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Mental health and well-being in the first year of the COVID-19 pandemic among different population subgroups: evidence from representative longitudinal data in Germany

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Mental health and well-being in the first year of the COVID-19 pandemic among different population subgroups: evidence from representative longitudinal data in Germany

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ABSTRACT

Objectives: To examine potential deteriorations in mental health and well-being in the first COVID-19 pandemic year compared to the previous decade focusing on the following vulnerable subgroups of the German population: women with minor children in the household, those living without a partner, younger and older adults, those in a precarious labor market situation, immigrants and refugees, and those with pre-existing physical or mental health risks

Design: Analyses of secondary longitudinal survey data using cluster-robust pooled OLS models

Participants: More than 20,000 individuals (aged 16+) in Germany

Primary and secondary outcome measures: Mental Component Summary Scale (MCS) of the SF-12 and a single item on global life satisfaction (LS)

Results: We find a decline in the average MCS in the 2020 survey that is not particularly striking in the overall time course, still resulting in a mean score below those of all preceding waves since 2010. We find no change in LS from 2019 to 2020 against the background of a general upward trend. Regarding vulnerability factors, only the results on age and parenthood are in line with our expectations. In 2020, LS declined among the youngest adults; MCS declined among mothers (and women and men without children) but not fathers. Unlike respective comparison groups, refugees, those unemployed before the pandemic, and those with pre-existing mental health risks experienced no MCS declines in 2020, whereas persons living without a partner, the eldest, and those with pre-existing health risks exhibited continued increases in LS.

Conclusions: There is no evidence for substantial breakdowns in mental health or subjective well-being in the first pandemic year in the German population or its subgroups, particularly when considering developments of the previous decade. Since the majority of hypothesized vulnerable groups to pandemic stressors showed more stable MCS and LS, our results warrant further study.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

- The paper uses data from a large-scale longitudinal random sample of private households in Germany to uncover pandemic-related changes in the long-term trajectories of mental health and well-being.
- We employ analyses for two different indicators: The Mental Component Summary Scale (MCS) as a mental health measure and life satisfaction as a measure of subjective well-being.
- We consider heterogeneous trajectories of mental health and well-being by looking at several possible vulnerability factors, namely gender and children, living arrangements, age, precarious employment, migration status and pre-existing physical and mental health risks.
- No data for the succeeding pandemic years after 2020 are available yet, limiting our possibilities to assess changes in mental health and well-being trajectories across vulnerability groups further into the pandemic.

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INTRODUCTION

Since 2020 and for over two years, the COVID-19 pandemic has posed a threat not only to the physical health of populations globally but may have had direct and collateral effects on individuals' mental health and well-being [1, 2]. In the first year of the pandemic, populations worldwide were exposed to major new stressors, such as the fear of infection with a poorly understood virus, severe illness, or death, as well as the repercussions of measures to control the spread of the virus via social contact restrictions, as well as economic consequences [2, 3]. In Germany, the first case was reported at the end of January 2020, marking the start of phase zero with sporadic cases [4]. Soon, the first wave of infections from March to May [4] prompted a lockdown, including far-reaching contact restrictions in work and private settings, closures of schools, childcare facilities, non-essentials and gastronomy. After a summer with relatively few cases, a more severe second wave of infections and the beginning of the vaccination campaign followed between October 2020 and February 2021 [4] with a partial lockdown in fall 2020 and a more far-reaching lockdown from December 2020 [5] onwards. Owing to the pandemic and containment measures, declines in mental health and well-being in 2020 compared to previous years were widely expected [6, 7]. The early stages of the pandemic have been examined extensively regarding potential mental health declines in Germany [8] and internationally [9, 10, 11, 12]. However, findings are mixed, and clear conclusions cannot be easily drawn [8, 13].

Despite the crisis' global nature, some population groups are likely to have been disproportionally affected [14]. The burden of the pandemic – similar to measures for infection mitigation – may have been unequally distributed across different groups in the population throughout the pandemic. For instance, *older individuals* and those with *pre-existing health conditions* face a greater risk of falling severely ill with COVID-19 [1, 15], which likely led to an increased perception of threat and anxiety, particularly in the first year of the pandemic, before vaccinations were developed. *Parents* [5], but especially *mothers* [16, 17], may have

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been especially burdened by new childcare demands during school and childcare facility closures. *Younger adults* experienced social contact and other restrictions during a transitional life stage [18]. *Older* individuals and those *living without a partner* [18] faced increased risks of isolation due to contact restrictions and social distancing [1]. Individuals in precarious labor market situations, such as *those unemployed* or *marginally employed,* were more likely to endure personal repercussions from economic consequences of the pandemic [19, 20, 21]. *Migrants*, particularly *refugees* (used here to refer to all persons who move to another country for humanitarian reasons, independent of their legal situation), may have faced increased risks due to restricted access to quality healthcare [22], poorer labor market attachment [23], but also greater risks of isolation when social networks in the country of residence are less established [24, 25], and concerns for family and friends in their country of origin. Those with *pre-existing mental health conditions* may be particularly vulnerable to the potential mental health consequences of these various pandemic-related stressors [18].

Indeed, existing research provides some evidence for associations between these vulnerability factors and poorer mental health in the first years of the pandemic in Germany or elsewhere: Younger adults [8, 26, 27, 28], older adults [29], parents [27, 30], mothers [31], those who are socioeconomically disadvantaged [32, 33] but also those who are not [34, 35], immigrants and refugees [36, 37, 25], individuals living alone [38], those with pre-existing mental [8, 39] and physical health conditions [11] have been found to show an elevated risk of mental health deterioration. Fewer studies also examined life satisfaction, identifying corresponding declines in the overall German population [40, 41] and particularly for mothers [42]. Yet, these studies looked only at shorter time spans (i.e., one time point before the pandemic or retrospective measures).

In light of previous research, we identify three main research gaps. First, we argue that it is crucial to consider mental health and subjective well-being indicators because the pandemic

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may have different impacts on the latter, particularly on cognitive evaluative measures such as life satisfaction. Second, most previous research relied on cross-sectional data. In contrast, longitudinal nationwide representative studies on mental health and well-being pre- and post-pandemic in Germany are still rare (exceptions include [12, 28, 43, 44]). Moreover, existing studies on Germany often only consider more recent timespans or a single comparison period disregarding pre-pandemic longer trends [30, 35, 39, 45]. In other words, previous studies have been limited in their capacity to distinguish differences in mental health and well-being between observation periods before and during the pandemic that may be part of longer ongoing trends or reflect a degree of fluctuation observed in previous years from pandemic-related changes. Third, potentially vulnerable groups like migrant and especially refugee populations have scarcely been addressed in the existing literature.

The present study addresses these research gaps by examining the impact of the pandemic on the development of a general mental health measure, namely, Mental Component Summary Scale (MCS) [46], and life satisfaction, a cognitive component of well-being [47], using nation-wide, representative, longitudinal data from approximately 20,000 adults in Germany. We explore the heterogeneous impact of the pandemic by addressing a whole set of candidate vulnerability factors: being female with children under the age of 16 in the household, living without a partner, being a younger or older adult, migration status, various less secure forms of employment, and pre-existing physical and mental health risks. We hypothesized that these vulnerability factors are associated with declines in MCS and life satisfaction in the first pandemic year compared to the pre-pandemic period. We used data from the SOEP-CORE (17,611 individuals providing 75,266 person-year observations), IAB-SOEP Migration sample (2,018 individuals providing 6,978 person-year observations), and IAB-BAMF-SOEP Survey of Refugees (2,391 individuals providing 6,014 person-year observations) (the number of observations refers to the analytical sample on mental health and sociodemographic

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vulnerability factors), which encompass six survey waves for mental health (between 2010 and 2020) and eleven survey waves for life satisfaction (2010-2020). To analyze the developments in both indicators, we estimated weighted pooled OLS-regressions and assessed the pandemic impact by using interaction effects between vulnerability factors and survey year dummies.

METHODS

Public involvement

Patients or the public were not involved in the design and conduct of this research.

Study design and analytical sample

The data employed in the present study comes from the German Socio-economic Panel (SOEP, v.37, EU version), which comprises the general SOEP-CORE population survey, 2010-2020 [48], and two integrated studies covering the recent immigrants in Germany, i.e., the IAB-SOEP Migration Sample, 2013-2020 [49], and the IAB-BAMF-SOEP Survey of Refugees 2016-2020 [50].

The SOEP-CORE is a large-scale longitudinal representative study of private households in Germany, launched in 1984 and conducted annually [48]. The target population of the IAB-SOEP Migration Sample was drawn from the register data of the Federal Employment Agency (BA), the so-called Integrated Employment Biographies, in 2013 [49]. The study is representative of immigrants arriving in Germany since 1995 and descendants of immigrants

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born after 1976 [51, 52].[1] The survey is based on a concept of households according to which every adult household member is interviewed. The IAB-BAMF-SOEP Sample of Refugees in Germany was launched in 2016, in the aftermath of the surge of refugee migration to Europe in 2015 [50]. The data were drawn from the Central Register of Foreigners [53] and are representative of refugees who arrived in Germany between January 2013 and December 2016 (irrespective of their current legal status). It is based on the same household concept as that described for IAB-SOEP. By using appropriate sample weights, SOEP data allow us to make inferences for the population in Germany.

For analyses, we restricted the original data to the years 2010-2020 to minimize the lingering effects of the financial crisis in 2008/2009, which had a negative public health impact [54, 55]. Moreover, we considered 2010-2020 observations of respondents who participated in the survey year 2020, i.e., pandemic survey year, and in at least one pre-pandemic survey year. Due to specifics of the fieldwork, SOEP-CORE interviews were collected between January 10th and December 8th 2020, interviews of the IAB-SOEP Migration Sample between March 4th 2020 and August 12th 2020, while the IAB-BAMF-SOEP Sample of Refugee interviews started on August 24th 2020 and were completed on February 15th 2021. We included data from respondents interviewed on January 31st or later (exclusion of four respondents), the day after WHO declared COVID-19 a "public health emergency of international concern" and three days after the first case in Germany [56].

[1] As part of the SOEP-CORE study, the last immigrant refreshment sample dates back to 1995.

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These data restrictions resulted in a sample of 22,020 individuals for the analysis of mental health trajectories by sociodemographic vulnerability factors that have been interviewed up to 6 times (4.5 on average). While about 80 percent of interviews in our utilized SOEP-CORE and IAB-SOEP Migration Sample data were conducted by the end of May 2020, interviews as part of the IAB-BAMF-SOEP Survey of Refugee only started in August 2020, and 83 percent were conducted by the end of 2020. All analyses in this study are weighted with the sample weights provided with the survey data to compensate for distortions caused by over- or underrepresented groups, and non-response.

Outcome variables

We consider *mental health* and *subjective well-being* as dependent variables. Our measure of mental health was the Mental Component Summary Scale (MCS) from the Short-Form Health Survey (SF-12), which includes six items capturing vitality (energy vs. fatigue), social functioning, role limitations due to emotional problems, and emotional well-being over the past four weeks on a five-point scale [46]. The MCS-12 has been tested to be able to screen for depression and anxiety disorders [57, 58] and has been commonly used in previous research to assess mental health-related quality of life [59, 60]. We formed composite MCS-12 scores ranging from 0 to 100 normalized to the 2004 SOEP wave for comparability [61]. MCS was

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collected in two-year intervals from 2010 until 2020, providing one pandemic-time survey date (between January 30th 2020 and February 15th 2021).[2]

Our measure of subjective well-being is a single item on global life satisfaction, a well-established 11-point scale ranging from 0 (completely dissatisfied with life) to 10 (completely satisfied with life). Life satisfaction is generally conceived as the cognitive component of subjective well-being (e.g. [62]). Life satisfaction was collected annually, yielding pandemic-time observations between January 30th 2020 and February 15th 2021.

Vulnerability factor variables

The vulnerability factors to be examined were measured using the following variables: Gender and having children under the age of 16 living in the same household were grouped in a variable *gender and children* with the following categories: (1) men without children (reference category), (2) men with children, (3) women without children, and (4) women with children. To measure *living arrangements*, we contrasted living without a partner (including single, married or in a registered partnership living separately, widowed) with cohabiting with a partner (irrespective of marriage).

Age was grouped into the following five categories: (1) 16-25 years (reference category), (2) 26-45 years, (3) 46-59 years, (4) 60-74 years, or (5) 75 + years old. The age group of 16-25-

[2] The year 2017 is an exception. Here, a new refreshment sample of more than 2,000 refugees was added, who were asked about the MCS in their first interview, outside the regular cycle. For this reason, we report the 2017 MCS only for the vulnerability factor migration status in our main results.

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year-olds represents young adults in education or early career. The second age group comprising persons aged between 26-45 includes working adults. Those aged between 46-59 represent a middle age group with a potentially more established and stable career path. Two last groups aged between 60–74 and those aged 75 and above are those most at risk of severe courses of disease due to COVID-19 infection [63, 64].

The variable for *migration background* is derived based on country of birth and legal status at arrival. The variable includes the following categories: (1) native-born ethnic majority (reference category), (2) immigrant (no refugee), (3) descendant of immigrant (no refugee), (4) refugee.

Employment status includes the following categories: (1) full-time, part-time employed or other (training/apprenticeship, sheltered workshop) (reference), (2) marginally employed, (3) self-employed, (4) unemployed (not working but job-seeking), and (5) inactive (retired or those not working but not job seeking).

An indicator for pre-existing (i.e., pre-pandemic) *mental health risks* was coded to one for those who reported having received a diagnosis of depression or burnout at some point in their lives, and zero otherwise. An indicator for pre-existing *physical health risks* was coded to one for those who reported having been diagnosed with asthma, cardiopathy, cancer, stroke, or hypertension at some point in their lives, and zero otherwise. Pre-existing conditions were coded such that they were carried forward from the first report and no conditions were carried backward.

To ensure the correct order of changes in time, we lagged the vulnerability factor values for employment status and health status from the last pre-pandemic survey wave to prevent reverse causality issues. We included corresponding dummy variables indicating missing information to capture item non-response in vulnerability factor variables.

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Control variables

We account for potential confounders that may vary by vulnerability factors and simultaneously shape mental health and life satisfaction. Specifically, we control for the *highest educational degree* aggregated into: (1) lower secondary education (reference category), (2) secondary or short-cycle non-tertiary education, (3) bachelor's degree or equivalent, and (4) master's degree or doctorate. We further control for square meters of *living space* per person (linear and squared) to account for the household's availability of private space per person. Additionally, we control for *district type* in which the respondent resides categorized into (1) independent large city (reference category), (2) urban district, (3) rural district with some density, and (4) sparsely populated rural district [65]. We control for the average *unemployment rate* in the local labor market region in the interview month to account for the local economic situation. Since Germany's counties and independent cities are connected by commuter linkages so that local labor markets extend beyond the boundaries of 401 administrative districts, we use the 141 functional local labor markets defined by Kosfeld and Werner [66]. To control for temporal trends, we include *survey year* fixed effects and the calendar *month of the interview*. Note that in the analyses on life satisfaction we include yearly dummies from 2010 (reference) to 2020. Since mental health was surveyed in two-year intervals, we consider 2-year dummies. Tables A1-A3 in the appendix show descriptive statistics for the vulnerability factors and control variables.

Statistical analyses

All analyses were conducted in Stata version 17.0. Our analyses of the different vulnerability factors were two-part: we separated analyses pertaining to structural factors and those pertaining to pre-existing health conditions. In the analyses pertaining to structural vulnerability factors, we applied pooled Ordinary Least Squares (OLS) models (with standard errors clustered at person-level) regressing MCS score and life satisfaction on the vulnerability factor

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variables, one interaction term per model of each vulnerability factor variable by the survey year variable, and control variables. Correspondingly, we calculated one model per vulnerability factor variable for each outcome variable to include only a single interaction term per model.

We analyzed pre-existing health risks as vulnerability factors separately from the other factors because of their uniquely close relationship with the outcome variables. Another reason is reduced sample size, as information on pre-existing health risks is unavailable for most refugees. These pooled OLS models predicting MCS or life satisfaction included dummies for physical or mental health risks, one interaction term per model of physical or mental health risks by the survey year variable, as well as all remaining structural vulnerability factors and further controls.

