Health advantage or disadvantage? Patterns of disability-free life expectancy of old age Turkish migrants living in Germany.

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Abstract

The research project shows new aspects of old age migrant health expectancies in Germany in comparison to the German host population. The remaining years of life are divided into years spent in good and in bad health by considering age-specific prevalences of disability. The data used in this study are population data from the German Office for National Statistics (Destatis) and the Central register of Foreigners (AZR) as well as data on age-specific prevalences of disability from the German Generations and Gender Survey (GGS). The measurement of health expectancy is used to highlight health inequalities between Turkish migrants living in Germany and Germans. The decomposition method is employed in order to explore the impact of mortality and disability on differences in health expectancy. The research results on health expectancy show distinct differences according to sex and nationality in terms of the proportion of remaining life expectancy spent in good and in bad health and their statistical impact on life expectancy. Within the Turkish population, especially women display greater advantages in life expectancy, but also stronger disadvantages in health.

Keywords

Germany, Turkish migrants, Life Expectancy, Health Status, Sullivan Method

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1 Introduction

From a social and socio-political perspective, the topic of aging and migration is gaining relevance in Germany. Fifty years after the first recruitment of labour migrants, the first migrant generation in Germany is about to enter the post-working phase of life, or has been retired already.

A closer look at the development of the age structure of migrants in Germany since 1970 reveals that the migrant population is ageing (Bundesamt für Migration und Flüchtlinge im Auftrag der Bundesregierung, 2006; p. 161). The statistics also point out that the probability of these citizens returning to their home countries decreases with age (Bundesministerium für Familie, 2005; p. 439; Razum et al., 2008; Razum et al., 2005; Razum et al., 2004). Consequently the proportion of elderly migrants among the foreign population is constantly rising[2]. In 1991, shortly after reunification, 298,200 migrants aged 60 years and older were living in Germany. In 2009 the number of 60+ old migrants has risen to 943,735 (Bundesamt, 2010, Bundesamt, 1991). Projections show that the proportion of the foreign population in Germany of age 60 and older will nearly double by 2030 to 13.2% from 6.8% in 1998 (Münz and Ulrich, 2000, Ulrich, 2001).

The consequences of this ageing population represent a big challenge for the economy, for the society and for the social security system (Hahlen, 2004). Especially the health care system faces the challenge of providing adequate and sufficient medical, advisory and elderly care services for an increasingly heterogeneous society. But more research on and analyses of migrants' health is needed to enable the political powers and the responsible authorities to be sensitized to the specific problems and needs of these target groups. For Germany, there are few valid studies regarding the problems an ageing migrant population poses, especially for the present health system. The future high proportion of old age people with a migration background will stem mainly from the first generation of the working migrants (Bundesministerium für Familie, Frauen und Jugend, 2000). The heterogeneity of this migrant group requires a differentiated view regarding the nationality and socio-cultural characteristics. In this study we focus on the Turkish population in Germany because of its validated data pool. In contrast to cross-country studies on this subject, we will utilize an inter-population comparison to avoid bias resulting from the high heterogeneity of different migration groups and the different response categories and reference levels used in answering questions about health.

Taking these aspects into consideration, the present study aims to explore the current health status of older Turkish migrants in Germany in comparison to the German host population. The central question to be answered is whether the remaining years of life for these groups are spent in good or in poor health. Specifically, the question is addressed of how many years and which proportion of the remaining life span is lived free of any disability or with disability. Furthermore, are there sex-specific differences in health expectancies within the migrant population and in comparison to the German population?

[2] The exact number of old people with migration background is unknown. Only the number of those migrants and elderly with migration background who do not have German citizenship is known. Naturalized migrants are treated statistically as Germans.

In the following we introduce the theoretical considerations behind our analysis and the hypotheses guiding this study. This is followed by an outline of the data and methods used. We also discuss the issue of data quality. In Section Four we give a detailed description of the outcome of the investigated differences in health status. In the concluding section we offer a discussion of the methods of measurement and the integration of the results into the current socio political debate.

2 Background: An explanatory approach to the link between migration and health

Research on the health of international migrants has – as other aspects of demographic behavior of migrants - a basic problem: there is no decisive and comprehensive theoretical model in this field of research (Spallek and Razum, 2008). Different hypotheses are discussed when analyzing the differences in health associated with ethnic and migration backgrounds. These hypotheses are explained diversely, referring mainly to, e.g.: the socio-demographic characteristics of migrants, disadvantages in their social circumstances, the process of acculturation, barriers to entering the health care services, and inadequate data records in the area of migration statistics (Schenk, 2007; Razum et al., 2004; Kohls, 2008a; McKay et al., 2003). For this reason, the effect a life with migration background or with ethnic migration status has on health has not yet been uncontestably established. To explain our hypotheses we also draw on the prevalent models.

In the past the research area of migration and health was discussed in a *'pathogenetic'* and problem-centered way. The biomedical model assumes a dichotomous concept of sensitivities (such as healthy/ill) and is manifested and understood mostly at the physical level (Eichler, 2008; Pourgholm-Ernst, 2002; Faltermaier, 2001; Razum et al., 2004; Boger, 2004). This model classifies migrants as a "difficult" population group with special needs towards the care system, i.e. it was assumed that they need special services and are at a greater health risk (Pourgholm-Ernst, 2002).

Newer explanations abandon the one-sided, deficit-oriented approach and add a *'salutogenetic'* model. In this respect the explanation goes one step further, as it does not refer to health as a state but rather as a process, whereby possible health-related resources are focused on (Faltermaier, 2001). Human health is not only defined physically/organically, but must be explained in terms of the individual's holistic perception of their own state of health (Razum et al., 2004; Faltermaier, 2001; Antonovsky, 1997; Bengel et al., 2001). Underscoring this concept, Razum et al. (2004) argue that people use migration for an active organization of their life, using both resources of their home country and of the host country.

In Germany little is known so far about whether the old-age migrant population displays a worse or better health status than the comparable German population. Few studies have focused on the aging of migrants and the social consequences of this process (Razum et al., 1998; Razum and Rohrmann, 2002a; Lechner and Mielck, 1998). Further, the available studies do not provide a clear picture of the relative health status of immigrants. Some evidence suggests that,

despite expectations associated with their social status, immigrants are healthier and have lower mortality rates than native Germans (Razum and Twardella, 2002; Jasso et al., 2004; Razum et al., 1998; Razum et al., 2000). This result is proven by various national and international studies. In this regard McKay et. al. (2003) give a comprehensive overview of different studies concerning international migration and health. Among them Tsugane et.al (1989) refer to a lower general mortality for the Japanese migrant population in Brasil in comparison to the host population and to the population in the country of origin (McKay et al., 2003; Tsugane et al., 1989). Similar results were also found for different migration populations in the US, Canada, UK and the Netherlands (McKay et al., 2003; Abraido-Lanza et al., 1983; Sharma et al., 1990; Uitenbroek and Verhoeff, 2002; Balarajan and Raleigh, 1997).

A possible explanation for this mortality advantage could be cultural differences in health behavior, such as a balanced diet (e.g. less red meat or less alcohol consumption) (Razum et al., 2004). At the same time there are serious concerns about the reliability of migration statistics which underestimate the mortality of foreigners (Kibele et al., 2008). Other research has found higher morbidity rates especially at older ages (Lechner and Mielck, 1998). As such, working migrants display a higher incidence of physical illness. Corresponding to the specific conditions of their situation, above all in terms of their job and migration situation, families of foreign origin are subject to specific health risks. Within the field of outpatient care, illnesses of the skeleto-muscular system are at the top of the list of diagnosed ailments (Bundesministerium für Familie, 2000).

