rehabilitation according to their needs at first sight, foreign G1 showed the highest association. However, when looking more in detail, something like under- and oversupply co-exist in all subgroups, while foreign G1 employees with lower need were the only ones without rehabilitation usage. Yet, undersupply exists in all groups independent of migrant status. Therefore, the need-oriented utilization of rehabilitation should be increased among all employees, e.g. by providing more information, removing barriers or identifying official need with the same standards. The findings highlight the necessity for distinct operationalization and investigation of migrant groups in research and resulting policy.

Supporting information

S1 Table. Weighting factors for inverse probability weighting.
(DOCX)

S2 Table. Characterization of study population (unweighted sample, n = 3944).
(DOCX)

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