We calculated predictive margins for the outcome variables for each vulnerability factor sub-group from the regression results. Specifically, we estimated the following regressions separately for each of the five vulnerability factor groups $V \in \{GENDCHILD, LIVARR, AGEGRP, MIG, EMPL\}$:

$$Y_{i,r,t,v} = \boldsymbol{\alpha}_v 1[\boldsymbol{surveyyear} = \boldsymbol{t}] + \beta_v GENDCHILD_{i,t} + \gamma_v LIVARR_{i,t} + \delta_v AGEGRP_{i,t} + \zeta_v MIG_{i,t} + \eta_v EMPL_{i,t} + \boldsymbol{\theta}_v 1[\boldsymbol{surveyyear} = \boldsymbol{t}] \times V_{i,t} + \boldsymbol{\vartheta} \boldsymbol{X}_{i,t} + \boldsymbol{\iota} \boldsymbol{X}_{r,t},$$

where Y is either MCS or life satisfaction of individual i in region r in survey year t and bolt font indicates vectors. Concerning vulnerability factors, *GENDCHILD* relates to gender and children, *LIVARR* to living arrangements, *AGEGRP* to age group, *MIG* to migration status and *EMPL* to employment status. $X_{i,t}$ denotes individual control variables and $X_{r,t}$ regional control variables. Note that individual vulnerability factors vary in the pre-pandemic period, while for the post-pandemic period, they are fixed to the last observed pre-pandemic values. The main

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coefficient of interest θ refers to the interaction effects of the survey year dummies with the vulnerability factor *v*.

RESULTS

Development of MCS and life satisfaction in the German population

We begin by examining the overall development of the MCS and life satisfaction in the German population in the recent decade. As shown in Figure 1, in the pandemic year 2020, the average MCS significantly declined to a level below previous survey waves since 2010. We find a 0.7-point reduction in mean MCS (on the theoretical scale between 0 to 100) in the population in 2020 compared to the last pre-pandemic measure (2018). While this decline points to a possible pandemic-related impact on mental health, it is not a marked change in the overall time course and could be a continuation of declines seen since 2016. At the same time, we do not observe any change in the population average life satisfaction from 2019 to 2020. Considering the general upward trend of life satisfaction between 2010 and 2020, the absence of change may be linked to a pandemic-related attenuation. In the following, we examine whether the observed trends differ between population subgroups with different vulnerabilities to the pandemic.

– Figure 1 –

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Development of MCS by vulnerability factors

As shown in Figure 2, Table A4 and Table A5, most sociodemographic groups show a significant decline in estimated MCS from 2018 to 2020:[3] (1) women with and without children as well as men without children, (2) those cohabiting with a partner as well as those living without a partner, (3) all age groups, (4) the native-born ethnic majority as well as immigrants and their descendants (but not refugees) and (5) those in full-/ part-time employment, self-employed and those who are inactive. Likewise, following Figure 3 and Table A6, (6) those with and without certain pre-existing physical health risks and (7) persons without certain pre-existing mental health risks show a significant decline in the estimated MCS. Yet, in the context of the overall trajectories since 2010, the MCS declines from 2018 to 2020 in the outlined groups are not of a remarkable magnitude or otherwise particularly striking.

– Figure 2 –

– Figure 3 –

Five groups did not show estimated MCS declines from 2018 to 2020: (1) men with children, (2) the marginally employed and (3) unemployed group, (4) refugees, and (5) those with prior mental health risks. For the marginally employed individuals, we observed declines as well, yet, these were statistically insignificant; however, it should be noted that the sample size in

[3] In Table A4 we show coefficients for all variables of the regression behind Figure 2. In Table A5, we report the main (non-interacted) effect of the dummy variable 1[survey year = 2020] for varying base-categories in the vulnerability factor variables.

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this group is small and limits statistical power. There is no evidence from the overall time trajectories that the absence of a decline in the other four groups may represent an attenuation of a previous upward trend. Even though these groups' MCS may have improved without the pandemic, it can be ruled out that the pandemic led to a decline from previous levels. Note that individuals with prior mental health risks exhibit by far the lowest MCS of all groups throughout the observation period; the unemployed exhibit the second lowest levels of MCS.

Development of life satisfaction by vulnerability factors

In contrast to the results for the MCS, most sociodemographic groups do not show pronounced changes in estimated life satisfaction from 2019 to 2020 (see Figure 4 and Tables A7, A8). The only exceptions were decreases in life satisfaction among the youngest age group (ages 16-25), full-/ part-time employed, the self-employed, and those without pre-existing physical health risks. Persons living without a partner, the two oldest age groups (ages 60-74 and 75 and over), those inactive in the labor market, and the unemployed group exhibit significant increases in life satisfaction from 2019 to 2020. Pre-existing physical or mental risks are associated with a significant increase in life satisfaction from 2019 to 2020. In contrast, persons without pre-existing physical risks show some deterioration in the same period (See Figure 5 and Table A9).

– Figure 4 –

– Figure 5 –

Looking at the overall time trajectories of estimated life satisfaction in Figures 4 and 5, none of the significant increases or decreases from 2019 to 2020 appear particularly striking in the context of the observation period between 2010 and 2020. In most groups, life satisfaction has increased gradually over these ten years. Thus, the absence of a change from 2019 to 2020 could represent pandemic-related attenuations, while significant increases may be the

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continuation of ongoing trends. Increases for persons without a partner, the oldest two age groups, and persons with pre-existing physical or mental risks visually do not stand out against the trend of increasing life satisfaction before 2019. However, these increases are still unexpected, given that they are all found within hypothesized vulnerable groups and not their hypothesized non-vulnerable counterparts. The increases among inactive and unemployed persons appear slightly more marked in the time course. Concerning the observed significant declines, the overall time trends provide context as follows: in the youngest age group and the employed group, decreases are relativized by year-to-year fluctuations of similar magnitudes before 2019. However, the youngest age does reach a life satisfaction score estimate numerically below most previous estimates in the observation period. For the self-employed, it is quite striking that the decrease goes against a general trend of increase. The significant reduction in life satisfaction from 2019 to 2020 among persons without prior physical health risks also happens against an overall increasing trend; however, 2016 to 2017 saw an even slightly greater decline.

While life satisfaction results are largely inconclusive in light of longer time trends, it is noteworthy that despite the pandemic, several hypothesized vulnerable groups showed an increase in life satisfaction, and many groups exhibit no change, demonstrating the clear absence of a pandemic-related life satisfaction breakdown in most subgroups. Overall, only four out of 24 groups (youngest age group; full-/ part-time employed; self-employed; without pre-existing physical health risks) may have experienced pandemic-related declines in life satisfaction compared to the year before.

DISCUSSION

Using panel data, we examined the development of mental health (measured using the Mental Component Summary Scale, MCS-12) and subjective well-being (indicated by life satisfaction)

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in more than 20,000 individuals in Germany before and during the pandemic (2010-2020). We found a decline in the MCS population average from 2018 to 2020. Considering that most of our data was collected in the early phases of the pandemic, our results are in line with previous findings for Germany, indicating increased symptoms of depression and anxiety in April 2020 [37] and in June 2020 [28] compared to previous years, but not with others [67]. While the mean MCS score in 2020 is below any mean score observed since 2010, this finding needs to be evaluated in light of previous trends suggesting a decline from 2016 to 2018. Further research is therefore needed to disentangle the potential effects of the pandemic from general time trends. Our results for life satisfaction also stress the importance of longitudinal analyses and the consideration of ongoing time trends. While our finding of no change in life satisfaction in 2020 supports resilience, we observed a rising trend in life satisfaction in our data before 2020. Hence, the absence of a decline from 2019 to 2020 may represent a pandemic-related attenuation.

Overall, declines in mental health and the absence of declines in life satisfaction suggest that cognitive evaluations of life satisfaction may have been more robust than mental health. At the same time, different specifications of the measures need to be considered. For measuring MCS, respondents are asked to evaluate specific aspects with respect to the last four weeks *("How often in the last four weeks…")* while the assessment of life satisfaction is formulated more generally *(translated from the German version: "How satisfied are you currently, all in all, with your life")*. These temporal specifications may be particularly important in fast-moving times like the pandemic. Overall, our analyses stress the importance of considering several indicators for a deeper understanding of the general psychological effects of the pandemic.

With regard to the examined candidate vulnerability factors, most of our findings did not match our expectations. Starting with the vulnerability factor of gender and children, MCS deteriorated in all considered subgroups, except for fathers, whereas none of these groups

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experienced life satisfaction deterioration. Our results, therefore, only partly conform to previous studies consistently reporting pandemic-related worsened mental health for women [8, 13] and mothers [31]. However, our findings contradict our expectations to find declines for parents (compared to non-parents). However, the stable MCS levels among fathers conform to previous studies pointing to fathers' increased family satisfaction after changing to short-time work [42]. Spending more time with family, e.g., through working from home policies and school and childcare facility closures, without bearing most of the childcare burden [5], may have dampened the negative effects of the pandemic for fathers. Overall, consideration of gender and parental status proved crucial in understanding potential pandemic impacts from the gender perspective.

Our analyses for the vulnerability indicator for living arrangements revealed declines in MCS in both groups and even a significant increase in life satisfaction among individuals living without a partner compared to no change among those cohabiting with a partner. These results only partly support our expectations. Both groups' mental health declines may hint at different risks in both groups: On the one hand, decreased MCS of those living without a partner might reflect the challenges imposed by the pandemic. Social isolation and loneliness due to social distancing has been highlighted as a key concern for mental health during the pandemic [68], and being single has been previously linked to greater loneliness during the pandemic [38]. On the other hand, decreased MCS of individuals cohabiting with a partner might be related to external stress due to the pandemic, such as autonomy-connection tensions [69]. This external stress is associated with an increased risk of marital dissolution and challenges the partnership as such, exacerbating existing problems or creating new ones [70, 71]. Our findings of a potential attenuation of life satisfaction among those living with a partner but not among those living without a partner may also relate to these stressors. In sum, these results, and the

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challenge they pose for interpretation highlight the complexity of potential risk and resilience factors.

We found MCS declines from 2018 to 2020 for all age groups, contrary to our hypotheses of an increased risk for decline among the youngest and the eldest. For life satisfaction, we found increases from 2019 to 2020 for the older age groups (60-74 and 75+), contrary to our hypotheses, and decreases for 16–25-year-olds, in keeping with our hypotheses. These declines in life satisfaction and those in MCS of the youngest age group support the previous literature showing high psychological distress for young adults during the pandemic [26, 27]. Early adulthood functions as a critical period and includes necessary steps for interpersonal development like identity formation, separation from childhood family or significant decisions for education and career development [72, 73]. Social isolation measures and school closures drastically affected the daily life of young adults.

For the vulnerability factor immigration status, we found deteriorating MCS from 2018 to 2020 for all (including those of the native-born ethnic majority) except refugees and no change in life satisfaction from 2019 to 2020 for any of these groups. Our results for refugees are consistent with Entringer et al. [74], who found no increase in refugees' psychological distress from 2016 or 2019 to 2020. At this point, it remains unclear whether the results are due to changes in refugee population compositions, as those with poorer mental health were more likely to have left Germany [74]. Our results for life satisfaction also contrast Goßner, Kosyakova and Laible [25], who revealed negative effects for the specific event of the second nationwide lockdown in Germany on refugees' life satisfaction. Hence, a closer look at specific time periods might yield different results. The absence of significant drops in refugees' MCS in our analyses could be attributed to different underlying factors. First, refugees' mental health may improve over time in the host country as post-migration stressors decrease and individuals become better adapted to the new environment [75], mitigating or eliminating any potential

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negative pandemic effects. Second, refugee populations may also be more resilient to stressors (such as the pandemic) because of their previous experiences and personal characteristics [76]. It should also be noted that different field periods might limit comparability between groups by migration status. At the same time, these differences do not affect the finding of an absence of pandemic-related declines in the refugee population.

Our findings for MCS and life satisfaction among employed (negative effects) and unemployed (positive or no effects) individuals resonate with the results for the UK showing increased mental distress for individuals employed before the pandemic and no such effect for those unemployed or inactive [27]. However, we do not examine the possible impact of becoming unemployed during the pandemic, which has been associated with heightened depression symptoms in Germany [77]. The negative trend for the self-employed group in both the MCS and life satisfaction is consistent with findings for the UK highlighting psychological distress among the self-employed during the pandemic [78]. Financial worries seem to mediate the pandemic's impact on mental distress [79, 80], as the self-employed were more likely to expect income losses during the pandemic and were less likely to be considered in government assistance programs. Contrary to our expectations, the marginally employed exhibited no MCS declines. However, the observation numbers for this group are small yielding low statistical power. Mixed results were also found for the inactive with decreasing MCS and increasing life satisfaction from the last pre-pandemic observation to 2020. We take from these results that the choice of measure for psychological well-being needs to be carefully considered and the use of multiple measures is critical to check the robustness of results.

Individuals with pre-existing physical health risks did not differ from those without these pre-existing risks with regard to MCS trajectories into 2020. Patterns in life satisfaction were the direct opposite of our expectations, with the former group showing increases between 2019 and 2020 and the latter group showing decreases. While the increase in the former group may

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merely represent a continuation of a time trend already observed since 2016, the complete absence of any potential pandemic effects is still surprising, considering the risk of severe COVID-19 cases [15] in this group. Therefore, further research is required to determine the extent to which pre-pandemic physical health risks enabled individuals to employ coping mechanisms in the face of the pandemic.

For individuals with pre-existing mental health risks, we found no change in the MCS from 2018 to 2020 and an improvement in life satisfaction from 2019 to 2020. Given the previous developments over the years, neither finding stands out, making the pandemic impact on pre-existing mental health risks unclear. At the same time, we find a decline in the MCS and no change in life satisfaction for individuals without pre-existing mental health risks. While these results contrast our expectations and some previous literature [81, 82, 8], a systematic review and meta-analysis present comparable results revealing no evidence of a change in symptoms at the beginning of the pandemic among those with pre-existing mental health conditions, while overall increases in symptoms were found compared to pre-pandemic levels [11]. The authors of this meta-analysis argue that this may be due to the positive impacts of lifestyle changes linked to transmission mitigation measures for this group as well as to regression to the mean effects, whereby naturally occurring recovery over time results in improvements in mental health outcomes over time in those with pre-existing conditions. Likewise, increased mental health problems at the beginning of the pandemic were noted among persons without a pre-existing clinical depression diagnosis compared to no change among persons with such diagnosis in the UK [34] and even improvements in those with the most severe mental health disorder burden in the Netherlands [83].

The results of the development of MCS during the pandemic raise the question of clinical relevance. Among all groups, the MCS declines from the last pre-pandemic observation by no more than about one point on the theoretical 100-point scale. Although this average decline is

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of small magnitude, some groups may experience effects that are of clinical relevance. To explore the clinical relevance of our findings, we dichotomized the MCS according to a threshold identified as clinically relevant in previous studies of the SF-12-based MCS. Specifically, the cutoff value of 45 has been found to have high predictive accuracy of depression and anxiety disorders, e.g., in the Australian general population comparing the MCS-12 to physician diagnoses [57] and in six European countries, where scores on the MCS-12 were compared with a WHO-issued method (CIDI 3.0) for determining mental disorders in in-depth interviews [58]. The replications of our main results are shown in Tables A10, A11 (regressions) and Figures A1, A2 (corresponding predictive margins) in the Appendix. Conforming to our main results, fathers, those living without a partner, refugees, and persons with pre-existing mental health risks are less likely to fall below the threshold of 45 during the pandemic than their corresponding comparison groups. For the comparison groups, the probability of falling below the clinically relevant threshold increases by four to five percentage points.

Limitations

We need to address some limitations. First, the distribution of interview modes in SOEP has changed during the pandemic due to legal contact restrictions and voluntary self-protection measures of respondents and interviewers [84]. The survey methodology literature has found effects of survey mode, particularly when collecting health data [85], with face-to-face surveys leading to a higher response rate [86] and fewer reports on mental health problems [87]. In the 2020 survey, the switch to telephone interviews (CAPI-TEL) was above average among refugee respondents, while self-administered interviews were not offered to these groups. Among other respondents, the share of CAPI interviews decreased from 68 to 39 percent from 2019 to 2020 and self-administered interviews increased to just under one-third [84]. Against this background, it cannot be ruled out that a) changes in survey mode pre- versus peri-pandemic

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may affect time trends in the observed indicators, and that b) different adjustments in interview mode between refugees and non-refugees may distort the group comparisons in health indicators.