These somewhat contrary research outcomes of mortality and morbidity of migrants are generally explained by the *'healthy migrant effect'* and its explanatory approaches. The model explains the often-observed health advantage of migrant after their move in contrast to the majority population. In this context it refers to the epidemiological concept of the *'healthy worker effect'* (Spallek and Razum, 2008, Schenk, 2007, Schenk, 2008, Razum and Rohrmann, 2002a, Kohls, 2008a, McKay et al., 2003a, McMichael, 1976). The underlying explanatory approach assumes a positive selection effect of mainly healthy people migrating. This applies especially to the first cohort of so-called guest workers who came to Germany in the early 1970s. A good physical constitution was one of the enlisting criteria for a work permit in Germany. Hence, at the beginning of their stay these foreign workers displayed a lower morbidity despite their worse working conditions (Razum and Rohrmann, 2002a; Schenk, 2007; Lechner and Mielck, 1998).

This effect was adopted in the *'healthy migrant effect'* with its international migration flow. A cross-border move is an important and incisive experience in life which requires high physical and at the same time mental health. Only those who are healthy and motivated dare to take this step whereas the ill and disabled persons stay. This health advantage is, however, only temporary and disappears rather fast (Spallek and Razum, 2008; Schenk, 2007).

Frequently, the *'healthy migrant effect'* is reduced to the temporary mortality advantages of migrants. But the concept also contains a line of argumentation to prove the increase of mortality over time. This increase of mortality over time is explained using the theoretical construct of *'health inequality'* (or *'*health disparity*'*). The concept refers to the relationship between poverty, absence of education and a

worse state of health as well as a statistically increased risk of illness for socially underprivileged people (Mielck, 2005; Richter and Hurrelmann, 2006).
Migrants in particular are exposed to special health, social and economic strains (Spallek and Razum, 2008). It is known from a variety of studies of the population group without a migration background that those who are socially or economically disadvantaged are exposed to a higher risk of illness or premature death (Mielck, 2005; Richter and Hurrelmann, 2006). Based on the higher health strains of underprivileged groups (in this context: migrants) the health advantage is only temporary and decreases as a result of social disadvantage and access barriers to the health system (Razum et al., 2008; Lechner and Mielck, 1998; Razum et al., 2004; Richter and Hurrelmann, 2006) Thus migration-related influences act on the individual's health at different levels: on the individual, physical/environmental and social levels. As a result migrant health status is determined by factors of a genetic nature, factors related to the situation in their home countries (e.g. health system, terms of employment, etc.) and by the migration process itself (e.g. loss of family, integration standards, etc.) (Spallek and Razum, 2008; Razum, 2006). The situation in the host country is of special interest. Social status, acculturation, the juridical situation, environmental factors and possible access barriers to the health services are explanation attempts for the social circumstances of migrants in the host country and their impact on health inequalities and therefore on morbidity and mortality.[3]

Combining both factors of influence gives rise to the model of the healthy migrant effect. Due to positive selection the migrants display a lower mortality compared to the host population at the time of immigration. As a consequence of socio-economic disadvantages, limited access to the health system and health strains, an increase in the mortality of the population occurs. Newer researches observe that migrants from many countries in Europe display a relatively low mortality for a longer time period. Razum and Rohrmann (2002) were able to ascertain a mortality advantage at least for the first migrant generation compared to the majority population despite social disadvantages. In view of the inverse association between socioeconomic status and mortality the healthy migrant effect represents a paradox.

On the one hand this is explained by the *'Salmon Bias effect'* (Schenk, 2008; Razum, 2007; Razum, 2006; Razum and Rohrmann, 2002a; Razum et al., 1998; Spallek and Razum, 2008; Kohls, 2008b). The argumentation here is that distortions in the statistics are attributable to the non-registration of death in the Causes of Death Statistics among migrants abroad. Additional causes are a selective return of ill and old people to their country of origin without deregistration in Germany. In regards to the figures, these people remain in the resident population and thus influence the observed mortality. On the other hand the paradox is explained by referring to the *'late entry bias'* which results from migrants who have returned to their home countries not being included in the study population (Schenk, 2008; Spallek and Razum, 2008).

[3] A detailed description of the models of social and health inequality presented, their categorization as well as a subdivision of the single explanatory approaches can be found in MIELCK, A. (2005) *Soziale Ungleichheit und Gesundheit. Einführung in die aktuelle Diskussion,* Bern, Verlag Hans Huber, RICHTER, M. & HURRELMANN, K. (2006) *Gesundheitliche Ungleichheit. Grundlagen, Probleme, Perspektiven,* Wiesbaden, VS Verlag für Sozialwissenschaften.

In this regard Ronellenfitsch and Razum (2004) point out that criticism is due, as newer studies did not establish evidence for the return of migrants to their home country (Ronellenfitsch and Razum, 2004; Spallek and Razum, 2008). In addition, some studies assume that in cases of illness, migrants remain in the host country to profit from the very good health care system, staying into retirement (Razum et al., 2005; Schenk, 2008; Razum and Rohrmann, 2002b).

Recent evidence suggests that selection effects, error and remigration cannot fully account for the mortality advantage. As a consequence, the demand for an alternative explanatory approach to the lasting mortality advantage of the migrant population arises. Thus, Razum and Twardella (2002) enlarged the dominating social-epidemiological discourse on the *'healthy migrant effect'* with the concept of the health transition.

According to this, in modern societies a gradual change has taken place from a high mortality (mainly triggered by infectious diseases) to low mortality with an increase of chronic illnesses (Omran, 1971; Razum and Twardella, 2002). For the concept of health transition from the perspective of migration this means that the country of origin and country of destination are in different phases of epidemiological transition and thus the migration process itself represents the health transition. As a consequence, the country of origin is mostly characterized by higher mortality rates due to infectious disease and inadequate health care as the cause of death (Razum and Twardella, 2002; Razum, 2006; Zeeb et al., 2002). However, the country of destination (industrialized country), displays a rising life expectancy due to better health care and a domination of degenerative and civilization illnesses (Razum, 2006; Razum and Twardella, 2002; Spallek and Razum, 2008). With their immigration, migrants change to other disease patterns. Infectious diseases are not prevalent but rather chronic illnesses and illnesses with a high latency (such as cardio vascular diseases) have an impact. But immigrants have a double burden in older ages, as they were exposed to unfavorable health risks (e.g. lack of food in infancy) during a part of there lives; these affect their general health even decades later (Spallek and Razum, 2008; Razum, 2006). At the same time they display a mortality advantage due to the fact that they risk contracting civilization illnesses only from the time of immigration. Compared to the host population this gives them a temporal advantage which lasts for many years after the migration and after adaptation to the ′western life style′.

Thus the current discussion on migration and health ranges between the contradictory arguments of „migration creates illness" and "migration improves the chances of health".

With this study we aim to provide new insights into the research on health differences in Germany between Turkish migrants and the German host population. Our guiding hypotheses are derived from the theoretical framework as follows:

H1) Hypotheses on mortality: when it comes to mortality the impact of migrants is discussed by competing hypotheses:

a) Mortality advantages: From the theoretical background we assume on the one hand, lower mortality rates of the Turkish migrant population compared to the Germans due to selection effects, errors in the statistics which lower mortality rates by an artificial increase in the apparent population size, and selective

remigration of unhealthy and socioeconomically disadvantaged people. The health transition theory refers as well to mortality advantages of migrants due to the fact that migrants are subject to the risk of modern illnesses only from the time point of immigration. Thus, a temporal advantage occurs compared to the host population which persists many years after the migration process and after adaptation to the western life style.

b) Mortality disadvantages: On the other hand, our contrary assumption concerning mortality evidence is that Turkish migrants do not display lower mortality rates but rather higher mortality than the German population under consideration. We based our assumptions on recent evidence which suggests that selection effects, error and remigration cannot fully account for the mortality advantage. Furthermore, in cases of illness and also in retirement, people will stay in the host country to profit from the high-quality of the health care system.

A mortality advantage or disadvantage says nothing about the health status. Lower mortality does not entail that migrants (in our case Turks) are healthier over time.