Second, our data is representative of adult individuals living in private households in Germany. Since healthy individuals are over-represented in such surveys [88], it is to be expected that individuals who are not encountered privately due to particularly severe courses of illness (e.g., due to hospitalization) are systematically underrepresented in our sample. During the 2020 field period (January 2020 to February 2021), about 10 percent were hospitalized [4]. However, with just over 2.2 million reported cases of infection by the end of January 2021 [89], only a small share of the population had contact with the virus, even taking into account unreported cases that may be many times higher. Hence, we expect the bias due to such systematic wave drop-outs to be small and consider the pandemic effects we measured as representing conservative lower limits.

Third, since a substantial share of observations came from before phase I of the pandemic in Germany, and most of the rest of our data only captures the initial phase of the pandemic, these may have resulted in underestimation of any pandemic-related effects on mental health and subjective well-being. On the one hand, the first year of the pandemic may have been particularly stressful in some regards (lack of knowledge of the virus' biology and health risk, first-time contact restrictions etc.). On the other hand, there is some empirical evidence for mental health declines, particularly in later stages, starting from late 2020 [67]. Further research covering a longer pandemic time-span in the population subgroups is called for.

Fourth, we cannot make a concluding statement regarding the resilience of the most vulnerable groups. They could reflect an individual psychological state resulting from pre-pandemic hardships, which taught them coping strategies, or reflect successful political measures implemented to alleviate hardships. It may also be that efforts to contain the spread of the virus

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even conferred some advantages to specific groups, for example, by decelerating life in different ways. In order to disentangle micro and macro effects in this respect, a quasi-natural experimental design between regions that implemented different anti-COVID-19 measures would be necessary.

CONCLUSION

The present study adds to a growing literature on mental health and well-being development in the first pandemic year. It is among the rare studies that are nationally representative, longitudinal, include representative estimates from migrant and refugee populations, and stands out for its 10-year pre-pandemic observation period. Yearly or biannual estimates this far back in time before the pandemic allow for a more comprehensive contextualization and assessment of the significance of any potential pandemic-related changes.

From a broader perspective, our results reveal three points. First, the findings for pandemic impact must be contextualized into longer-term developments. As we show, changes from the last pre-pandemic observation to 2020 were several times put into a different perspective when considering overall time trends. Second, our study shows pronounced differences between vulnerability groups, confirming that the pandemic did affect some subgroups disproportionally, and that vulnerability factors are worthy of consideration. Third, given the cases where we found different effects on mental health compared to life satisfaction, our study shows the importance of considering other measures to assess the psychological impact of stressful events such as the pandemic.

CONTRIBUTORS

PJ, YK, CK, and LW conceived the study and planned the analyses with feedback from SH, JJ, EH, TMTT, and MB. PJ and YK conducted the analyses. PJ, YK, CK, LW and LG wrote the

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manuscript. JJ, EH, MB and SH provided feedback on the manuscript. All authors read and approved the final manuscript.

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COMPETING INTERESTS

None declared

RESEARCH ETHICS

This study involves human participants but was not approved by an Ethics Committee or Institutional Board. The study uses secondary survey data that is generally available for researchers upon registration with the research data center at the German Institute for Economic Research (DIW) in Berlin. Respondents are informed that their participation in the survey is voluntary and that they will not suffer any disadvantages if they do not participate. Before the data are delivered to researchers, appropriate measures are taken to ensure the anonymity of the respondents.

DATA AVAILABILITY STATEMENT

The data analyzed in this study is subject to the following licenses/ restrictions: This article uses data from the SOEP-CORE (DOI: https://www.doi.org/10.5684/soep.core.v37eu), the IAB-BAMF-SOEP Survey of Refugees (DOI: 10.5684/soep.iab-bamf-soep-mig.2020) and the IAB-SOEP Migration Sample (DOI: 10.5684/soep.iab-soep-mig.2020). The German SOEP is an ongoing representative yearly panel survey of private households in Germany at the German

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Institute for Economic Research (DIW). The IAB-BAMF-SOEP Survey of Refugees is a representative longitudinal survey conducted jointly by the Institute for Employment Research (IAB), the research data center of the Federal German Office for Migration and Refugees (BAMF), and the German SOEP at the DIW. The IAB-SOEP Migration Sample is a longitudinal survey representative of the migrant population in Germany conducted jointly by the IAB in Nuremberg and the German SOEP at the DIW Berlin. Data access was provided via a Scientific Use File supplied by the Research Data Centre (FDZ) of the DIW. All documentation concerning both surveys, including questionnaires and data manuals, are made available by the DIW (https://www.diw.de/en/diw_01.c.603160.en/integrated_studies.html). Due to German Data Protection legislation, we cannot make the original data or the generated dataset available. Researchers can, however, apply for data access via the DIW. The computer codes for data preparation and analyses are available at https://osf.io (URL not shown for the review process). This study design and analysis was not preregistered.

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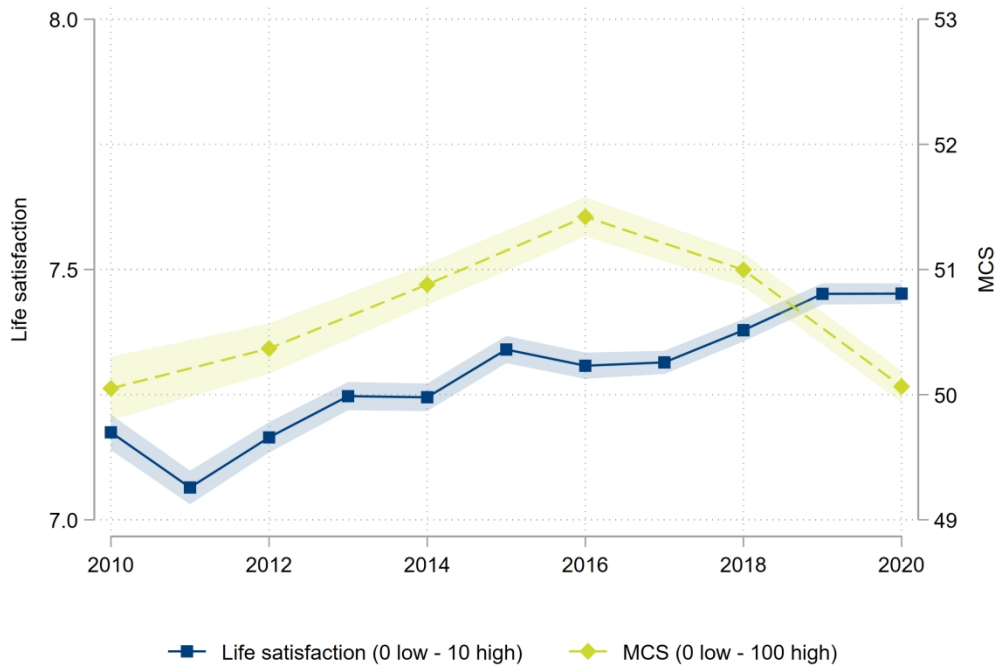

Figure 1: MCS and life satisfaction between 2010-2020
Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

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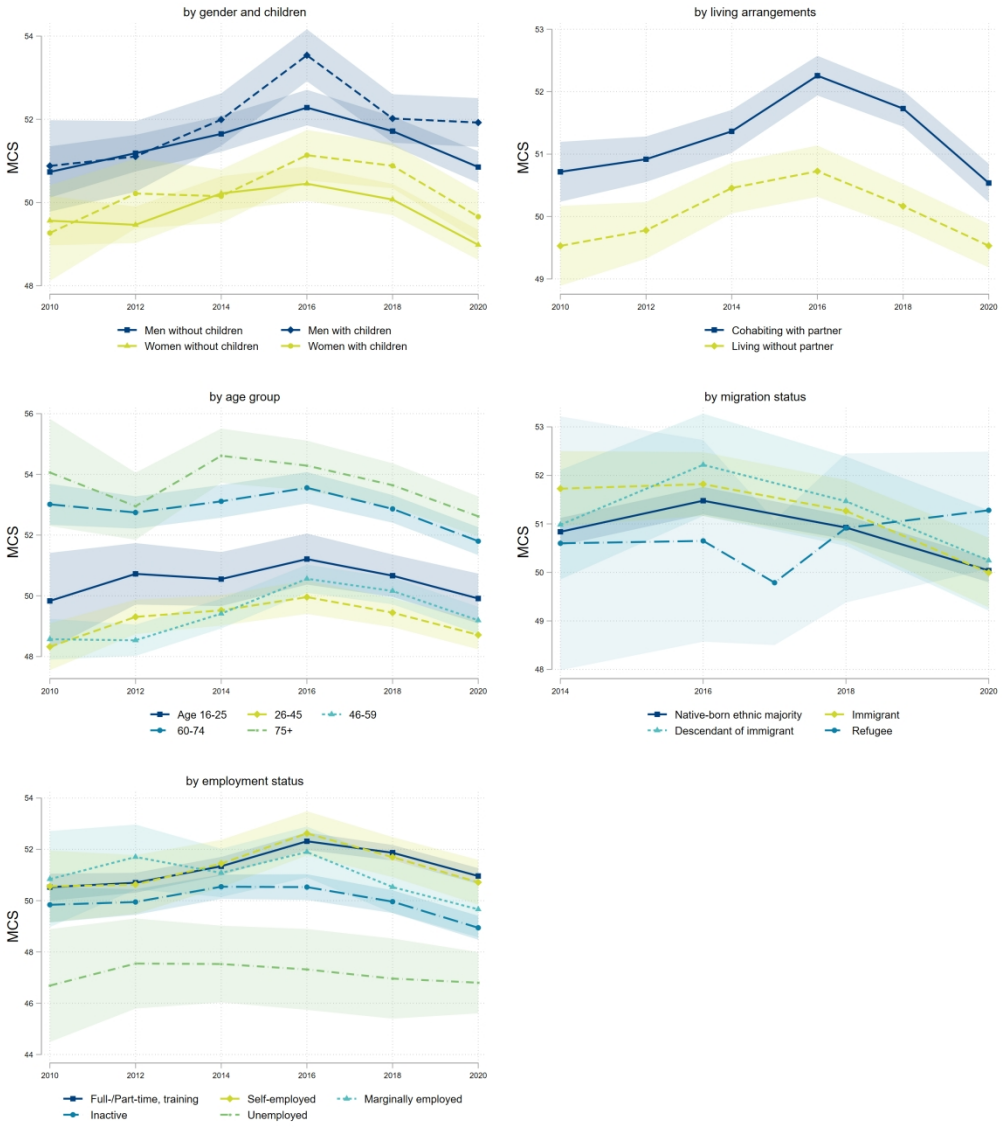

Figure 2: Predictive margins for MCS by sociodemographic vulnerability factors
Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.
Notes: Predictive margins partial out the main effects of vulnerability factor variables from other panels and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

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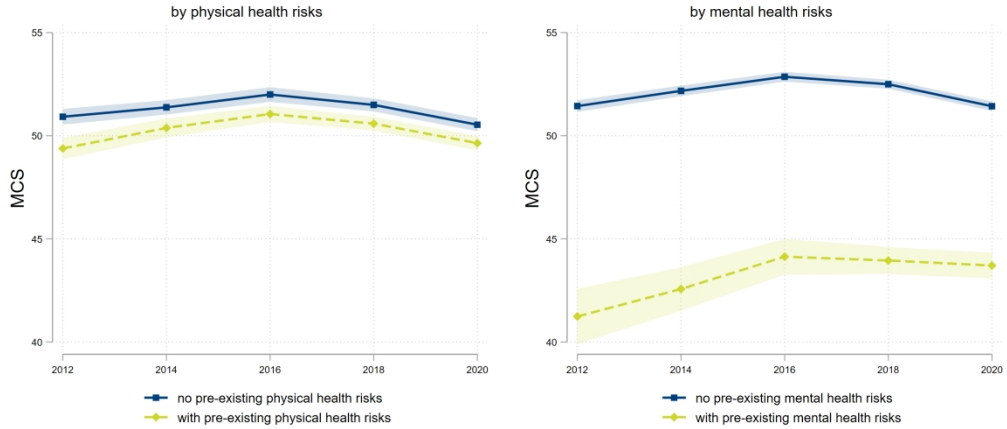

Figure 3: Predictive margins for MCS by pre-existing health conditions
Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.
Notes: Predictive margins partial out the main effects of sociodemographic vulnerability factor variables and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

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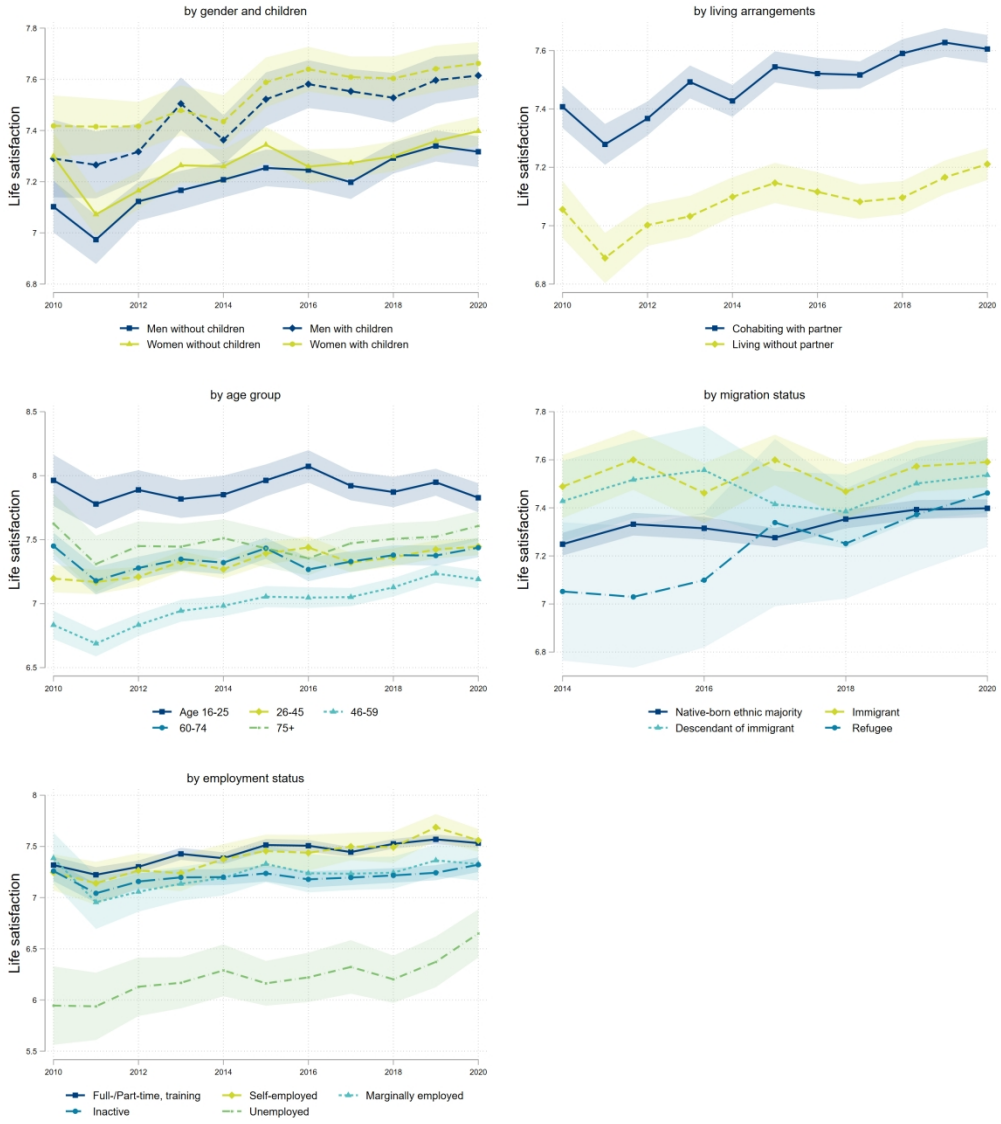