H2) Morbidity (migrant morbidity hypothesis): For the first generation of Turkish working migrants, we expect to find a worse health status than for the German host population. The influencing factors presented lead to the decrease of the *'healthy migrant effect'* over time (e.g. socioeconomic strains). This effect is compounded by the double burden for the health condition of migrants at the higher age postulated by the health transition theory. As a consequence, we hypothesize that the stressful and high pressure situation of the migration process itself and the living conditions in Germany cause longstanding illness and result in the migrants spending their remaining years of life in poorer health than the native German population.

How difficult the assessment of differences in morbidity and mortality between migrant and the majority population of the host country can be is determined among others by the available data sources and statistics. In the following, the data bases and data quality will be outlined which represent a reference for working out the questions and hypothesis.

3 Calculation of Health Expectancy – Method and data

3.1 Method

To gain new insights into disparities between the states of health of the Turkish migrant and the host populations, the indicator of 'life expectancy' is no longer adequate: In the past an increase in life expectancy was interpreted as an improvement in the health of a population. But, resulting from social developments attended by an epidemiological transition of mortality, chronic diseases have become more prevalent as the primary cause of death (Molla et al., 2003; Robine, 2002; Robine and Ritchie, 1991; Mathers, 2002). The link between mortality and health is thereby weakened, as many causes of morbidity are not fatal conditions which result in death (Robine and Jagger, 2006; Mathers, 2002; Molla et al., 2003).

Given that mortality rates are declining and life expectancy is increasing, the major question with an aging population is whether the remaining years of life are spent in good or in poor health. Due to this, the 'L*ife Expectancy' (LE)* indicator must be enhanced by the risk of becoming ill, which is not only linked to the risk of dying, but also to the risk of surviving with a functional restriction or activity limitations (Riley, 1990).

Taking these factors into account, the concept of LE is extended to include morbidity and disability components which are fixed by the concept of *'Health Expectancy' (HE)* (Molla et al., 2003; Mathers, 2002; Robine, 2002; Robine et al., 1999; Robine and Jagger, 2006). This concept provides a means of breaking down life expectancy into life spent in various states of health. Whereas LE alone focuses only on quantity of life lived, the HE model focus on the quality of life lived by dividing the years lived at particular ages into healthy or unhealthy years (Robine et al., 2003b; Robine et al., 2003a).

As HE combines life expectancy with different health concepts, and as there is a variety of different health dimensions, HE is a generic term including a range of specific indicators (Mathers, 2002; Robine and Jagger, 2006). These indicators are categorized in two major groups: *'Health State Expectancies' (HSE)* and *'Health-Adjusted-Life-Expectancies' (HALE[4]) (Robine and Jagger, 2006; Molla et al., 2003).*

Of interest in this paper is the HSE. It draws on a range of indicators which combine mortality and morbidity to include the various health measures in terms of a given state of health (Razum, 2006; Robine, 2002). The indicators of HSE were classified by the 'International Network on Health Expectancies' (REVES) (Robine and Jagger, 2006; Robine, 2002; Mathers, 2002). They propose four broad sub-indicators for HSE: *'Disease-Free-Life-Expectancy'*, *'Life expectancy in perceived health'*, *'Health-Adjusted-Life-Expectancy'* and *'Disability-Free-Life-Expectancy.* This entire class of indicators allows for a differentiation of life expectancy into positive and negative states of health (Robine and Jagger, 2006; Mathers, 2002; Robine, 2002).

An appropriate indicator which we used to analyze a population's health status in terms of functional ability is the *'Healthy Life Years' (HLY)* indicator (also called *'Disability Free Life Expectancy' (DFLE))* as broadly defined by the International Classification of Impairments, Disabilities and Handicaps (Mathers, 2002).

Health Expectancy calculation by Sullivan

To determine and break down the HE of the 50+ old Turkish and German male and female populations into the number of years lived with and without disability, our calculations were based on the method devised by Sullivan (1971).
The methodological requirements are mainly the classic demographic instrument of the life table combined with representative cross-sectional survey data of observed prevalence at the same point of time (Sullivan, 1971). This method estimates life

[4]HALE is a generic term for all life expectancy weighted by the social value given to different states of health to produce a multidimensional index of health expectancies. In this work we did not rely on this concept due to the fact that we did not focus on weighted states of health. We consider the nominal states of health. MATHERS, C. D. (2002) Health Expectancies: An Overview and Critcal Appraisal. IN MURRAY, C. J. L.,SALOMON, J. A.,C.D., M. & LOPEZ, A. D. (Eds.) *Summary Measures of Population Health. Concepts, Ethics, Measurement and Applications.* Geneva, World Health Organization.

expectancy as a function of disability by division of the total life expectancy into different states of health based on prevalence at a single point in time (Sullivan's method see Appendix A) (Molla et al., 2003; Jagger et al., 2007)**.** To calculate the population of each interval, the model uses two separate and independent partial health measurements: for the morbidity component the proportion of the population in a healthy ($(1-{}_n\pi_x)$) and unhealthy (${}_n\pi_i$) state and for the mortality component number of survivors at age x (${}_n l_x$) and the total number of years lived in the age interval (${}_n L_x$) is used (Molla et al., 2003; Andreev et al., 2002). Figure 1 displays a schematic framework for the index of HLY calculation.
According to this method the following equation can be used to determine age-specific HE in good and in bad health:

$$DFLE_x = \frac{1}{{}_n l_x}\sum_{i=x}^{\omega}(1-{}_n\pi_i)\cdot{}_n L_i \qquad DLE_x = \frac{1}{{}_n l_x}\sum_{i=x}^{\omega}({}_n\pi_i)\cdot{}_n L_i$$

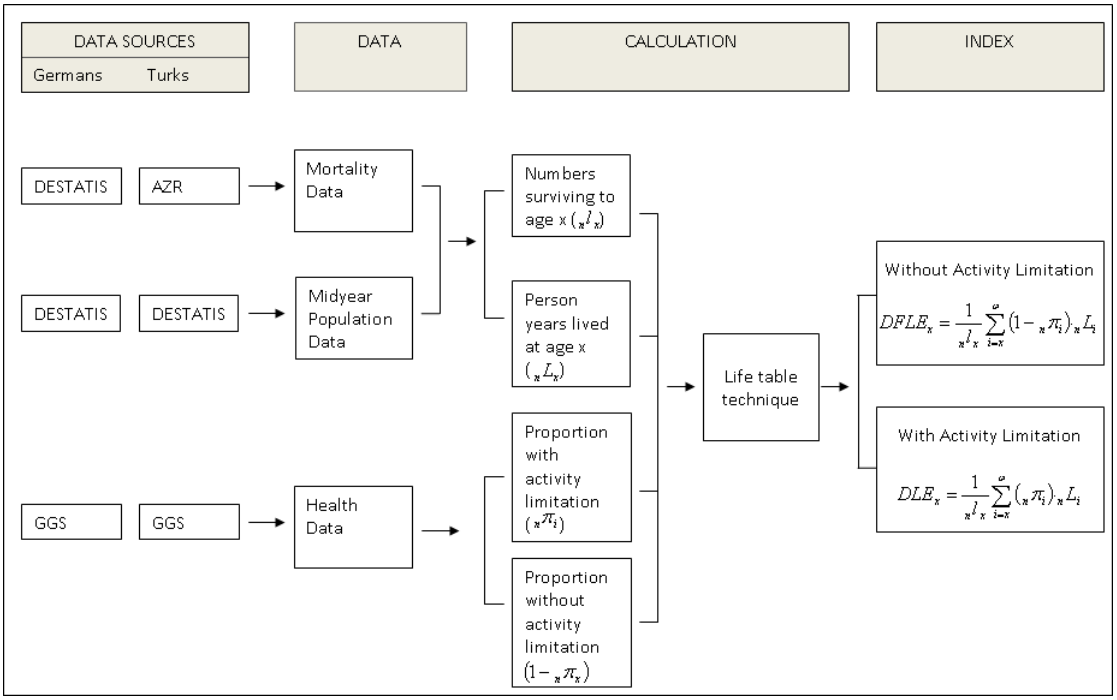
where:
${}_n l_x$ is the number of survivors at age x ;
$(1-{}_n\pi_x)$ represents the age-specific rate of being healthy
${}_n\pi_x$ represents the age-specific rate of being unhealthy
${}_n L_x$ is the total number of years lived by a cohort in the age interval (x,x+n)
ω is the oldest age category.
At the end the sum of the calculated health state expectancies must be equal to the total life expectancy.
The main advantage of the Sullivan method is that the data on mortality and disability are collected separately. Based on Chiang (1984), in our calculations abridged life tables with 5-year age groups were used.

The calculated HLY depicts the current state of morbidity in the target groups adjusted for age and mortality and independent of the size of populations. This means that the method calculates the expected years of life spent with or without activity limitation from a certain age, given that the mortality and morbidity rates in the observed period remain constant (Jagger et al., 2007).

Our analyses of the populations under consideration cover the age range from 50 to 79. We restrict our HE calculations to the starting age of 50 assuming that increasing disabilities appear at this point of life (Bundesministerium für Familie, Frauen und Jugend, 2000). As the survey used (see information in the following section on data) did not include any data on older ages than 79, we used partial life expectancy[5] up to this age instead of total life expectancy (Arriaga, 1984).

[5] Partial life expectancy or temporary life expectancies are the life expectancies between two specific ages. ${}_i e_x = \frac{T_x - T_{x+i}}{l_x}$

Figure1: A schematic framework for estimating 'HLY' at the national level using functional limitation as health indicator.



Source: This schematic explanation is derived from the schematic framework of (Molla et al., 2003) pp.10) transformed for the specific calculation of Health Expectancies due to this method.

Decomposition tool by Nusselder & Looman

In a second methodological part it is of interest to split the differences between the two health expectancies into each component. The question is whether the differences in health according to nationality are due to higher effects on mortality or higher effects on disability. In other words, we assess the contribution that mortality and disability make to differences in HE by using a decomposition tool. This tool splits the differences in HE into additional differences based on kind of effect.

To compute the differences of HE we used the decomposition method described by Nusselder & Looman (2004) which is an extension of the Arriaga (1984) method for total life expectancy (Arriaga, 1984). The technique reflects the smaller (larger) number of person-years lived (mortality effect) and further expresses the smaller (higher) prevalence of disability (disability effects) (Nusselder and Looman, 2004; Nusselder et al., 2005; Andreev et al., 2002).

3.2 Data

For research on HE, two types of information are required: a) standard period life table data from which age and sex-specific mortality information and life expectancy can be obtained and b) prevalence data by age and sex from a cross-sectional survey for the same period as the standard life table (Jagger et al., 2007). The prevalence data are connected to the structural indicator of HLY as measured by limitations in

daily activities (Jagger et al., 2007). Accordingly, the disability free life years are the statistically expected time which a person spends in good health from a given time up to his death.

Data on mortality and on the mid-year population of German and Turks living in Germany during the years under consideration are provided by the Federal Statistical Office (Destatis) and the Central Register of Foreigners (AZR), which reports to the Federal Office for Migration and Refugees.

In order to apply the different concepts of disability-free life expectancy, data on health-related functional limitations are necessary. Such data were collected for both population groups within the German Generations and Gender Survey (GGS).

The GGS is part of the The Generations and Gender Program, which is coordinated by the United Nations Economic Commission for Europe (UNECE) in Geneva and is implemented by the member countries themselves. In Germany the GGS has been carried out by the Federal Institute of Population Research (BiB) together with TNS Infratest. The first wave of the main questionnaire on the German population was collected in 2005 and includes a nationally representative sample of Germans aged 18 to 79, with 10,017 respondents.

The German 'Migration Survey' (which includes only Turkish migrants in Germany) corresponds to the contents of the GGS main questionnaire in the structure of the subsample. It was conducted in 2006 among 4,000 people with Turkish nationality living in Germany. The sample size of the GGS migrant survey is based on registered Turkish citizens in the year 2006 in Germany within the age range of 18 to 79 years.

The cross-sectional survey (which is a household sample) offers the standard data collected but also information on the state of health of Germans and Turkish migrants by sex and age group.

Information on the current state of health is provided by the GALI[6] question concerning long-standing, health-related limitations (restrictions) in daily life. In both surveys the respondents were asked in identical wording about '*limitations in their ability to carry out normal everyday activities because of a physical or mental health problem or a disability*' (Robine et al., 2003b; Van Oyen et al., 2006; Ette et al., 2007). Respondents could rate their limitations with 'yes', 'no', '*do not know*' and '*no answer*'. Table 1 gives information of the number of respondents related to their health status.

[6] Global Activity Limitations Indicator (GALI): registering the presence or absence of limitations

Table1: Number of respondents by sex, age, and health status for German and Turkish nationals in Germany in 2005/2006

Age	Germans						Turks					
	N	without activiy limitation	% without activiy limitation in age group	with activity limitation	% with activity limitation in age group	N.A.	N	without activiy limitation	% without activiy limitation in age group	with activity limitation	% with activity limitation in age group	N.A.
Males												
25-29	294	290	*99*	4	*1*	0	274	265	97	9	3	0
30-34	269	260	*97*	9	*3*	0	331	323	98	8	2	0
35-39	380	369	*97*	11	*3*	0	289	273	94	8	3	4
40-44	482	457	*95*	25	*5*	0	264	255	97	7	3	2
45-49	441	423	*96*	16	*4*	2	127	117	92	10	8	0
50-54	360	329	*91*	29	*8*	2	81	73	90	8	10	0
55-59	365	325	*89*	40	*11*	0	91	79	87	10	11	2
60-64	392	340	*87*	51	*13*	1	124	102	82	21	17	1
65-69	433	389	*90*	41	*9*	3	74	62	84	11	15	1
70-74	258	233	*90*	25	*10*	0	29	20	69	7	24	2
75-79	231	191	*83*	38	*16*	2	6	3	50	2	33	1
Total	**3905**	**3606**		**289**		**10**	**1690**	**1572**		**101**		**13**
Females												
25-29	357	345	*97*	10	*3*	2	256	252	98	4	2	0
30-34	405	393	*97*	9	*2*	3	313	299	96	11	4	3
35-39	534	519	*97*	13	*2*	2	270	262	97	4	1	4
40-44	677	644	*95*	31	*5*	2	186	170	91	12	6	4
45-49	541	514	*95*	26	*5*	1	125	113	90	12	10	0
50-54	466	429	*92*	33	*7*	4	116	97	84	16	14	3
55-59	376	338	*90*	37	*10*	1	120	91	76	27	23	2
60-64	362	343	*95*	17	*5*	2	78	62	79	15	19	1
65-69	384	342	*89*	40	*10*	2	29	21	72	8	28	0
70-74	313	271	*87*	39	*12*	3	10	9	90	1	10	0
75-59	277	228	*82*	47	*17*	2	4	2	50	1	25	1
Total	**4692**	**4366**		**302**		**24**	**1507**	**1378**		**111**		**18**

Source: Calculations based on German GGS 2005 and GGS - Subsample 2006 in Germany.

N = Number of Respondents
N.A. = No Answer

4 Data quality

Our analysis is based on investigations of life expectancy with a further differentiation of healthy or ill; this separation does not have a long tradition in Germany (yet). This has two reasons: On the one hand there are only few data sources which allow for suitable investigations. On the other hand reservations exist towards a combination of soft (subjective state of health) and hard data (mortality) which is based on the different statistical certainties of the data sources and the possible generalization of the results.
Differences in the definitions of health and health restrictions and the collection of data thereon lead to the fact that results are only comparable in a limited way. We therefore gave special attention to possible limitations due to data quality.

An adequate analyses of mortality, and therefore also of HE is dependent on the quality of the data provided. In particular, for the information on the individual population groups, as in the case of the Turkish migrants, there is a restriction caused by limitations in data validity resulting from two factors: under-coverage of registered deaths especially in older ages and over-coverage of the population numbers in the population registers. The latter effect is caused by a frequent lack of

de-registration of Turks who emigrate from Germany (Kohls, 2008b; Kibele et al., 2008).