Figure 4: Predictive margins for life satisfaction by sociodemographic vulnerability factors
Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.
Notes: Predictive margins partial out the main effects of vulnerability factor variables from other panels and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

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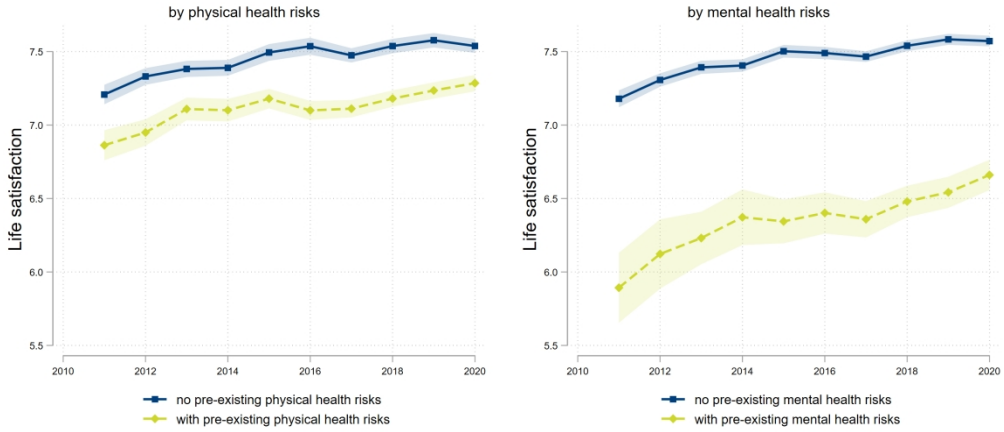

Figure 5: Predictive margins for life satisfaction by pre-existing health conditions
Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.
Notes: Predictive margins partial out the main effects of sociodemographic vulnerability factor variables and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

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APPENDIX

Table A1: Descriptive statistics on vulnerability and control variables

	mean	sd	min	max	N
Survey year: 2010	5.35	22.50	0.00	100.00	184,275
2011	5.59	22.97	0.00	100.00	184,275
2012	6.46	24.58	0.00	100.00	184,275
2013	7.00	25.51	0.00	100.00	184,275
2014	7.84	26.88	0.00	100.00	184,275
2015	8.63	28.08	0.00	100.00	184,275
2016	9.61	29.48	0.00	100.00	184,275
2017	10.43	30.56	0.00	100.00	184,275
2018	11.63	32.06	0.00	100.00	184,275
2019	12.87	33.48	0.00	100.00	184,275
2020	14.61	35.32	0.00	100.00	184,275
Men without children	38.37	48.63	0.00	100.00	184,185
Men with children	9.73	29.64	0.00	100.00	184,185
Women without children	40.54	49.10	0.00	100.00	184,185
Women with children	11.36	31.73	0.00	100.00	184,185
Age: 16-25	7.83	26.86	0.00	100.00	184,275
26-45	30.10	45.87	0.00	100.00	184,275
46-59	28.37	45.08	0.00	100.00	184,275
60-74	23.22	42.22	0.00	100.00	184,275
75+	10.48	30.64	0.00	100.00	184,275
Highest educational degree: Lower secondary	12.58	33.16	0.00	100.00	182,839
Short cycle non-tertiary	62.23	48.48	0.00	100.00	182,839
Bachelor or equivalent	15.27	35.97	0.00	100.00	182,839
Master or Doctoral	9.93	29.91	0.00	100.00	182,839
Cohabiting with partner	52.70	49.93	0.00	100.00	183,605
Living without partner	47.30	49.93	0.00	100.00	183,605
Native-born ethnic majority	82.92	37.63	0.00	100.00	184,236
Immigrant	10.89	31.15	0.00	100.00	184,236
Descendant of immigrant	4.51	20.76	0.00	100.00	184,236
Refugee	1.67	12.82	0.00	100.00	184,236

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Employment: Full-/Part-time, training	51.41	49.98	0.00	100.00	182,729
Self-employed	5.60	23.00	0.00	100.00	182,729
Marginally employed	4.87	21.53	0.00	100.00	182,729
Inactive	34.14	47.42	0.00	100.00	182,729
Unemployed	3.98	19.55	0.00	100.00	182,729
Living space per person in household (square meters): < 16	1.18	10.80	0.00	100.00	184,275
16-30	20.30	40.22	0.00	100.00	184,275
31-45	29.86	45.76	0.00	100.00	184,275
46-60	22.34	41.65	0.00	100.00	184,275
61-75	12.62	33.21	0.00	100.00	184,275
> 75	13.70	34.39	0.00	100.00	184,275
Pre-existing physical health risks	44.46	49.69	0.00	100.00	158,560
Pre-existing mental health risks	13.44	34.11	0.00	100.00	160,089
District-type: Independent large city	31.55	46.47	0.00	100.00	181,788
Urban district	36.55	48.16	0.00	100.00	181,788
Rural district with some density	16.56	37.17	0.00	100.00	181,788
Sparsely populated rural district	15.34	36.04	0.00	100.00	181,788
Unemployment rate in local labor market region	6.46	2.66	1.40	19.48	181,632

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

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Table A2: MCS by vulnerability/control variable and year

Survey year:	2018			2019			2020		
	Mean	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**
Men without children	51.90	9.56	6,389	46.76	12.47	25	51.10	10.05	7,957
Men with children	51.42	8.75	3,620	51.95	10.74	37	51.10	8.52	4,212
Women without children	50.39	10.55	6,960	50.57	13.58	8	49.33	10.42	8,179
Women with children	49.63	9.24	4,317	53.22	7.80	40	48.25	9.96	4,702
Age: 16-25	49.69	9.64	2,265	44.66	11.63	24	48.60	10.07	2,449
26-45	49.81	9.63	7,142	52.90	9.92	60	48.94	9.74	8,039
46-59	50.64	10.16	6,146	47.41	14.19	21	49.67	10.30	7,407
60-74	52.58	9.65	4,125	54.62	8.31	4	51.63	10.05	5,077
75+	52.56	9.98	1,650	53.21		1	51.73	10.09	2,086
Educational degree: Lower secondary	50.14	10.59	3,706	48.45	10.84	79	49.07	10.82	4,224
Short cycle non-tertiary	51.15	9.93	11,797	57.50	8.63	18	50.13	10.20	13,569
Bachelor or equivalent	51.02	9.82	3,477	51.80	11.00	13	50.29	9.68	4,254
Master or Doctoral	51.18	8.93	2,155			0	50.74	9.12	2,802
Cohabiting with partner	51.95	9.28	12,446	51.40	11.05	85	50.81	9.67	14,707
Living without partner	50.01	10.43	8,795	48.12	10.67	24	49.28	10.48	10,244
Native-born ethnic majority	51.09	9.94	15,274			0	50.20	10.08	17,657
Immigrant	50.87	9.51	2,601			0	49.63	10.29	2,850
Descendant of immigrant	50.39	9.79	1,156			0	49.05	10.41	1,445
Refugee	49.71	10.60	2,293	50.78	10.98	110	49.98	9.18	3,102
Employment: Full-/Part-time, training	51.10	9.10	10,851	49.28	10.99	27	50.28	9.37	11,779
Self-employed	51.92	8.82	1,073	43.63		1	51.16	9.47	1,937
Marginally employed	50.41	10.31	1,076	63.03	2.73	2	49.22	10.88	1,140
Inactive	51.34	10.62	6,857	50.85	10.97	80	50.46	10.63	7,208
Unemployed	45.72	12.84	1,471			0	45.74	11.69	1,499
Living space per person in household (square meters): < 16	48.28	10.26	915	50.46	10.37	33	48.69	11.25	1,124
16-30	50.33	9.86	6,450	51.30	10.66	69	49.19	9.98	7,014
31-45	50.65	9.90	6,076	39.57	15.22	5	50.26	10.02	6,856
46-60	51.33	10.10	3,797	63.40		1	49.72	10.15	4,576
61-75	51.68	9.66	2,064	57.59		1	51.08	10.11	2,601
> 75	51.73	9.70	2,026	59.35		1	50.74	10.12	2,887
Pre-existing physical health risks	51.12	10.38	8,680			0	50.25	10.51	9,534
Pre-existing mental health risks	43.70	12.00	3,030			0	43.23	11.61	3,397

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District-type: Independent large city	50.56	10.10	6,487	49.30	12.66	28	49.91	10.10	6,966
Urban district	51.32	9.89	7,454	52.32	11.99	41	50.57	9.91	8,203
Rural district with some density	51.28	9.42	3,701	50.70	8.61	30	50.19	9.83	3,988
Sparsely populated rural district	50.83	9.96	3,686	51.30	9.09	11	49.84	10.27	3,970

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: MCS is scaled from 0 to 100.

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Table A3: Life satisfaction by vulnerability/control variable and year

Survey year:	2018			2019			2020		
	Mean	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**
Men without children	7.32	1.70	6,489	7.39	1.70	7,616	7.36	1.72	8,131
Men with children	7.63	1.47	3,698	7.70	1.48	4,047	7.70	1.38	4,277
Women without children	7.32	1.74	7,070	7.39	1.73	7,795	7.42	1.70	8,352
Women with children	7.60	1.59	4,383	7.66	1.63	4,560	7.66	1.53	4,791
Age: 16-25	7.53	1.65	2,330	7.61	1.57	2,517	7.47	1.67	2,495
26-45	7.45	1.56	7,274	7.53	1.58	7,651	7.54	1.51	8,154
46-59	7.25	1.77	6,214	7.37	1.72	7,078	7.32	1.71	7,543
60-74	7.38	1.72	4,188	7.39	1.75	4,808	7.45	1.72	5,200
75+	7.40	1.74	1,677	7.43	1.81	1,970	7.51	1.77	2,167
Educational degree: Lower secondary	7.13	1.86	3,836	7.18	1.97	4,134	7.18	1.93	4,339
Short cycle non-tertiary	7.33	1.71	11,937	7.41	1.67	12,970	7.41	1.68	13,842
Bachelor or equivalent	7.56	1.50	3,537	7.62	1.57	4,039	7.66	1.43	4,323
Master or Doctoral	7.67	1.48	2,175	7.81	1.46	2,664	7.76	1.36	2,839
Cohabiting with partner	7.59	1.58	12,628	7.65	1.59	14,049	7.61	1.57	15,008
Living without partner	7.16	1.76	8,967	7.25	1.77	9,924	7.28	1.73	10,439
Native-born ethnic majority	7.37	1.68	15,462	7.43	1.68	17,282	7.43	1.66	17,993
Immigrant	7.46	1.67	2,644	7.56	1.70	2,677	7.55	1.64	2,915
Descendant of immigrant	7.47	1.73	1,177	7.57	1.71	1,348	7.57	1.74	1,473
Refugee	7.07	1.82	2,395	7.20	1.87	2,713	7.28	1.78	3,173
Employment: Full-/Part-time, training	7.51	1.49	10,970	7.58	1.48	11,935	7.52	1.50	11,938
Self-employed	7.53	1.70	1,085	7.76	1.52	1,970	7.62	1.48	1,972
Marginally employed	7.30	1.66	1,090	7.43	1.64	1,162	7.39	1.73	1,164
Inactive	7.31	1.82	7,022	7.35	1.86	7,418	7.42	1.79	7,406
Unemployed	5.99	2.24	1,516	6.22	2.33	1,539	6.47	2.21	1,538
Living space per person in household (square meters): < 16	7.08	1.87	961	7.41	1.98	1,048	7.32	1.88	1,151
16-30	7.34	1.73	6,568	7.47	1.70	6,755	7.48	1.67	7,161
31-45	7.39	1.65	6,156	7.45	1.67	6,571	7.42	1.65	6,971
46-60	7.34	1.72	3,853	7.37	1.72	4,443	7.35	1.69	4,688
61-75	7.39	1.66	2,085	7.47	1.65	2,469	7.54	1.61	2,652
> 75	7.48	1.65	2,060	7.56	1.64	2,738	7.56	1.65	2,936
Pre-existing physical health risks	7.18	1.78	8,778	7.24	1.79	9,504	7.29	1.77	9,761
Pre-existing mental health risks	6.40	2.10	3,083	6.49	2.07	3,346	6.58	2.03	3,462

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District-type: Independent large city	7.38	1.72	6,584	7.45	1.70	7,099	7.47	1.67	7,110
Urban district	7.42	1.68	7,589	7.53	1.64	8,334	7.49	1.63	8,342
Rural district with some density	7.35	1.66	3,782	7.36	1.74	4,061	7.39	1.63	4,074
Sparsely populated rural district	7.31	1.68	3,728	7.34	1.74	4,036	7.35	1.72	4,045

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Life satisfaction is scaled from 0 to 10.

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Table A4: OLS regressions of mental health on sociodemographic vulnerability factors

Vulnerability factor:	**Gender, children**	**Living arrangements**	**Age**	**Migration status**	**Employment**
	(1)	(2)	(3)	(4)	(5)
Surveyyear 2010 (ref: 2018)	-0.981***	-1.014***	-0.830	-0.771***	-1.343***
	(0.325)	(0.260)	(0.860)	(0.226)	(0.284)
Surveyyear 2012	-0.530**	-0.812***	0.061	-0.575***	-1.171***
	(0.243)	(0.199)	(0.593)	(0.166)	(0.219)
Surveyyear 2014	-0.066	-0.365**	-0.111	-0.088	-0.527***
	(0.234)	(0.179)	(0.521)	(0.156)	(0.201)
Surveyyear 2016	0.566***	0.527***	0.548	0.553***	0.446**
	(0.209)	(0.160)	(0.456)	(0.145)	(0.184)
Surveyyear 2020	-0.864***	-1.193***	-0.750*	-0.886***	-0.909***
	(0.191)	(0.149)	(0.424)	(0.126)	(0.165)
Men with children (ref: men w/o children)	0.304	0.661***	0.632**	0.670***	0.627**
	(0.345)	(0.249)	(0.249)	(0.250)	(0.249)
Surveyyear 2010 # Men with children	-0.159				
	(0.684)				
Surveyyear 2012 # Men with children	-0.384				
	(0.546)				
Surveyyear 2014 # Men with children	0.039				
	(0.423)				
Surveyyear 2016 # Men with children	0.954**				
	(0.395)				
Surveyyear 2020 # Men with children	0.767**				
	(0.387)				
Women without children	-1.645***	-1.667***	-1.660***	-1.667***	-1.672***
	(0.257)	(0.202)	(0.202)	(0.202)	(0.202)
Surveyyear 2010 # Women without children	0.473				
	(0.435)				
Surveyyear 2012 # Women without children	-0.077				
	(0.336)				
Surveyyear 2014 # Women without children	0.214				
	(0.318)				
Surveyyear 2016 # Women without children	-0.185				
	(0.303)				
Surveyyear 2020 # Women without children	-0.226				

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	(0.267)				
Women with children	-0.833**	-1.145***	-1.167***	-1.140***	-1.170***
	(0.333)	(0.264)	(0.264)	(0.264)	(0.264)
Surveyyear 2010 # Women with children	-0.634				
	(0.689)				
Surveyyear 2012 # Women with children	-0.135				
	(0.526)				
Surveyyear 2014 # Women with children	-0.665				
	(0.423)				
Surveyyear 2016 # Women with children	-0.311				
	(0.371)				
Surveyyear 2020 # Women with children	-0.359				
	(0.361)				
Living without partner (ref: cohabiting with partner)	-1.236***	-1.564***	-1.243***	-1.235***	-1.238***
	(0.194)	(0.237)	(0.194)	(0.194)	(0.194)
Surveyyear 2010 # Living without partner		0.378			
		(0.401)			
Surveyyear 2012 # Living without partner		0.425			
		(0.308)			
Surveyyear 2014 # Living without partner		0.655**			
		(0.279)			
Surveyyear 2016 # Living without partner		0.033			
		(0.263)			
Surveyyear 2020 # Living without partner		0.558**			
		(0.236)			
Age 26-45 (ref: 16-25)	-1.233***	-1.232***	-1.218***	-1.227***	-1.222***
	(0.296)	(0.296)	(0.416)	(0.296)	(0.295)
Surveyyear 2010 # 26-45			-0.292		
			(0.973)		
Surveyyear 2012 # 26-45			-0.199		
			(0.688)		
Surveyyear 2014 # 26-45			0.187		
			(0.597)		
Surveyyear 2016 # 26-45			-0.035		
			(0.529)		
Surveyyear 2020 # 26-45			0.018		
			(0.483)		
46-59	-0.943***	-0.938***	-0.502	-0.930***	-0.936***
	(0.323)	(0.323)	(0.427)	(0.322)	(0.322)

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Surveyyear 2010 # 46-59			-0.759		
			(0.934)		
Surveyyear 2012 # 46-59			-1.685**		
			(0.659)		
Surveyyear 2014 # 46-59			-0.636		
			(0.582)		
Surveyyear 2016 # 46-59			-0.146		
			(0.513)		
Surveyyear 2020 # 46-59			-0.217		
			(0.475)		
60-74	2.295***	2.292***	2.200***	2.300***	2.270***
	(0.337)	(0.337)	(0.437)	(0.337)	(0.337)
Surveyyear 2010 # 60-74			0.980		
			(0.932)		
Surveyyear 2012 # 60-74			-0.180		
			(0.662)		
Surveyyear 2014 # 60-74			0.360		
			(0.587)		
Surveyyear 2016 # 60-74			0.147		
			(0.519)		
Surveyyear 2020 # 60-74			-0.312		
			(0.479)		
75+	3.038***	3.017***	2.981***	3.029***	3.114***
	(0.413)	(0.413)	(0.519)	(0.413)	(0.416)
Surveyyear 2010 # 75+			1.249		
			(1.247)		
Surveyyear 2012 # 75+			-0.753		
			(0.823)		
Surveyyear 2014 # 75+			1.081		
			(0.692)		
Surveyyear 2016 # 75+			0.097		
			(0.611)		
Surveyyear 2020 # 75+			-0.276		
			(0.541)		
Immigrant (ref: native-born ethnic majority)	0.248	0.251	0.249	0.342	0.249
	(0.277)	(0.277)	(0.277)	(0.347)	(0.276)
Surveyyear 2010 # Immigrant				-0.487	
				(0.699)	
Surveyyear 2012 # Immigrant				-0.165	

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				(0.586)	
Surveyyear 2014 # Immigrant				0.547	
				(0.446)	
Surveyyear 2016 # Immigrant				-0.000	
				(0.394)	
Surveyyear 2020 # Immigrant				-0.385	
				(0.388)	
Descendant of immigrant	0.360	0.363	0.358	0.542	0.355
	(0.398)	(0.398)	(0.399)	(0.486)	(0.399)
Surveyyear 2010 # Descendant of immigrant				-0.921	
				(1.652)	
Surveyyear 2012 # Descendant of immigrant				-0.264	
				(0.948)	
Surveyyear 2014 # Descendant of immigrant				-0.396	
				(0.671)	
Surveyyear 2016 # Descendant of immigrant				0.198	
				(0.642)	
Surveyyear 2020 # Descendant of immigrant				-0.335	
				(0.578)	
Refugee	0.258	0.299	0.300	-0.009	0.341
	(0.679)	(0.681)	(0.678)	(0.794)	(0.679)
Surveyyear 2010 # Refugee				1.183	
				(3.525)	
Surveyyear 2012 # Refugee				-0.965	
				(1.618)	
Surveyyear 2014 # Refugee				-0.228	
				(1.358)	
Surveyyear 2016 # Refugee				-0.820	
				(1.055)	
Surveyyear 2020 # Refugee				1.252*	
				(0.746)	
Self-employed (ref: full-/part-time, training)	-0.036	-0.048	-0.035	-0.045	-0.171
	(0.305)	(0.305)	(0.305)	(0.305)	(0.422)
Surveyyear 2010 # Self-employed					0.201
					(0.816)
Surveyyear 2012 # Self-employed					0.102
					(0.668)
Surveyyear 2014 # Self-employed					0.274
					(0.590)

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Surveyyear 2016 # Self-employed					0.479
					(0.534)
Surveyyear 2020 # Self-employed					-0.072
					(0.518)
Marginally employed	-0.583*	-0.584*	-0.572*	-0.575*	-1.338**
	(0.317)	(0.317)	(0.316)	(0.317)	(0.537)
Surveyyear 2010 # Marginally employed					1.653
					(1.096)
Surveyyear 2012 # Marginally employed					2.343***
					(0.816)
Surveyyear 2014 # Marginally employed					1.079
					(0.730)
Surveyyear 2016 # Marginally employed					0.919
					(0.697)
Surveyyear 2020 # Marginally employed					0.038
					(0.660)
Inactive	-1.498***	-1.491***	-1.520***	-1.492***	-1.907***
	(0.233)	(0.233)	(0.233)	(0.233)	(0.288)
Surveyyear 2010 # Inactive					1.221***
					(0.463)
Surveyyear 2012 # Inactive					1.158***
					(0.342)
Surveyyear 2014 # Inactive					1.109***
					(0.312)
Surveyyear 2016 # Inactive					0.121
					(0.309)
Surveyyear 2020 # Inactive					-0.110
					(0.267)
Unemployed	-4.293***	-4.285***	-4.266***	-4.289***	-4.908***
	(0.444)	(0.445)	(0.445)	(0.445)	(0.815)
Surveyyear 2010 # Unemployed					1.071
					(1.245)
Surveyyear 2012 # Unemployed					1.758
					(1.165)
Surveyyear 2014 # Unemployed					1.095
					(1.056)
Surveyyear 2016 # Unemployed					-0.089
					(1.098)
Surveyyear 2020 # Unemployed					0.748

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					(0.912)
Educational degree: Short cycle non-tertiary (ref: lower secondary)	0.563**	0.555**	0.570**	0.554**	0.569**
	(0.276)	(0.276)	(0.277)	(0.276)	(0.276)
Bachelor or equivalent	0.586*	0.581*	0.594*	0.581*	0.592*
	(0.343)	(0.343)	(0.343)	(0.343)	(0.343)
Master or Doctoral	0.964***	0.965***	0.979***	0.967***	0.977***
	(0.354)	(0.354)	(0.354)	(0.354)	(0.354)
Living space per person in household (square meters)	0.022***	0.022***	0.022***	0.023***	0.022***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Squared	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment rate in local labor market region (month of interview)	0.017	0.018	0.017	0.017	0.016
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
District-type: Urban district (ref: independent large city)	0.018	0.013	0.010	0.012	0.015
	(0.221)	(0.221)	(0.221)	(0.221)	(0.221)
Rural district with some density	-0.230	-0.231	-0.228	-0.231	-0.236
	(0.276)	(0.276)	(0.276)	(0.276)	(0.276)
Sparsely populated rural district	-0.367	-0.370	-0.357	-0.368	-0.368
	(0.262)	(0.262)	(0.262)	(0.263)	(0.263)
Person-Year observations	88,258	88,258	88,258	88,258	88,258
Person observations	22,020	22,020	22,020	22,020	22,020
R2 adjusted	0.045	0.045	0.045	0.045	0.045
Dep. var. mean	50.835	50.835	50.835	50.835	50.835
Command	regress	regress	regress	regress	regress
Model	ols	ols	ols	ols	ols

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Standard errors clustered at person-level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

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Table A5: OLS regressions of mental health on sociodemographic vulnerability factors (with varying base-categories)

Gender and children

Base-category:	Men w/o children	Men w/ children	Women w/o children	Women w/ children
Main effect of survey year 2020 (ref: 2018)	-0.864***	-0.097	-1.089***	-1.223***
	(0.191)	(0.325)	(0.192)	(0.311)

Living arrangements

	Cohabiting w/ partner	Living w/o partner
Main effect of survey year 2020 (ref: 2018)	-1.193***	-0.635***
	(0.149)	(0.184)

Age group

Base-category:	16-25	26-45	46-59	60-74	75+
Main effect of survey year 2020 (ref: 2018)	-0.750*	-0.732***	-0.967***	-1.062***	-1.026***
	(0.424)	(0.236)	(0.223)	(0.230)	(0.338)

Employment status

Base-category:	Full-/Part-time, training	Self-employed	Marginally employed	Inactive	Unemployed
Main effect of survey year 2020 (ref: 2018)	-0.909***	-0.981**	-0.870	-1.019***	-0.161
	(0.165)	(0.490)	(0.638)	(0.208)	(0.882)

Migration status

Base-category:	Native-born ethnic majority	Immigrant	Descendant of immigrant	Refugee
Main effect of survey year 2020 (ref: 2018)	-0.886***	-1.272***	-1.222**	0.365
	(0.126)	(0.371)	(0.568)	(0.738)

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: The regression models correspond to our main analyses in Figure 2, i.e. we partial out the main effects of all vulnerability factor variables and control variables as well as the interactions of the vulnerability factor variable (as denoted in the corr. table row) with survey year dummies. The reported results in the table correspond to the regression coefficients of a non-interacted dummy variable 1[survey year = 2020]. From col. 1-5, we change the base-categories of vulnerability factor variables.

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Table A6: OLS regressions of mental health on pre-COVID health risks

Vulnerability factor:	Physical health (1)	Mental health (2)
Surveyyear 2012 (ref: 2018)	-0.574***	-1.059***
	(0.220)	(0.163)
Surveyyear 2014	-0.119	-0.322**
	(0.202)	(0.150)
Surveyyear 2016	0.504***	0.364***
	(0.185)	(0.134)
Surveyyear 2020	-0.961***	-1.064***
	(0.168)	(0.124)
Pre-existing physical health risks	-0.910***	
	(0.238)	
Surveyyear 2012 # Pre-existing physical health risks	-0.628*	
	(0.347)	
Surveyyear 2014 # Pre-existing physical health risks	-0.085	
	(0.304)	
Surveyyear 2016 # Pre-existing physical health risks	-0.036	
	(0.267)	
Surveyyear 2020 # Pre-existing physical health risks	0.018	
	(0.233)	
Pre-existing mental health risks		-8.546***
		(0.352)
Surveyyear 2012 # Pre-existing mental health risks		-1.654**
		(0.721)
Surveyyear 2014 # Pre-existing mental health risks		-1.060*
		(0.573)
Surveyyear 2016 # Pre-existing mental health risks		-0.177
		(0.453)
Surveyyear 2020 # Pre-existing mental health risks		0.820**
		(0.354)
Immigrant (ref: native-born ethnic majority)	0.253	-0.019
	(0.284)	(0.263)
Descendant of immigrant	0.336	-0.066
	(0.399)	(0.360)
Refugee	-0.015	-0.235
	(0.834)	(0.733)
Educational degree: Short cycle non-tertiary (ref: lower secondary)	0.599**	0.475*
	(0.287)	(0.258)
Bachelor or equivalent	0.387	0.268
	(0.353)	(0.318)
Master or Doctoral	0.927**	0.546
	(0.362)	(0.334)
Living space per person in household (square meters)	0.021***	0.028***
	(0.008)	(0.007)
squared	-0.000**	-0.000***
	(0.000)	(0.000)
Unemployment rate in local labor market region (month of interview)	0.038	0.002
	(0.038)	(0.035)
District-type: Urban district (ref: independent large city)	-0.001	-0.281
	(0.224)	(0.204)
Rural district with some density	-0.303	-0.572**
	(0.279)	(0.256)
Sparsely populated rural district	-0.413	-0.624**
	(0.266)	(0.242)
Person-Year observations	71,001	71,848
Person observations	18,817	18,685
R2 adjusted	0.045	0.130
Dep. var. mean	50.978	51.084

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Command	regress	regress
Model	ols	ols

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Standard errors clustered at person-level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

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Table A7: OLS regressions of life satisfaction on sociodemographic vulnerability factors

Vulnerability factor:	Gender, children	Living arrangements	Age	Migration status	Employment
Surveyyear 2010 (ref: 2019)	-0.237***	-0.220***	0.014	-0.167***	-0.251***
	(0.055)	(0.041)	(0.113)	(0.036)	(0.045)
Surveyyear 2011	-0.366***	-0.349***	-0.170	-0.313***	-0.346***
	(0.052)	(0.038)	(0.109)	(0.033)	(0.041)
Surveyyear 2012	-0.217***	-0.260***	-0.060	-0.202***	-0.269***
	(0.043)	(0.033)	(0.090)	(0.028)	(0.035)
Surveyyear 2013	-0.173***	-0.135***	-0.131	-0.134***	-0.142***
	(0.042)	(0.032)	(0.086)	(0.028)	(0.034)
Surveyyear 2014	-0.132***	-0.200***	-0.097	-0.144***	-0.185***
	(0.039)	(0.030)	(0.087)	(0.027)	(0.032)
Surveyyear 2015	-0.086**	-0.084***	0.014	-0.061**	-0.055*
	(0.038)	(0.029)	(0.073)	(0.026)	(0.032)
Surveyyear 2016	-0.094**	-0.107***	0.124*	-0.078***	-0.063**
	(0.039)	(0.028)	(0.071)	(0.025)	(0.031)
Surveyyear 2017	-0.142***	-0.111***	-0.028	-0.117***	-0.124***
	(0.034)	(0.025)	(0.062)	(0.021)	(0.025)
Surveyyear 2018	-0.047	-0.037	-0.077	-0.040**	-0.044*
	(0.029)	(0.023)	(0.058)	(0.019)	(0.024)
Surveyyear 2020	-0.022	-0.022	-0.121**	0.005	-0.037*
	(0.027)	(0.021)	(0.055)	(0.018)	(0.022)
Men with children (ref: men w/o children)	0.257***	0.271***	0.267***	0.272***	0.270***
	(0.056)	(0.039)	(0.039)	(0.039)	(0.039)
Surveyyear 2010 # Men with children	-0.069				
	(0.102)				
Surveyyear 2011 # Men with children	0.035				
	(0.092)				
Surveyyear 2012 # Men with children	-0.063				
	(0.081)				
Surveyyear 2013 # Men with children	0.081				
	(0.074)				
Surveyyear 2014 # Men with children	-0.101				
	(0.069)				
Surveyyear 2015 # Men with children	0.011				

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	(0.072)				
Surveyyear 2016 # Men with children	0.078				
	(0.066)				
Surveyyear 2017 # Men with children	0.098*				
	(0.058)				
Surveyyear 2018 # Men with children	-0.022				
	(0.057)				
Surveyyear 2020 # Men with children	0.041				
	(0.055)				
Women without children	0.020	0.062*	0.063*	0.062*	0.062*
	(0.042)	(0.033)	(0.032)	(0.033)	(0.033)
Surveyyear 2010 # Women without children	0.178**				
	(0.071)				
Surveyyear 2011 # Women without children	0.079				
	(0.066)				
Surveyyear 2012 # Women without children	0.022				
	(0.056)				
Surveyyear 2013 # Women without children	0.078				
	(0.055)				
Surveyyear 2014 # Women without children	0.032				
	(0.053)				
Surveyyear 2015 # Women without children	0.071				
	(0.052)				
Surveyyear 2016 # Women without children	-0.007				
	(0.053)				
Surveyyear 2017 # Women without children	0.056				
	(0.046)				
Surveyyear 2018 # Women without children	-0.013				
	(0.042)				
Surveyyear 2020 # Women without children	0.061				
	(0.038)				
Women with children	0.302***	0.334***	0.331***	0.335***	0.333***
	(0.055)	(0.039)	(0.039)	(0.039)	(0.039)
Surveyyear 2010 # Women with children	0.014				
	(0.087)				
Surveyyear 2011 # Women with children	0.140*				
	(0.081)				
Surveyyear 2012 # Women with children	-0.008				
	(0.072)				