The reasons for this lie, among other things, in the general problems of acquisition of data on foreigners by the various authorities in Germany which lead to temporal delays in the registration of relevant events. Furthermore, the bias is caused by a decentralized data collection and by the fact that the migration statistics are only a byproduct of the registers of residents; the accumulated data are acquired for the purpose of administrative duties and not for scientific purposes (Haug, 2005; Currle, 2005).

Another major contribution to the limitation of data quality is the fact that the Turkish migrant population shows special characteristics concerning their calculated prevalences (see Figures 2a & 2b). Starting from the age of 60 the prevalences show a high uncertainty. Furthermore, prevalences decline in the older age groups (ages 70 to 79). This can be attributed to low response rates to the survey's question of limitations of activity (see Table 1).

For the analysis, we consequently do not use the calculated prevalences between the ages 60 to 79 for the Turkish migrant population, but rather the extrapolated linear trend for these age groups.

Figure 2a: Age-specific prevalence for Turkish migrant men in Germany 2006

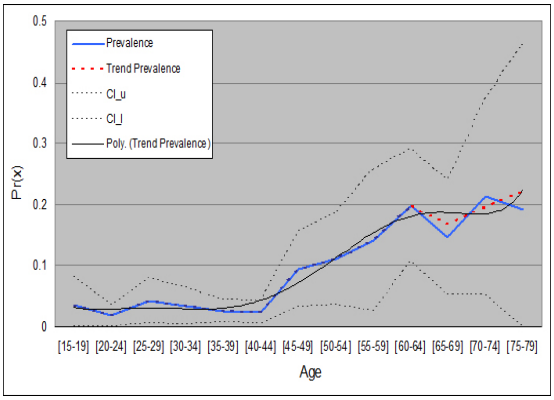
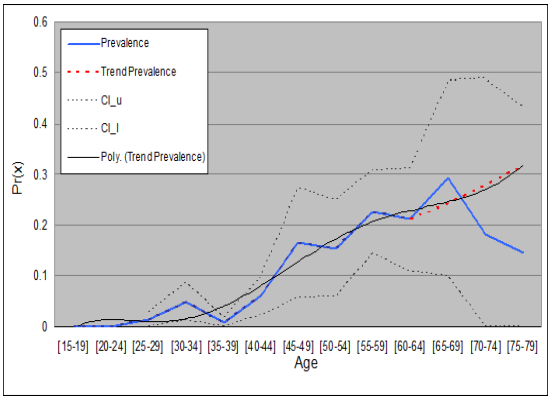


Figure 2b: Age-specific prevalence for Turkish migrant women in Germany 2006



Source: Calculations based on GGS - Subsample 2006

5 Results: Expected years of healthy life for the Turkish and German populations

Health life years (HLY) as an extension of life expectancy, which is obtained by decomposing life expectancy into the two components of disability free life expectancy (DFLE) and life expectancy with disability (LEWD) based on limitations in daily activities.

The total life expectancy calculated by the standard life table measure in the year 2006 shows higher life expectancy for the Turkish male population than for the German male population until the age of 60 (see Figures 3a & 3b). From the age of 60, German males display advantages in their life expectancy compared to the Turkish male population. Turkish migrant women show higher life expectancy than German women over the whole age range, and especially in older age classes.

Figure 3a: Life expectancy of Turkish migrants and German men in Germany 2006

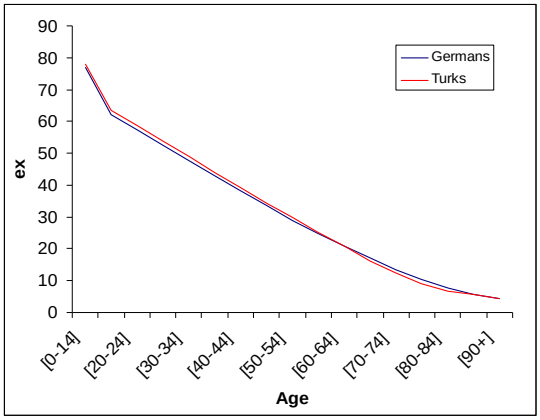
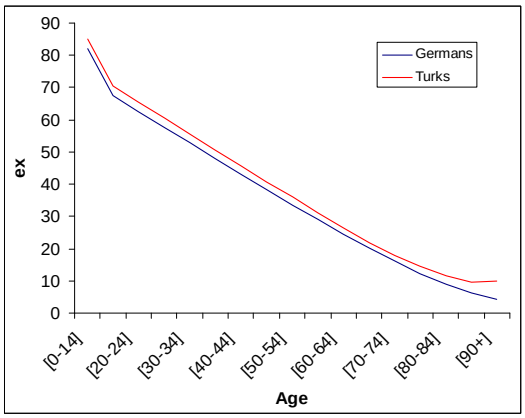


Figure 3b: Life expectancy of Turkish migrants and German men in Germany 2006[7]



Source: Calculations based on AZR 2006, Destatis 2004, 2005, 2006

5.1 Expected years of healthy life (without activity limitation) for Germans and Turks throughout the age range

The distribution of those people free of any activity limitation grouped according to nationality, 5-year intervals and sex is presented in Table 2. The expected years without disability limitation for Germans and Turks for both sexes decline with increasing age. German men at the age of 25-29 could be expected to spend more than 92 percent (44.8 years) of their life expectancy without activity limitations and German women 93 percent (47.9 years) respectively. These percentages decline only about 5 percent points for men and 6 percent points for women until the age group of 65-69. By contrast, for the Turkish population the percentages of disability free life expectancy decline. Men of Turkish nationality at the age of 25-79 could be expected to spend about 3 percent points less time free of activity limitations (in total 89.3 percent or 45 years) than German men.

The Turkish female population displays an even bigger decrease in the age group 25-79 and has therefore fewer expected years without limitations as compared to their German counterparts (about 8 percent points less, which represents 85 percent or 44.5 years). In the older age class of 65-69 the difference between the disability free life expectancy of the German and Turkish populations increases. Whereas men show a small decline of roughly 6 percent points between the age groups 25-29 and 65-69, the expectancy of Turkish women to spend their remaining years without limitations drops by almost 15 % in the same time span.

[7] For the data points see Appendix B

Table 2: Partial life expectancy and expected years without any activity limitation for the German and Turkish migrant populations, by age and sex: Germany, 2005/2006

	Germans			Turks			Differences in years	
Sex and age	Expected years of life	Expected years without any activity limitation	Years without any activity limitation as a % of life expectancy	Expected years of life	Expected years without any activity limitation	Years without any activity limitation as a % of life expectancy	Expected years of life	Expected years without any activity limitation
Male								
[25-29]	48.5	44.8	92.2	50.4	45.0	89.3	1.9	0.3
[30-34]	43.7	40.0	91.4	45.5	40.3	88.6	1.8	0.3
[35-39]	38.9	35.3	90.8	40.6	35.6	87.6	1.7	0.3
[40-44]	34.1	30.6	89.8	35.7	30.8	86.2	1.6	0.2
[45-49]	29.4	26.2	89.0	30.9	26.1	84.4	1.5	-0.1
[50-54]	24.9	21.8	87.7	26.2	21.8	83.2	1.3	0.0
[55-59]	20.6	17.9	86.9	21.7	17.8	81.8	1.2	-0.1
[60-64]	16.4	14.1	86.1	17.0	13.7	80.6	0.6	-0.4
[65-69]	12.3	10.7	86.5	12.4	10.0	80.8	0.1	-0.6
[70-74]	8.4	7.1	85.1	8.2	6.5	79.3	-0.1	-0.6
[75-79]	4.4	3.6	82.1	4.2	3.3	77.8	-0.2	-0.4
Female								
[25-29]	51.5	47.9	93.1	52.5	44.5	84.9	1.0	-3.4
[30-34]	46.5	43.1	92.6	47.5	39.6	83.4	0.9	-3.5
[35-39]	41.6	38.3	92.0	42.5	34.9	82.1	0.9	-3.4
[40-44]	36.7	33.5	91.2	37.6	30.0	79.8	0.9	-3.5
[45-49]	31.9	28.9	90.6	32.7	25.4	77.6	0.8	-3.5
[50-54]	27.2	24.5	89.9	27.8	21.3	76.5	0.6	-3.1
[55-59]	22.6	20.1	89.1	23.0	17.2	74.8	0.4	-2.9
[60-64]	18.0	16.0	89.0	18.1	13.4	74.1	0.1	-2.6
[65-69]	13.5	11.8	86.9	13.5	9.8	72.3	0.0	-2.0
[70-74]	9.1	7.8	85.5	9.0	6.3	70.3	-0.1	-1.4
[75-79]	4.7	3.8	82.5	4.7	3.2	68.4	0.0	-0.7