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Surveyyear 2013 # Women with children	0.010				
	(0.073)				
Surveyyear 2014 # Women with children	-0.074				
	(0.069)				
Surveyyear 2015 # Women with children	0.033				
	(0.070)				
Surveyyear 2016 # Women with children	0.092				
	(0.066)				
Surveyyear 2017 # Women with children	0.109*				
	(0.057)				
Surveyyear 2018 # Women with children	0.009				
	(0.054)				
Surveyyear 2020 # Women with children	0.043				
	(0.053)				
Living without partner (ref: Cohabiting with partner)	-0.415***	-0.462***	-0.416***	-0.416***	-0.415***
	(0.030)	(0.039)	(0.030)	(0.030)	(0.030)
Surveyyear 2010 # Living without partner		0.110*			
		(0.063)			
Surveyyear 2011 # Living without partner		0.072			
		(0.058)			
Surveyyear 2012 # Living without partner		0.096*			
		(0.049)			
Surveyyear 2013 # Living without partner		0.001			
		(0.048)			
Surveyyear 2014 # Living without partner		0.133***			
		(0.046)			
Surveyyear 2015 # Living without partner		0.064			
		(0.046)			
Surveyyear 2016 # Living without partner		0.057			
		(0.045)			
Surveyyear 2017 # Living without partner		0.028			
		(0.040)			
Surveyyear 2018 # Living without partner		-0.032			
		(0.037)			
Surveyyear 2020 # Living without partner		0.067**			
		(0.033)			
Age 26-45 (ref: 16-25)	-0.549***	-0.549***	-0.526***	-0.548***	-0.548***
	(0.043)	(0.043)	(0.063)	(0.043)	(0.043)
Surveyyear 2010 # 26-45			-0.242*		

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			(0.129)		
Surveyyear 2011 # 26-45			-0.084		
			(0.121)		
Surveyyear 2012 # 26-45			-0.154		
			(0.104)		
Surveyyear 2013 # 26-45			0.037		
			(0.097)		
Surveyyear 2014 # 26-45			-0.057		
			(0.099)		
Surveyyear 2015 # 26-45			-0.045		
			(0.088)		
Surveyyear 2016 # 26-45			-0.108		
			(0.084)		
Surveyyear 2017 # 26-45			-0.074		
			(0.073)		
Surveyyear 2018 # 26-45			0.015		
			(0.068)		
Surveyyear 2020 # 26-45			0.144**		
			(0.063)		
46-59	-0.854***	-0.853***	-0.714***	-0.852***	-0.853***
	(0.048)	(0.048)	(0.065)	(0.048)	(0.047)
Surveyyear 2010 # 46-59			-0.416***		
			(0.127)		
Surveyyear 2011 # 46-59			-0.376***		
			(0.121)		
Surveyyear 2012 # 46-59			-0.342***		
			(0.102)		
Surveyyear 2013 # 46-59			-0.160		
			(0.098)		
Surveyyear 2014 # 46-59			-0.155		
			(0.098)		
Surveyyear 2015 # 46-59			-0.195**		
			(0.085)		
Surveyyear 2016 # 46-59			-0.312***		
			(0.082)		
Surveyyear 2017 # 46-59			-0.156**		
			(0.072)		
Surveyyear 2018 # 46-59			-0.031		
			(0.067)		

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Surveyyear 2020 # 46-59			0.077		
			(0.064)		
60-74	-0.541***	-0.541***	-0.573***	-0.540***	-0.544***
	(0.050)	(0.050)	(0.068)	(0.050)	(0.050)
Surveyyear 2010 # 60-74			0.060		
			(0.126)		
Surveyyear 2011 # 60-74			-0.026		
			(0.123)		
Surveyyear 2012 # 60-74			-0.037		
			(0.103)		
Surveyyear 2013 # 60-74			0.103		
			(0.100)		
Surveyyear 2014 # 60-74			0.042		
			(0.101)		
Surveyyear 2015 # 60-74			0.043		
			(0.086)		
Surveyyear 2016 # 60-74			-0.233***		
			(0.085)		
Surveyyear 2017 # 60-74			-0.019		
			(0.075)		
Surveyyear 2018 # 60-74			0.080		
			(0.069)		
Surveyyear 2020 # 60-74			0.183***		
			(0.066)		
75+	-0.424***	-0.426***	-0.426***	-0.424***	-0.415***
	(0.063)	(0.063)	(0.084)	(0.063)	(0.064)
Surveyyear 2010 # 75+			0.088		
			(0.162)		
Surveyyear 2011 # 75+			-0.043		
			(0.155)		
Surveyyear 2012 # 75+			-0.013		
			(0.131)		
Surveyyear 2013 # 75+			0.053		
			(0.123)		
Surveyyear 2014 # 75+			0.086		
			(0.114)		
Surveyyear 2015 # 75+			-0.105		
			(0.104)		
Surveyyear 2016 # 75+			-0.293***		

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			(0.099)		
Surveyyear 2017 # 75+			-0.024		
			(0.088)		
Surveyyear 2018 # 75+			0.060		
			(0.082)		
Surveyyear 2020 # 75+			0.206***		
			(0.074)		
Immigrant (ref: native-born ethnic majority)	0.198***	0.198***	0.196***	0.180***	0.197***
	(0.043)	(0.043)	(0.044)	(0.057)	(0.043)
Surveyyear 2010 # Immigrant				0.089	
				(0.111)	
Surveyyear 2011 # Immigrant				-0.024	
				(0.098)	
Surveyyear 2012 # Immigrant				-0.091	
				(0.089)	
Surveyyear 2013 # Immigrant				0.055	
				(0.074)	
Surveyyear 2014 # Immigrant				0.060	
				(0.075)	
Surveyyear 2015 # Immigrant				0.088	
				(0.072)	
Surveyyear 2016 # Immigrant				-0.033	
				(0.072)	
Surveyyear 2017 # Immigrant				0.144**	
				(0.059)	
Surveyyear 2018 # Immigrant				-0.065	
				(0.060)	
Surveyyear 2020 # Immigrant				0.013	
				(0.057)	
Descendant of immigrant	0.122**	0.123**	0.123**	0.109	0.120**
	(0.055)	(0.055)	(0.055)	(0.078)	(0.055)
Surveyyear 2010 # Descendant of immigrant				-0.355	
				(0.255)	
Surveyyear 2011 # Descendant of immigrant				0.061	
				(0.164)	
Surveyyear 2012 # Descendant of immigrant				-0.046	
				(0.131)	
Surveyyear 2013 # Descendant of immigrant				0.093	
				(0.113)	

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Surveyyear 2014 # Descendant of immigrant				0.070	
				(0.104)	
Surveyyear 2015 # Descendant of immigrant				0.076	
				(0.101)	
Surveyyear 2016 # Descendant of immigrant				0.133	
				(0.108)	
Surveyyear 2017 # Descendant of immigrant				0.030	
				(0.087)	
Surveyyear 2018 # Descendant of immigrant				-0.077	
				(0.086)	
Surveyyear 2020 # Descendant of immigrant				0.030	
				(0.078)	
Refugee	-0.093	-0.089	-0.085	-0.021	-0.092
	(0.084)	(0.084)	(0.084)	(0.122)	(0.084)
Surveyyear 2010 # Refugee				0.142	
				(0.316)	
Surveyyear 2011 # Refugee				-0.205	
				(0.322)	
Surveyyear 2012 # Refugee				-0.424	
				(0.260)	
Surveyyear 2013 # Refugee				-0.792***	
				(0.195)	
Surveyyear 2014 # Refugee				-0.176	
				(0.165)	
Surveyyear 2015 # Refugee				-0.282	
				(0.180)	
Surveyyear 2016 # Refugee				-0.195	
				(0.176)	
Surveyyear 2017 # Refugee				0.084	
				(0.184)	
Surveyyear 2018 # Refugee				-0.081	
				(0.134)	
Surveyyear 2020 # Refugee				0.085	
				(0.129)	
Self-employed (ref: full-/part-time, training)	-0.019	-0.020	-0.020	-0.019	0.117*
	(0.050)	(0.050)	(0.049)	(0.050)	(0.068)
Surveyyear 2010 # Self-employed					-0.189*
					(0.111)
Surveyyear 2011 # Self-employed					-0.201*

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					(0.120)
Surveyyear 2012 # Self-employed					-0.153
					(0.101)
Surveyyear 2013 # Self-employed					-0.306***
					(0.103)
Surveyyear 2014 # Self-employed					-0.126
					(0.093)
Surveyyear 2015 # Self-employed					-0.176*
					(0.092)
Surveyyear 2016 # Self-employed					-0.186**
					(0.094)
Surveyyear 2017 # Self-employed					-0.064
					(0.077)
Surveyyear 2018 # Self-employed					-0.149*
					(0.081)
Surveyyear 2020 # Self-employed					-0.091
					(0.062)
Marginally employed	-0.215***	-0.215***	-0.213***	-0.214***	-0.206**
	(0.046)	(0.046)	(0.046)	(0.046)	(0.082)
Surveyyear 2010 # Marginally employed					0.272*
					(0.150)
Surveyyear 2011 # Marginally employed					-0.062
					(0.158)
Surveyyear 2012 # Marginally employed					-0.038
					(0.125)
Surveyyear 2013 # Marginally employed					-0.086
					(0.117)
Surveyyear 2014 # Marginally employed					0.013
					(0.119)
Surveyyear 2015 # Marginally employed					0.021
					(0.117)
Surveyyear 2016 # Marginally employed					-0.063
					(0.117)
Surveyyear 2017 # Marginally employed					-0.006
					(0.103)
Surveyyear 2018 # Marginally employed					-0.076
					(0.093)
Surveyyear 2020 # Marginally employed					0.000
					(0.074)

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Inactive	-0.243***	-0.243***	-0.247***	-0.243***	-0.326***
	(0.035)	(0.035)	(0.035)	(0.035)	(0.046)
Surveyyear 2010 # Inactive					0.268***
					(0.069)
Surveyyear 2011 # Inactive					0.146**
					(0.064)
Surveyyear 2012 # Inactive					0.183***
					(0.056)
Surveyyear 2013 # Inactive					0.097*
					(0.054)
Surveyyear 2014 # Inactive					0.142***
					(0.052)
Surveyyear 2015 # Inactive					0.049
					(0.051)
Surveyyear 2016 # Inactive					-0.002
					(0.051)
Surveyyear 2017 # Inactive					0.077*
					(0.046)
Surveyyear 2018 # Inactive					0.018
					(0.042)
Surveyyear 2020 # Inactive					0.115***
					(0.036)
Unemployed	-1.198***	-1.198***	-1.193***	-1.200***	-1.197***
	(0.066)	(0.066)	(0.066)	(0.066)	(0.129)
Surveyyear 2010 # Unemployed					-0.176
					(0.233)
Surveyyear 2011 # Unemployed					-0.088
					(0.209)
Surveyyear 2012 # Unemployed					0.026
					(0.189)
Surveyyear 2013 # Unemployed					-0.062
					(0.175)
Surveyyear 2014 # Unemployed					0.102
					(0.175)
Surveyyear 2015 # Unemployed					-0.154
					(0.158)
Surveyyear 2016 # Unemployed					-0.089
					(0.161)
Surveyyear 2017 # Unemployed					0.075

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					(0.172)
Surveyyear 2018 # Unemployed					-0.126
					(0.146)
Surveyyear 2020 # Unemployed					0.314***
					(0.118)
Educational degree: Short cycle non-tertiary (ref: lower secondary)	0.158***	0.157***	0.161***	0.157***	0.158***
	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)
Bachelor or equivalent	0.309***	0.309***	0.314***	0.309***	0.311***
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)
Master or Doctoral	0.433***	0.431***	0.436***	0.432***	0.434***
	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)
Living space per person in household (square meters)	0.008***	0.008***	0.008***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment rate in local labor market region (month of interview)	-0.017***	-0.017***	-0.016***	-0.017***	-0.016***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
District-type: Urban district (ref: independent large city)	-0.063*	-0.063*	-0.061*	-0.063*	-0.063*
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Rural district with some density	-0.141***	-0.140***	-0.139***	-0.141***	-0.141***
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
Sparsely populated rural district	-0.122***	-0.122***	-0.119***	-0.122***	-0.122***
	(0.044)	(0.044)	(0.043)	(0.044)	(0.043)
Person-Year observations	182,126	182,126	182,126	182,126	182,126
Person observations	25,549	25,549	25,549	25,549	25,549
R2 adjusted	0.065	0.065	0.066	0.065	0.065
Dep. var. mean	7.425	7.425	7.425	7.425	7.425
Command	regress	regress	regress	regress	regress
Model	ols	ols	ols	ols	ols

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Standard errors clustered at person-level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

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Table A8: OLS regressions of life satisfaction on sociodemographic vulnerability factors (with varying base-categories)

Gender and children

Base-category:	Men w/o children	Men w/ children	Women w/o children	Women w/ children
Main effect of survey year 2020 (ref: 2019)	-0.022	0.018	0.039	0.021
	(0.027)	(0.047)	(0.027)	(0.046)

Living arrangements

	Cohabiting w/ partner	Living w/o partner
Main effect of survey year 2020 (ref: 2019)	-0.022	0.045*
	(0.021)	(0.025)

Age group

Base-category:	16-25	26-45	46-59	60-74	75+
Main effect of survey year 2020 (ref: 2019)	-0.121**	0.022	-0.044	0.062*	0.084*
	(0.055)	(0.031)	(0.033)	(0.036)	(0.049)

Employment status

Base-category:	Full-/Part-time, training	Self-employed	Marginally employed	Inactive	Unemployed
Main effect of survey year 2020 (ref: 2019)	-0.037*	-0.128**	-0.036	0.078***	0.278**
	(0.022)	(0.058)	(0.071)	(0.029)	(0.116)

Migration status

Base-category:	Native-born ethnic majority	Immigrant	Descendant of immigrant	Refugee
Main effect of survey year 2020 (ref: 2019)	0.005	0.018	0.035	0.090
	(0.018)	(0.055)	(0.076)	(0.127)

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: The regression models correspond to our main analyses in Figure 4, i.e. we partial out the main effects of all vulnerability factor variables and control variables as well as the interactions of the vulnerability factor variable (as denoted in the corr. table row) with survey year dummies. The reported results in the table correspond to the regression coefficients of a non-interacted dummy variable 1[survey year = 2020]. From col. 1-5, we change the base-categories of vulnerability factor variables.

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Table A9: OLS regressions of life satisfaction on pre-COVID health risks

Vulnerability factor:	Physical health (1)	Mental health (2)
Surveyyear 2011 (ref: 2019)	-0.370***	-0.404***
	(0.038)	(0.033)
Surveyyear 2012	-0.247***	-0.277***
	(0.034)	(0.027)
Surveyyear 2013	-0.195***	-0.191***
	(0.033)	(0.027)
Surveyyear 2014	-0.188***	-0.178***
	(0.032)	(0.025)
Surveyyear 2015	-0.083**	-0.081***
	(0.032)	(0.025)
Surveyyear 2016	-0.041	-0.093***
	(0.032)	(0.024)
Surveyyear 2017	-0.103***	-0.118***
	(0.026)	(0.021)
Surveyyear 2018	-0.040*	-0.044**
	(0.024)	(0.018)
Surveyyear 2020	-0.039*	-0.012
	(0.022)	(0.017)
Pre-existing physical health risks	-0.342***	
	(0.037)	
Surveyyear 2012 # Pre-existing physical health risks	-0.039	
	(0.057)	
Surveyyear 2013 # Pre-existing physical health risks	0.069	
	(0.052)	
Surveyyear 2014 # Pre-existing physical health risks	0.054	
	(0.050)	
Surveyyear 2015 # Pre-existing physical health risks	0.027	
	(0.047)	
Surveyyear 2016 # Pre-existing physical health risks	-0.095**	
	(0.044)	
Surveyyear 2017 # Pre-existing physical health risks	-0.021	
	(0.040)	
Surveyyear 2018 # Pre-existing physical health risks	-0.015	
	(0.036)	
Surveyyear 2020 # Pre-existing physical health risks	0.089***	
	(0.033)	
Pre-existing mental health risks		-1.041***
		(0.056)
Surveyyear 2012 # Pre-existing mental health risks		-0.143
		(0.122)
Surveyyear 2013 # Pre-existing mental health risks		-0.120
		(0.094)
Surveyyear 2014 # Pre-existing mental health risks		0.008
		(0.101)
Surveyyear 2015 # Pre-existing mental health risks		-0.117
		(0.081)
Surveyyear 2016 # Pre-existing mental health risks		-0.047
		(0.075)
Surveyyear 2017 # Pre-existing mental health risks		-0.066
		(0.065)
Surveyyear 2018 # Pre-existing mental health risks		-0.019
		(0.057)
Surveyyear 2020 # Pre-existing mental health risks		0.130**
		(0.052)
Immigrant (ref: native-born ethnic majority)	0.179***	0.153***
	(0.045)	(0.043)

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Descendant of immigrant	0.110*	0.095*
	(0.057)	(0.054)
Refugee	-0.219**	-0.227**
	(0.097)	(0.095)
Educational degree: Short cycle non-tertiary (ref: lower secondary)	0.154***	0.148***
	(0.046)	(0.044)
Bachelor or equivalent	0.285***	0.297***
	(0.055)	(0.052)
Master or Doctoral	0.412***	0.390***
	(0.056)	(0.055)
Living space per person in household (square meters)	0.008***	0.009***
	(0.001)	(0.001)
squared	-0.000***	-0.000***
	(0.000)	(0.000)
Unemployment rate in local labor market region (month of interview)	-0.013**	-0.019***
	(0.006)	(0.006)
District-type: Urban district (ref: independent large city)	-0.062*	-0.095***
	(0.035)	(0.033)
Rural district with some density	-0.146***	-0.184***
	(0.042)	(0.041)
Sparsely populated rural district	-0.116***	-0.142***
	(0.044)	(0.042)
Person-Year observations	153,961	154,863
Person observations	21,961	21,818
R2 adjusted	0.072	0.109
Dep. var. mean	7.428	7.434
Command	regress	regress
Model	ols	ols

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Standard errors clustered at person-level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

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Table A10: Clinically relevant mental health risks and sociodemographic vulnerability factors, Outcome: 1[MCS > 45]

Vulnerability factor:	Gender, children	Living arrangements	Age	Migration status	Employment
Surveyyear 2010 (ref: 2018)	-0.046***	-0.033***	-0.002	-0.022**	-0.048***
	(0.015)	(0.012)	(0.036)	(0.010)	(0.013)
Surveyyear 2012	-0.025**	-0.033***	0.018	-0.019**	-0.039***
	(0.011)	(0.010)	(0.028)	(0.008)	(0.011)
Surveyyear 2014	-0.002	-0.009	0.018	0.002	-0.017*
	(0.011)	(0.008)	(0.025)	(0.007)	(0.010)
Surveyyear 2016	0.021**	0.023***	0.018	0.021***	0.021**
	(0.010)	(0.007)	(0.022)	(0.007)	(0.009)
Surveyyear 2020	-0.040***	-0.051***	-0.050**	-0.039***	-0.040***
	(0.009)	(0.007)	(0.021)	(0.006)	(0.008)
Men with children (ref: men w/o children)	0.025	0.037***	0.035***	0.037***	0.036***
	(0.015)	(0.011)	(0.011)	(0.011)	(0.011)
Surveyyear 2010 # Men with children	-0.003				
	(0.034)				
Surveyyear 2012 # Men with children	-0.009				
	(0.026)				
Surveyyear 2014 # Men with children	-0.003				
	(0.021)				
Surveyyear 2016 # Men with children	0.021				
	(0.019)				
Surveyyear 2020 # Men with children	0.031*				
	(0.019)				
Women without children	-0.072***	-0.063***	-0.063***	-0.063***	-0.064***
	(0.011)	(0.008)	(0.008)	(0.008)	(0.008)
Surveyyear 2010 # Women without children	0.051***				
	(0.020)				
Surveyyear 2012 # Women without children	0.014				
	(0.016)				
Surveyyear 2014 # Women without children	0.019				
	(0.015)				

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Surveyyear 2016 # Women without children	0.002				
	(0.014)				
Surveyyear 2020 # Women without children	-0.003				
	(0.013)				
Women with children	-0.026*	-0.033***	-0.034***	-0.033***	-0.034***
	(0.015)	(0.011)	(0.011)	(0.011)	(0.011)
Surveyyear 2010 # Women with children	-0.007				
	(0.032)				
Surveyyear 2012 # Women with children	-0.019				
	(0.026)				
Surveyyear 2014 # Women with children	-0.016				
	(0.020)				
Surveyyear 2016 # Women with children	-0.009				
	(0.018)				
Surveyyear 2020 # Women with children	-0.004				
	(0.018)				
Living without partner (ref: cohabiting with partner)	-0.051***	-0.066***	-0.051***	-0.051***	-0.051***
	(0.008)	(0.010)	(0.008)	(0.008)	(0.008)
Surveyyear 2010 # Living without partner		0.017			
		(0.018)			
Surveyyear 2012 # Living without partner		0.024			
		(0.015)			
Surveyyear 2014 # Living without partner		0.026*			
		(0.013)			
Surveyyear 2016 # Living without partner		-0.001			
		(0.012)			
Surveyyear 2020 # Living without partner		0.026**			
		(0.011)			
Age 26-45 (ref: 16-25)	-0.056***	-0.056***	-0.049**	-0.056***	-0.056***
	(0.013)	(0.013)	(0.019)	(0.013)	(0.013)
Surveyyear 2010 # 26-45			-0.041		
			(0.041)		
Surveyyear 2012 # 26-45			-0.037		
			(0.032)		
Surveyyear 2014 # 26-45			-0.013		

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			(0.028)		
Surveyyear 2016 # 26-45			-0.002		
			(0.025)		
Surveyyear 2020 # 26-45			0.012		
			(0.024)		
46-59	-0.071***	-0.071***	-0.054***	-0.070***	-0.071***
	(0.014)	(0.014)	(0.019)	(0.013)	(0.013)
Surveyyear 2010 # 46-59			-0.058		
			(0.040)		
Surveyyear 2012 # 46-59			-0.077**		
			(0.031)		
Surveyyear 2014 # 46-59			-0.046*		
			(0.027)		
Surveyyear 2016 # 46-59			0.008		
			(0.024)		
Surveyyear 2020 # 46-59			0.011		
			(0.024)		
60-74	0.029**	0.029**	0.018	0.029**	0.028**
	(0.014)	(0.014)	(0.020)	(0.014)	(0.014)
Surveyyear 2010 # 60-74			0.022		
			(0.039)		
Surveyyear 2012 # 60-74			-0.009		
			(0.031)		
Surveyyear 2014 # 60-74			0.007		
			(0.028)		
Surveyyear 2016 # 60-74			0.009		
			(0.025)		
Surveyyear 2020 # 60-74			0.022		
			(0.024)		
75+	0.060***	0.059***	0.061***	0.060***	0.062***
	(0.017)	(0.017)	(0.023)	(0.017)	(0.017)
Surveyyear 2010 # 75+			0.041		
			(0.048)		
Surveyyear 2012 # 75+			-0.035		
			(0.037)		

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Surveyyear 2014 # 75+			0.013 (0.031)		
Surveyyear 2016 # 75+			0.005 (0.028)		
Surveyyear 2020 # 75+			0.002 (0.026)		
Immigrant (ref: native-born ethnic majority)	0.003 (0.012)	0.003 (0.012)	0.003 (0.012)	0.003 (0.016)	0.003 (0.012)
Surveyyear 2010 # Immigrant				-0.010 (0.036)	
Surveyyear 2012 # Immigrant				-0.025 (0.028)	
Surveyyear 2014 # Immigrant				0.023 (0.020)	
Surveyyear 2016 # Immigrant				0.008 (0.017)	
Surveyyear 2020 # Immigrant				-0.002 (0.019)	
Descendant of immigrant	0.004 (0.016)	0.004 (0.016)	0.004 (0.016)	0.014 (0.021)	0.003 (0.016)
Surveyyear 2010 # Descendant of immigrant				-0.078 (0.063)	
Surveyyear 2012 # Descendant of immigrant				0.006 (0.043)	
Surveyyear 2014 # Descendant of immigrant				-0.015 (0.032)	
Surveyyear 2016 # Descendant of immigrant				0.022 (0.027)	
Surveyyear 2020 # Descendant of immigrant				-0.029 (0.025)	
Refugee	-0.018 (0.029)	-0.016 (0.029)	-0.016 (0.028)	-0.037 (0.039)	-0.014 (0.028)
Surveyyear 2010 # Refugee				-0.029 (0.203)	
Surveyyear 2012 # Refugee				-0.085	

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				(0.090)	
Surveyyear 2014 # Refugee				-0.025	
				(0.072)	
Surveyyear 2016 # Refugee				-0.028	
				(0.065)	
Surveyyear 2020 # Refugee				0.085**	
				(0.036)	
Self-employed (ref: full-/part-time, training)	-0.007	-0.008	-0.007	-0.007	0.004
	(0.013)	(0.013)	(0.013)	(0.013)	(0.019)
Surveyyear 2010 # Self-employed					-0.005
					(0.039)
Surveyyear 2012 # Self-employed					-0.029
					(0.031)
Surveyyear 2014 # Self-employed					-0.017
					(0.030)
Surveyyear 2016 # Self-employed					-0.007
					(0.027)
Surveyyear 2020 # Self-employed					-0.012
					(0.026)
Marginally employed	-0.041***	-0.041***	-0.041***	-0.041***	-0.066***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.024)
Surveyyear 2010 # Marginally employed					0.076
					(0.048)
Surveyyear 2012 # Marginally employed					0.090**
					(0.036)
Surveyyear 2014 # Marginally employed					0.065*
					(0.034)
Surveyyear 2016 # Marginally employed					0.010
					(0.034)
Surveyyear 2020 # Marginally employed					-0.020
					(0.030)
Inactive	-0.069***	-0.069***	-0.070***	-0.069***	-0.088***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.012)
Surveyyear 2010 # Inactive					0.060***
					(0.020)

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Surveyyear 2012 # Inactive					0.035**
					(0.016)
Surveyyear 2014 # Inactive					0.048***
					(0.014)
Surveyyear 2016 # Inactive					0.004
					(0.014)
Surveyyear 2020 # Inactive					0.007
					(0.013)
Unemployed	-0.164***	-0.164***	-0.163***	-0.164***	-0.191***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.029)
Surveyyear 2010 # Unemployed					0.031
					(0.055)
Surveyyear 2012 # Unemployed					0.076*
					(0.044)
Surveyyear 2014 # Unemployed					0.058
					(0.040)
Surveyyear 2016 # Unemployed					0.006
					(0.040)
Surveyyear 2020 # Unemployed					0.025
					(0.037)
Educational degree: Short cycle non-tertiary (ref: lower secondary)	0.015	0.014	0.015	0.015	0.015
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Bachelor or equivalent	0.024*	0.023*	0.024*	0.024*	0.024*
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Master or Doctoral	0.044***	0.043***	0.044***	0.044***	0.044***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Living space per person in household (square meters)	0.001***	0.001***	0.001**	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
squared	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment rate in local labor market region (month of interview)	-0.001	-0.001	-0.001	-0.002	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
District-type: Urban district (ref: independent large city)	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Rural district with some density	-0.003	-0.003	-0.003	-0.003	-0.003

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	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Sparsely populated rural district	-0.010	-0.011	-0.010	-0.010	-0.010
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Person-Year observations	88,258	88,258	88,258	88,258	88,258
Person observations	22,020	22,020	22,020	22,020	22,020
R2 adjusted	0.028	0.028	0.029	0.028	0.029
Dep. var. mean	0.753	0.753	0.753	0.753	0.753
Command	regress	regress	regress	regress	regress
Model	ols	ols	ols	ols	ols

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Outcome variable is the dummy-recoded MCS (1: MCS > 45; 0: MCS <= 45). Standard errors clustered at person-level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

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Table A11: Clinically relevant mental health risks and pre-COVID health risks, 1[MCS > 45]

Vulnerability factor:	Physical health	Mental health
Surveyyear 2012 (ref: 2018)	-0.031***	-0.041***
	(0.010)	(0.008)
Surveyyear 2014	-0.005	-0.009
	(0.009)	(0.007)
Surveyyear 2016	0.015*	0.011*
	(0.009)	(0.006)
Surveyyear 2020	-0.045***	-0.045***
	(0.008)	(0.006)
Pre-existing physical health risks	-0.051***	
	(0.010)	
Surveyyear 2012 # Pre-existing physical health risks	0.004	
	(0.016)	
Surveyyear 2014 # Pre-existing physical health risks	0.007	
	(0.014)	
Surveyyear 2016 # Pre-existing physical health risks	0.009	
	(0.012)	
Surveyyear 2020 # Pre-existing physical health risks	0.008	
	(0.011)	
Pre-existing mental health risks		-0.337***
		(0.015)
Surveyyear 2012 # Pre-existing mental health risks		-0.057*
		(0.032)
Surveyyear 2014 # Pre-existing mental health risks		-0.031
		(0.026)
Surveyyear 2016 # Pre-existing mental health risks		0.018
		(0.020)
Surveyyear 2020 # Pre-existing mental health risks		0.031*
		(0.017)
Immigrant (ref: native-born ethnic majority)	0.002	-0.008
	(0.012)	(0.011)
Descendant of immigrant	0.005	-0.008
	(0.017)	(0.015)
Refugee	-0.027	-0.023
	(0.034)	(0.028)
Educational degree: Short cycle non-tertiary (ref: lower secondary)	0.016	0.012
	(0.012)	(0.011)
Bachelor or equivalent	0.015	0.014
	(0.014)	(0.013)
Master or Doctoral	0.043***	0.029**
	(0.015)	(0.014)
Living space per person in household (square meters)	0.001**	0.001***
	(0.000)	(0.000)
squared	-0.000	-0.000**
	(0.000)	(0.000)
Unemployment rate in local labor market region (month of interview)	-0.001	-0.002
	(0.002)	(0.001)
District-type: Urban district (ref: independent large city)	-0.001	-0.012
	(0.009)	(0.008)
Rural district with some density	-0.004	-0.014
	(0.011)	(0.010)
Sparsely populated rural district	-0.013	-0.018*
	(0.011)	(0.010)

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Person-Year observations	71,001	71,848
Person observations	18,817	18,685
R2 adjusted	0.031	0.096
Dep. var. mean	0.761	0.764
Command	regress	regress
Model	ols	ols

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Outcome variable is the dummy-recoded MCS (1: MCS > 45; 0: MCS <= 45). Standard errors clustered at person-level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