Source: Calculations based on German GGS 2005 and GGS - Subsample 2006 in Germany, AZR 2006, Destatis 2004, 2005, 2006

This means that the expected life free of disability as a percentage of life expectancy declines with age for both populations, also showing differences in the male and female populations. The calculated person years lived free of disability show that both population groups could expect to spend a large proportion of their remaining years between 25 and 79 in a healthy state. The last two columns of Table 2 and the Figures 4 and 5 display the differences in life expectancy and expected years without disability between Germans and their Turkish counterparts. It is shown that the differences in the populations' life expectancies do not align with the differences in the expected years without disability. At older ages (65+) the mortality advantages of the Turkish population turn into a disadvantage and therefore the German population has a higher life expectancy at those ages. For the expected years which could be spent in a healthy state, already at younger ages Turks show a disadvantage in comparison to Germans.

This indicates that German men and women spend a greater proportion of life in a healthy state across the age range of 25 to 79 than the Turkish migrant population. German women could expect to live more years in a healthy state as compared to German men of the same age. Turkish women however spend fewer years in a healthy state than Turkish men. This means Turkish men spent a greater proportion of their life without disability.

Figure 4a: Partial life expectancy and Health expectancy for German women in 2005 Germany

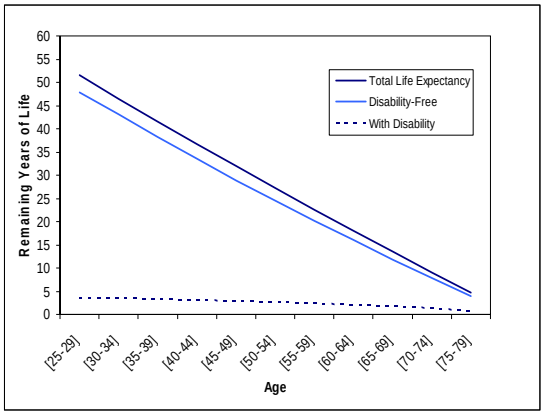
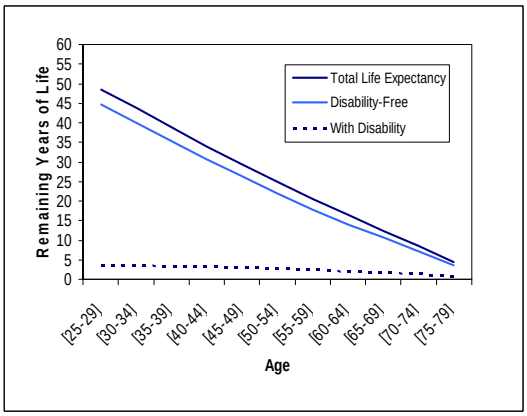


Figure 4b: Partial life expectancy and Health expectancy for German men in 2005 Germany



Source: Calculations based on German GGS 2005 and GGS - Subsample 2006 in Germany, AZR 2006, Destatis 2004, 2005, 2006

Figure 5a: Partial life expectancy and Health expectancy for Turkish women in 2005 Germany

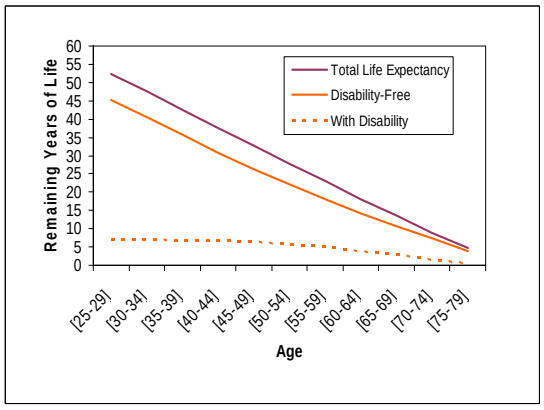
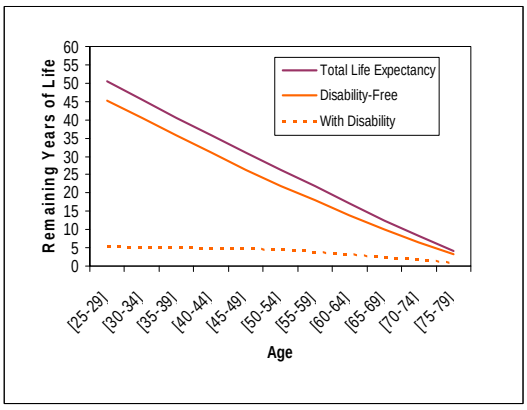


Figure 5b: Partial life expectancy and Health expectancy for Turkish men in 2005 Germany



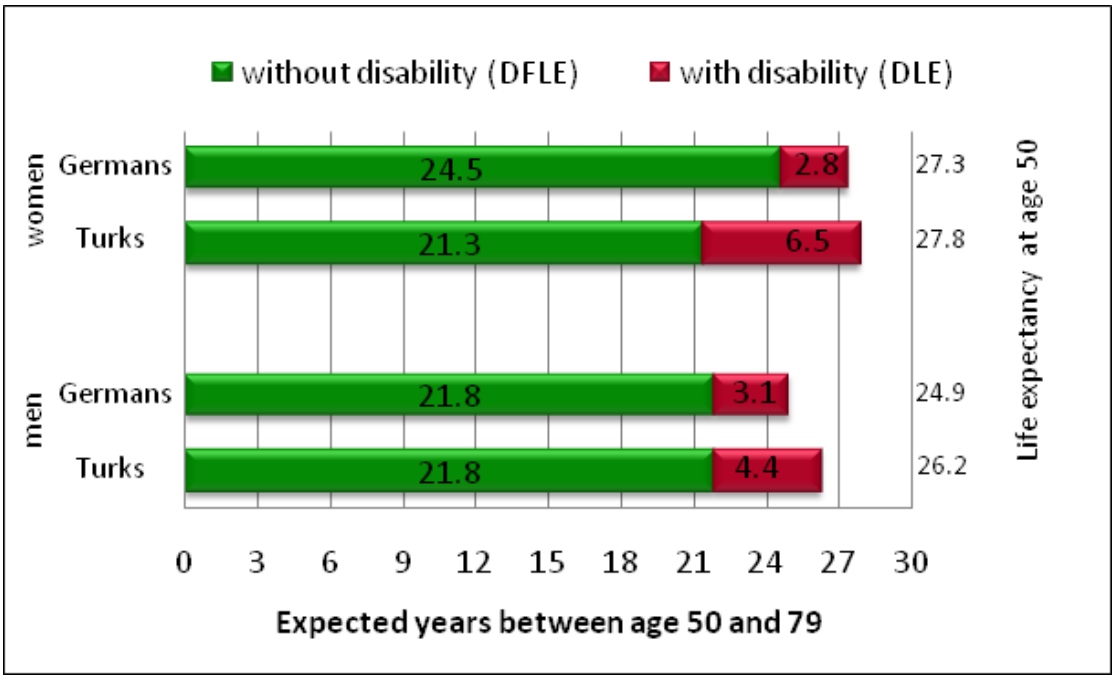
Source: Calculations based on German GGS 2005 and GGS - Subsample 2006 in Germany, AZR 2006, Destatis 2004, 2005, 2006

Proportion of partial life expectancy in different health states at older ages

Figure 5 shows how partial life expectancy between the ages of 50 to 79 is divided into years with and without disability in the year 2006. The total length of each bar, represents the expected remaining life expectancy between age 50 and 79. The remaining life expectancy at age 50 was 24.9 years for German men and 26.2 years for male Turkish migrants in Germany. Based on the GGS 2005/06, at age 50, German men spent 87.7% (21.8 years) of their remaining life without disability and 12.3% (3.1 years) with disability. The Turkish male population, at the same age, displays a longer life expectancy, but spends more time with disability. They have 16.8% (4.4 years) of this time with a disability. For the female population at age 50 the remaining life expectancy is 27.2 for Germans and 27.8 for Turkish migrants. For the female population, the results of the study indicate that Turkish women at the

age of 50 spend more time (23.4%; 6.5 years) of their remaining life expectancy with disability than the German population (10.1%; 2.8 years).

Figure 6: Expected years of life from 50 to 79 in various health states for Germans and Turkish migrants in 2005/2006



Source: Calculations based on German GGS 2005 and GGS - Subsample 2006 in Germany, AZR 2006, Destatis 2004, 2005, 2006

5.2 Decomposition of HE between different nationalities by type of effect (25 - 79)

The decomposition shows the differences between the populations with respect to HE according to the influencing factor. These effects are due to the contribution made by differences in mortality and by differences in the prevalence of disability. Our results show an explicit effect of disability for the Turkish migrant population.

Table 3 indicates that for men the difference in life expectancy with disability is 1.22 years; this figure can be broken down to take mortality into account, resulting in a figure of 1.02 which reflects a higher prevalence of disability in the Turkish migrants' life expectancy. The remaining 0.20 years reflect the lower total mortality. This means that, during their extra years of life as compared to the Germans, Turks are exposed to a higher risk of disability. By definition: the size of the disability is the same as for the disability free life expectancy, but differs in the direction. The disability effect of -1.02 years will be completely nullified by the mortality effect of 1.09.

In the case of women's life expectancy in an unhealthy state we see 3.66 out of 3.77 additional years with disability, reflecting a high prevalence of disability in the Turkish population. The remaining 0.10 years reflect a lower total mortality. In turn, during their extra years of life, also the Turkish women are exposed to a higher risk of disability.

All in all the remaining years reflect lower mortality but they are influenced by disability.

Table 3: Decomposition of Health Expectancy by nationality and type of effect (50 - 79)

	Men			**Women**		
	Total LE	DFLE	LED	Total LE	DFLE	LED
Germans	24.9	21.8	3.1	27.3	24.5	2.8
Turks in Germany	26.2	21.8	4.4	27.8	21.3	6.5
Differences (Ref.: Germans)	1.29	0.07	1.22	0.59	-3.17	3.77
Due to mortality	1.29	1.09	0.20	0.59	0.48	0.10
Due to disability		-1.02	1.02		-3.66	3.66

Source: Calculations based on German GGS 2005 and GGS - Subsample 2006 in Germany, AZR 2006, Destatis 2004, 2005, 2006

Total LE = Total Life Expectancy
DFLE = Disability Free Life Expectancy
LED = Life Expectancy with disability

6 Conclusion and discussion

We have attempted to find empirical evidence on the question of how the expected years of life are to be seen when considering functional health and disability aspects and whether greater life expectancy goes along with an increase in healthy years. At issue were the 50+ old Turkish female and male migrants in comparison to the corresponding German host population**.** The measurement of HE was used to highlight health inequalities between the two different population groups. Thus we add a quality dimension to the quantity of life lived by considering not only mortality, but also age-specific prevalences of disability.

We start the discussion by reviewing our results from the viewpoint of our working hypotheses. Our research results partly support the assumption (mortality advantages hypothesis) that the migrant population displays lower total mortality rates than the German host population.
According to the calculated standard life table, the Turkish female resident population has a higher life expectancy than the German female population, whereas the advantages in life expectancy of Turkish men in comparison to German men reverse in older ages. We assume that these results might be biased due to the data quality which we already described above[8]. With this we concur with other studies which discuss that migrant mortality calculations are strongly influenced by data artifacts (e.g. in older age classes there are too few registered deaths, possibly due to the fact that migrants did not reach older ages so far) (Kibele et al., 2008; Kohls, 2008b; Haug and Swiaczny, March, 2003).
This means that that, at older ages, the life expectancy of the migrant population may be lower than that of their German counterparts. This assumption is supported by our partial life expectancy calculations which were used to derive health

[8] See chapter 3 „Data quality", p. 12

expectancies. In our calculation we rely only on data from age 25 to 79. Therefore we can exclude data of older age groups which are marked by inconsistencies.
The results of the partial life expectancy calculations display – as a general trend – that starting from the age of 65 Turkish migrant women have higher mortality than German women. We found the same trend also for the Turkish male population in comparison to the Germans.
Hence, the results of our study stress, once again, that in general the data quality in the area of migration and the foreign population in Germany cannot be judged as satisfactory and needs to be improved (Haug, 2005). The reasons for the loss of data quality are at least threefold: 1) The decentralized data collection leads to temporal delays in the registration of registered events. 2) In the official data, migration statistics are only a byproduct of the registers of residents and therefore do not include variable or well-processed data which are important for migration analyses (e.g. no variables to analyze integration, no information on ethnic Germans or naturalization, no residence information). Furthermore, the data display no complete correlation to the resident register and has problems keeping data up to date. 3) The accumulated data are acquired for the purpose of administrative duties and not for scientific purposes, which means that researchers have only limited access to data provided by AZR. When data is accessible, it is only possible to get extracts of the variables acquired. Furthermore, mortality analyses using the AZR can only be carried out for the last five years because all mortality information which is older than five years is erased as a matter of routine (Currle, 2005).

The second part of the paper describes the health status of the population under consideration. For morbidity we found the hypothesis (migrant morbidity hypothesis) proven: Turkish migrants at the age of 50 spend a higher proportion of their remaining life expectancy in illness than in health. Especially Turkish women display greater advantages in life expectancy at the age of 50 to 79, but display at the same time bigger disadvantages in health.

To evaluate the HE outcome, we applied the decomposition method proposed by Nusselder and Looman (2004) to describe differences in healthy life years between nationalities by the effects of mortality and disability. For Turks, the results show that the contributions due to disability are much greater than those due to mortality. This might suggest that health inequalities have a larger effect on migrants' morbidity status than on that of the German population.

Social and work conditions as well as factors specific to their social level (physically hard and dangerous work, low income and educational level, poorer housing conditions etc.) lead to higher risks of disability (Desjarlais et. al. 1995).

Increased health risks may also be associated with the stressful experience of migration to a foreign country. The "Migration-Stress Hypothesis" argues that there is stress associated with cultural and social orientation to a new country due to factors like being away from family members and a complete devaluation of the immigrant's practical knowledge in the host country. There have also been reports of significant physical health issues arising from the emotional difficulties of dealing with discrimination during daily life. These sources of stress, combined with the possible low achievement of the immigrant's goals in the host country, can cause a variety of psychological and physical problems (Spallek and Razum 2007).

When drawing conclusions, we should also pay attention to the measures used. The results of our calculation might have been influenced by a bias of the GGS sample. Moreover, the significance of the statements regarding health factors in the GGS may be limited because standardized questioning cannot account for the different perspectives of various societal levels, cultures and gender. With this in mind, two factors must be considered which influenced the response rates to the health questions: First, a general problem in health studies with foreign and native populations is the different understanding and description of illness (Razum et al., 2004; Spallek and Razum, 2008). Differences between cultures may cause a different perception of good and bad health. An explanation for the low response rates to the question of limitations of activity could be that people at older ages consider their activity limitations as a usual aging process and did not consider them to be severe changes in health.

Second, another aspect which could result in a bias in the response rate of ill people is that the GGS is a cross sectional household survey which contains observed prevalence rates and excludes institutionalized people. It can be assumed that people in institutions display a poorer health status as well as more or more severe limitations in daily life activities. This selectivity could reflect a sampling error which leads to an underestimation of the share of people with disabilities, and at the same time display too positive an estimate of the health status. If the people in institutions could be taken into account, the results for the German population might change to show a higher illness status. The status of the Turkish migrant population would remain constant, however, due to the fact that in the past Turks did not take advantage of institutional care to the extent that Germans do (Matthäi, 2004). If then the relative health status of Turks compared to Germans were to change, must be left to further research.

Considering the methodology, this study displays an inherent limitation related to the Sullivan method used here. In general the method reflects the current health of a population adjusted for mortality and independent of age structure. That means the method applies age-specific health prevalence rates instead of incidence rates. Incidence rates are necessary to provide the number of person years lived in a health state at a particular age and time. This can be calculated by longitudinal measures to provide the transition rates between health states.

A more sophisticated increment-decrement life table as well as multistate life tables would be appropriate solutions. Unfortunately, these models require data that are rarely available. The dataset available to us does not provide the necessary data, either. Therefore, in our study the Sullivan method has the advantage of using more readily available data: age-specific prevalence of the health state and the total person years lived at a particular age. This makes it applicable to any state of health definition. It displays a further disadvantage, however, in that it assumes that individuals have the same mortality in the healthy and unhealthy state and therefore represents an oversimplification of reality. Robine and Mathers (1993) have shown that the Sullivan method and multistate methods produce similar results, providing all transition rates are smooth and regular over time (Robine and Mathers, 1993). Therefore, we can conclude that our results are appropriate in order to investigate the health status of elderly Turkish migrants in comparison to the German host population.

Besides, it is not the migration itself which produces disadvantages in health. Rather, it is the reasons and circumstances of the migration process as well as the living and working conditions in Germany which could lead to a worse state of health. Thus, a low socioeconomic status, harmful working and living conditions, cultural barriers, and the stress associated with migration are likely contributors to health disparities between Turkish immigrants and native Germans (Razum and Spallek, 2009; Schenk, 2007; Razum et al., 2008). Studies show that especially Turkish residents in Germany are exposed to higher unemployment rates and consequently lower incomes which correlate to increasing health risks compared to the employed population (Razum et al., 2008; Kohls, 2008b; Lechner and Mielck, 1998).

However, in general the health status, especially of older migrants, has not yet been sufficiently examined. Representative epidemiological investigations on the objective state of health of older migrants are not available. Due to missing comparability of data and the problems of the operationalization of migration or migration background there are only few empirically secure findings. Further research has to be conducted to resolve open questions on the health risks and health potentials of people with migration background.

When putting the results of our study in a wider societal context, several key health-related and quality-of-life questions for older ages in both the host and immigrant populations arise: The increasing proportion of older migrants in Germany and the accompanying trend towards a multi-cultural society make the question of health differences by cultural sub-populations highly relevant. This leads also to the question how the health care system deals with specific needs and problems of various sub-groups. These questions are obviously important both for the understanding of changes in the state of health of a given population and for the formulation of public policies directed at the provision of services. Since the beginning of the 1990s, older migrants have been gaining more and more societal and socio-political attention, especially in respect to their need for adequate assistance and care (Bundesministerium für Familie, Frauen und Jugend, 2000). Our results suggest that this special attention has, however, not led to equal health conditions between older Turks and Germans.

For the future, there are three reasons to assume that older immigrants in Germany will be in even higher care need than is the case today: 1) Since the present elderly migrants are still relatively young, their care needs are expected to rise in the near future as the age composition will shift towards older ages. 2) Immigrants as well as the German host population have an increasing risk of multi-morbidity at older ages which causes high nursing and care need of these old age population groups (Bundesministerium für Familie, Frauen und Jugend, 2000). 3) The specific risk exposure of migrants – as shown in our study – will increase the effect of multi-morbidity even more for the foreign population.

In the past, both from the side of policy makers and from scientists, it was assumed that most of the migrants were to return to their home countries at older ages. If this were true, the problem of cultural specific care would not be an issue at all (Bundesministerium für Familie, Frauen und Jugend, 2000). Today, we know, however, that this is not the case: Several studies of old age migrants show that their

return intentions are relatively low. The most important argument against a return at older ages is – next to family ties in Germany – the better health care system (Matthäi, 2004; Schenk, 2008; Dietzel-Papakyriakou, 2005; Dietzel-Papakyriakou and Olbermann, 1996).

Thus with the increased duration of stay of migrants in Germany and declining mortality in all age groups, not only is the proportion of the old age population rising, but with increasing age the probability of the individual's health being impaired also increases. It is widely thought that the care of these health-impaired elderly migrants is provided and secured by their family structure. But more and more migrants at higher ages are actually living in one-person households and do not want to be or just cannot be taken care of by their children (Dietzel-Papakyriakou and Olbermann, 1996; Matthäi, 2004; Schenk, 2008; Dietzel-Papakyriakou, 2005).

Taking into account that a growing number of working migrants who are getting older in Germany will someday have to receive care from the German health care and social security institutions the question has to be answered: Do the actual capacities of the German elderly care system match the challenges it is facing by having to take care of elderly migrants or is there a need for action? Amongst the challenges arising from a multi-cultural and multi-religious society are language use in care institutions, cultural and religious customs in health and palliative care.

As we have shown, Turks spent a higher proportion of their remaining life expectancy in illness than in health. Within the Turkish population, especially women display greater advantages in life expectancy, but also bigger disadvantages in health. It is also shown that during the remaining years of life, the Turkish migrant population is exposed to a higher risk of disability than the German one. According to our results, these people will be increasingly in need of health care and support by social security instruments. Further research is necessary to analyze how the social security system can adequately meet the specific needs of this migrant group.

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Appendix A

Sullivan Method

Calculation:

The calculation of life expectancy with or without disability starts with the calculation of the life table values.
(1) To compute the HSE with or without disability, the number of years lived (Lx) between each age is calculated by using survivors (lx) from a life table.
(2) By multiplying the values of person years lived (Lx) with the age and sex specific cross sectional prevalence rates (TTX or 1-TTx) the number of years lived in a specific health state (nLx(DF) or nLx(D)) is derived.
(3) By simply summing up all person years lived with or without disability (nLx(DF) or nLx(D)) from age group x up to x+n until the last age interval, the total number of years lived with our without disability (nTx(DF) or nTx(D)) can be calculated.
(4) To obtain the life expectancy with or without disability ((DFLE) or (DLE)) the total years lived in a specific health state (nTx(DF) or nTx(D)) is divided for each age interval by the number of survivors (lx) from the life table at that age (Jagger et al., 2007).

Appendix B

Age	MEN		Women	
	German	Turkish migrants	German	Turkish migrants
[0-14]	76.8	78	82.2	85
[15-19]	62.3	63.6	67.6	70.4
[20-24]	57.4	58.7	62.6	65.4
[25-29]	52.6	53.8	57.7	60.5
[30-34]	47.7	48.9	52.8	55.5
[35-39]	42.9	44.1	47.9	50.6
[40-44]	38.1	39.2	43	45.7
[45-49]	33.5	34.4	38.2	40.8
[50-54]	29	29.7	33.6	36
[55-59]	24.8	25.3	29	31.1
[60-64]	20.8	20.7	24.6	26.4
[65-69]	17	16.2	20.3	22
[70-74]	13.4	12.3	16.1	17.9
[75-79]	10.3	9	12.3	14.5
[80-84]	7.7	6.8	9	11.6
[85-89]	5.7	5.6	6.2	9.6
[90+]	4.4	4.4	4.3	10

Data source: own calculations based on AZR, Destatis