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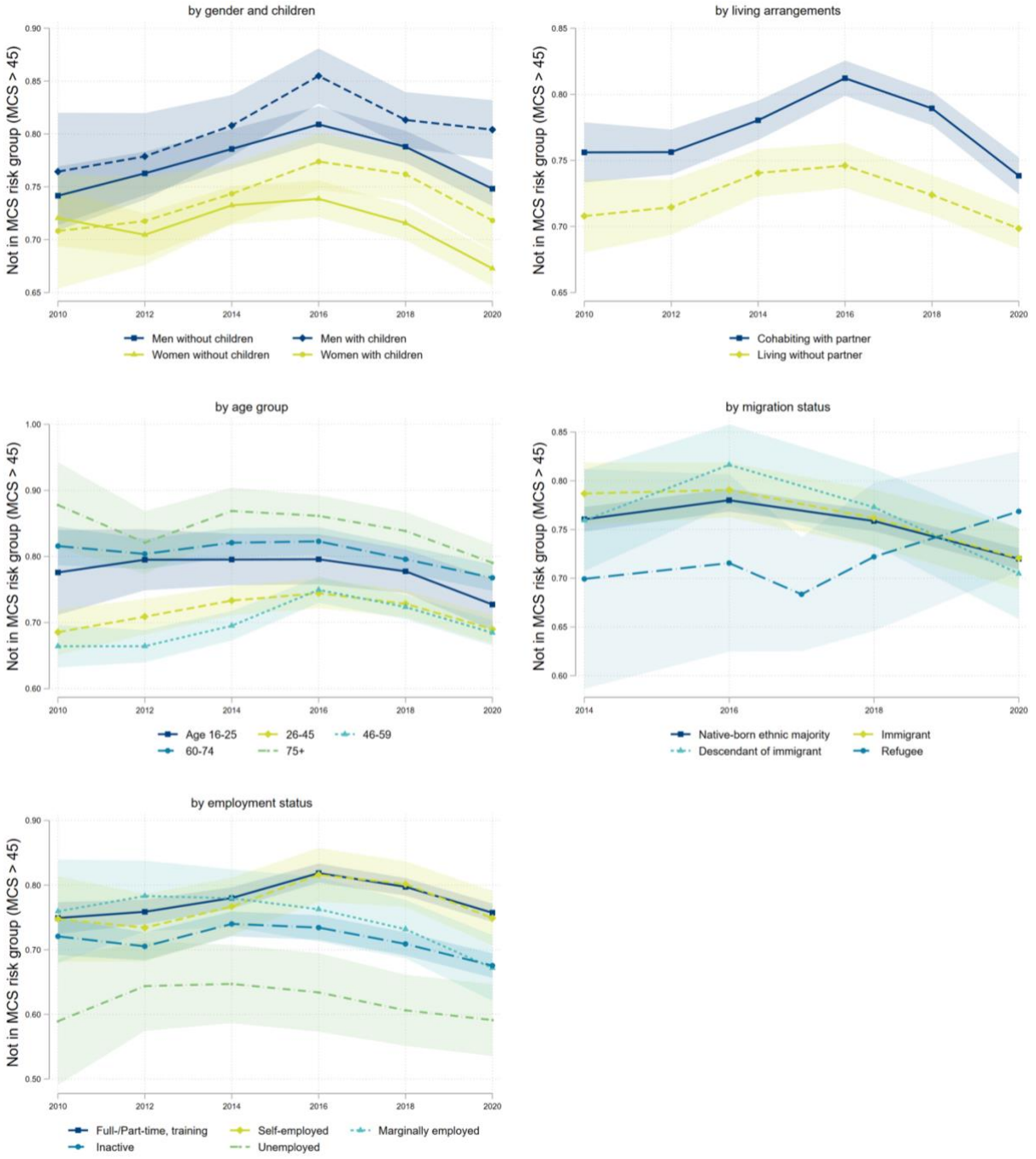
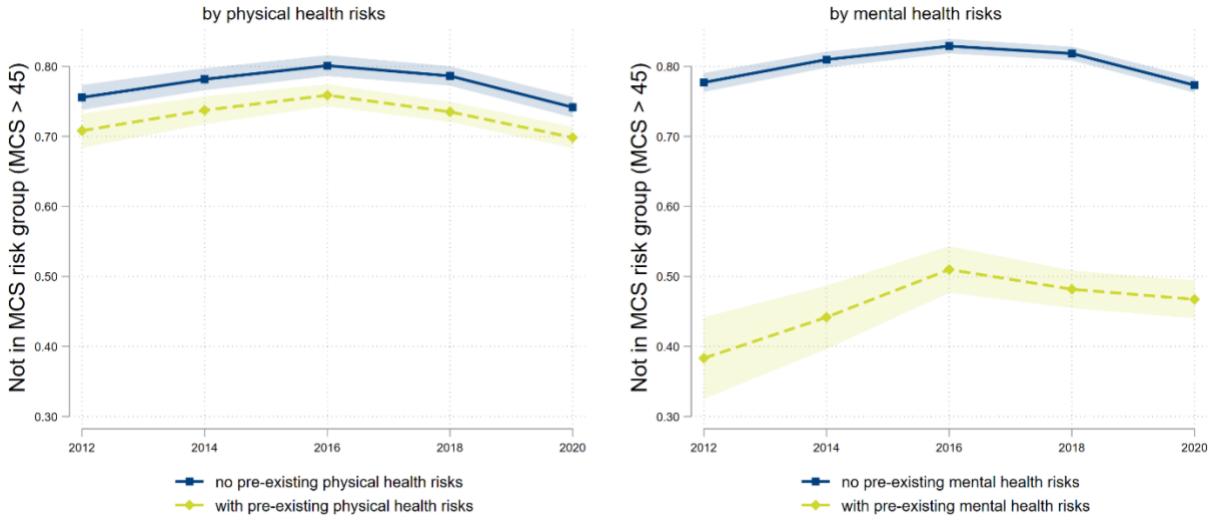
Figure A1: Predictive margins for clinically relevant mental health risks and sociodemographic vulnerability factors, Outcome: 1[MCS > 45]



Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Outcome variable is the dummy-recoded MCS (1: MCS > 45; 0: MCS <= 45). Predictive margins partial out the main effects of sociodemographic vulnerability factor variables and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

Figure A2: Predictive margins for clinically relevant mental health risks and pre-COVID health risks, Outcome: 1[MCS > 45]



Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Outcome variable is the dummy-recoded MCS (1: MCS > 45; 0: MCS <= 45). Predictive margins partial out the main effects of sociodemographic vulnerability factor variables and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

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STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	8
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9
Bias	9	Describe any efforts to address potential sources of bias	11
Study size	10	Explain how the study size was arrived at	8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	12
		(*b*) Describe any methods used to examine subgroups and interactions	12
		(*c*) Explain how missing data were addressed	11
		(*d*) If applicable, explain how loss to follow-up was addressed	8
		(*e*) Describe any sensitivity analyses	22
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	8
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13, Tab. A1
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) Summarise follow-up time (eg, average and total amount)	7
Outcome data	15*	Report numbers of outcome events or summary measures over time	8

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Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (*b*) Report category boundaries when continuous variables were categorized (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	11, Fig. 1-5, 10
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	14-16
Discussion			
Key results	18	Summarise key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	21
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	24
Generalisability	21	Discuss the generalisability (external validity) of the study results	23
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

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Mental health and well-being in the first year of the COVID-19 pandemic among different population subgroups: evidence from representative longitudinal data in Germany

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Secondary Subject Heading:	Mental health
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Mental health and well-being in the first year of the COVID-19 pandemic among different population subgroups: evidence from representative longitudinal data in Germany

Philipp Jaschke [1*], Yuliya Kosyakova [1,2*], Coline Kuche [4*], Lena Walther [3*], Laura Goßner [1], Jannes Jacobsen [5,6], Thi Minh Tam Ta [3], Eric Hahn [3], Silke Hans [4], Malek Bajbouj [3]

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ABSTRACT

Objectives: To examine potential deteriorations in mental health and well-being in the first COVID-19 pandemic year compared to the previous decade focusing on the following vulnerable subgroups in Germany: women with minor children in the household, those living without a partner, younger and older adults, those in a precarious labor market situation, immigrants and refugees, and those with pre-existing physical or mental health risks

Design: Analyses of secondary longitudinal survey data using cluster-robust pooled OLS models

Participants: More than 20,000 individuals (aged 16+) in Germany

Primary and secondary outcome measures: Mental Component Summary Scale (MCS) of the SF-12 measuring mental health-related quality of life, single item on life satisfaction (LS)

Results: We find a decline in the average MCS in the 2020 survey that is not particularly striking in the overall time course, still resulting in a mean score below those of all preceding waves since 2010. We find no change in LS from 2019 to 2020 against the background of a general upward trend. Regarding vulnerability factors, only the results on age and parenthood are partially in line with our expectations. In 2020, LS declined among the youngest adults; MCS declined among mothers (and women and men without children) but not fathers. Unlike respective comparison groups, refugees, those unemployed before the pandemic, and those with pre-existing mental health risks experienced no MCS declines in 2020, whereas persons living without a partner, the eldest, and those with pre-existing health risks exhibited continued increases in LS.

Conclusions: There is no evidence for substantial breakdowns in mental health or subjective well-being in the first pandemic year in the German population or its subgroups, particularly when considering developments of the previous decade. Since the majority of hypothesized vulnerable groups to pandemic stressors showed more stable MCS and LS, our results warrant further study.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

- The paper uses data from a large-scale longitudinal random sample of private households in Germany to uncover pandemic-related changes in the long-term trajectories of mental health and subjective well-being.
- We employ analyses for two different indicators: The Mental Component Summary Scale (MCS) capturing mental health-related quality of life as a mental health measure and life satisfaction as a measure of subjective well-being.
- We consider heterogeneous trajectories of mental health and well-being by looking at several possible vulnerability factors, namely gender and children, living arrangements, age, precarious employment, migration status and pre-existing physical and mental health risks.
- No data for the succeeding pandemic years after 2020 are available yet, limiting our possibilities to assess changes in mental health and well-being trajectories across vulnerability groups further into the pandemic.

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INTRODUCTION

Since 2020 and for over two years, the COVID-19 pandemic has posed a threat not only to the physical health of populations globally but may have had direct and collateral effects on individuals' mental health and well-being [1, 2]. In the first year of the pandemic, populations worldwide were exposed to major new stressors, such as the fear of infection with a poorly understood virus, severe illness, or death, as well as the repercussions of measures to control the spread of the virus via social contact restrictions, as well as economic consequences [2, 3]. In Germany, the first case was reported at the end of January 2020, marking the start of phase zero with sporadic cases [4]. Soon thereafter, the first wave of infections from March to May [4] prompted a lockdown, including far-reaching contact restrictions in work and private settings, closures of schools, childcare facilities, non-essentials and gastronomy. After a summer with relatively few cases, a more severe second wave of infections and the beginning of the vaccination campaign followed between October 2020 and February 2021 [4] with a partial lockdown in fall 2020 and a more far-reaching lockdown from December 2020 [5] onwards. Owing to the pandemic and containment measures, declines in mental health and well-being in 2020 compared to previous years were widely expected [6, 7]. The early stages of the pandemic have been examined extensively regarding potential mental health declines in Germany [8] and internationally [9, 10, 11, 12]. However, findings are mixed, and clear conclusions cannot be easily drawn [8, 13].

Despite the crisis' global nature, some population groups are likely to have been disproportionally affected [14]. The burden of the pandemic – both from the presence of the virus and measures for infection mitigation – may have been unequally distributed across different groups in the population throughout the pandemic. For instance, *older individuals* and those with *pre-existing health conditions* face a greater risk of falling severely ill with COVID-19 [1, 15], which likely led to an increased perception of threat and health anxiety, particularly

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in the first year of the pandemic, before vaccinations were developed. *Parents* [5], but especially *mothers* [16, 17], may have been particularly burdened by new childcare demands during school and childcare facility closures. *Younger adults* experienced social contact and other restrictions during a transitional life stage [18]. *Older* individuals and those *living without a partner* [18] faced increased risks of isolation due to contact restrictions and social distancing [1]. Individuals in precarious labor market situations, such as *those unemployed* or *marginally employed,* were more likely to endure personal repercussions from economic consequences of the pandemic [19, 20, 21]. *Migrants*, particularly *refugees* (used here to refer to all persons who move to another country for humanitarian reasons, independent of their legal situation), may have faced increased risks due to restricted access to quality healthcare [22], poorer labor market attachment [23], but also greater risks of isolation when social networks in the country of residence are less established [24, 25], and concerns for family and friends in their country of origin. Those with *pre-existing mental health conditions* may be particularly vulnerable to the potential mental health consequences of these various pandemic-related stressors [18].

Indeed, existing research provides some evidence for associations between these vulnerability factors and poorer mental health in the first years of the pandemic in Germany or elsewhere: Younger adults [8, 26, 27, 28], older adults [29], parents [27, 30], mothers [31], those with lower education levels [32, 33], lower household income [33] or those receiving welfare assistance [34], immigrants and refugees [35, 36, 25], individuals living alone [37], those with pre-existing mental [8, 38] and physical health conditions [11] have been found to show an elevated risk of mental health deterioration. Fewer studies also examined life satisfaction, identifying corresponding declines in the overall German population [39, 40] and particularly for mothers [41]. Yet, these studies looked only at shorter time spans (i.e., one time point before the pandemic or retrospective measures).

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In light of previous research, we identify three main research gaps. First, we argue that it is crucial to consider both measures of mental health and subjective well-being as outcomes because the pandemic may have different impacts on the latter, particularly on cognitive evaluative measures such as life satisfaction. Second, nationwide representative studies (exceptions include [42, 43]) and, in particular, longitudinal studies (exceptions include [28, 44, 45]) on mental health and well-being indicators pre- and peri-pandemic in Germany are still rare. Moreover, these and other existing studies consider only more recent pre-pandemic timespans or a single baseline period, not regarding longer pre-pandemic trends. In other words, previous studies have been limited in their capacity to distinguish differences in mental health and well-being between observation periods before and during the pandemic that may be part of longer ongoing trends or reflect a degree of fluctuation observed in previous years from pandemic-related changes. Third, migrant and especially refugee populations as potentially vulnerable groups have scarcely been addressed in the existing literature (exceptions include [25, 46]).

The present study addresses these research gaps by examining the potential impact of the early phases of the pandemic on the development of the Mental Component Summary Scale (MCS) of the Short Form-12 Health Survey, which assesses mental health-related quality of life [47], and life satisfaction, a cognitive component of subjective well-being [48], using nation-wide, representative, longitudinal data from approximately 20,000 adults in Germany. We explore the heterogeneous impact of the pandemic by addressing a whole set of candidate vulnerability factors: being female with children under the age of 16 in the household, living without a partner, being a younger or older adult, migration status, various less secure forms of employment, and pre-existing physical and mental health risks. We hypothesized that these vulnerability factors are associated with declines in MCS and life satisfaction in the first pandemic year compared to the pre-pandemic period. We used data from the SOEP-CORE

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(17,611 individuals providing 75,266 person-year observations), IAB-SOEP Migration sample (2,018 individuals providing 6,978 person-year observations), and IAB-BAMF-SOEP Survey of Refugees (2,391 individuals providing 6,014 person-year observations) (the number of observations refers to the analytical sample for the MCS and sociodemographic vulnerability factors), which encompass six survey waves for the MCS (between 2010 and 2020) and eleven survey waves for life satisfaction (2010-2020). To analyze the developments in both indicators, we estimated weighted pooled OLS-regressions and assessed the pandemic impact by using interaction effects between vulnerability factors and survey year dummies.

METHODS

Public involvement

Patients or the public were not involved in the design and conduct of this research.

Study design and analytical sample

The data employed in the present study comes from the German Socio-economic Panel (SOEP, v.37, EU version), which comprises the general SOEP-CORE population survey, 2010-2020 [49], and two integrated studies covering the recent immigrants in Germany, i.e., the IAB-SOEP Migration Sample, 2013-2020 [50], and the IAB-BAMF-SOEP Survey of Refugees 2016-2020 [51].

The SOEP-CORE is a large-scale longitudinal representative study of private households in Germany, launched in 1984 and conducted annually [49]. The target population of the IAB-SOEP Migration Sample was drawn from the register data of the Federal Employment Agency (BA), the so-called Integrated Employment Biographies, in 2013 [50]. The study is representative of immigrants arriving in Germany since 1995 and descendants of immigrants born after 1976 [52, 53]. As part of the SOEP-CORE study, the last immigrant refreshment

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sample before the IAB-SOEP Migration Sample dates back to 1995. The survey is based on a concept of households according to which every adult household member is interviewed. The IAB-BAMF-SOEP Sample of Refugees in Germany was launched in 2016, in the aftermath of the surge of refugee migration to Europe in 2015 [51]. The data were drawn from the Central Register of Foreigners [54] and are representative of refugees who arrived in Germany between January 2013 and December 2016 (irrespective of their current legal status). It is based on the same household concept as that described for IAB-SOEP. By using appropriate sample weights, SOEP data allow us to make inferences for the population in Germany.

For analyses, we restricted the original data to the years 2010-2020 to minimize the lingering effects of the financial crisis in 2008/2009, which had a negative public health impact [55, 56]. Moreover, we considered 2010-2020 observations of respondents who participated in the survey year 2020, i.e., pandemic survey year, and in at least one pre-pandemic survey year. Due to specifics of the fieldwork, SOEP-CORE interviews were collected between January 10th and December 8th 2020, interviews of the IAB-SOEP Migration Sample between March 4th 2020 and August 12th 2020, while the IAB-BAMF-SOEP Sample of Refugee interviews started on August 24th 2020 and were completed on February 15th 2021. We included data from respondents interviewed on January 31st or later (exclusion of four respondents), the day after WHO declared COVID-19 a "public health emergency of international concern" and three days after the first case in Germany [57].

These data restrictions resulted in a sample of 22,020 individuals for the analysis of mental health trajectories by sociodemographic vulnerability factors that have been interviewed up to 6 times (4.5 on average). While about 80 percent of interviews in our utilized SOEP-CORE and IAB-SOEP Migration Sample data were conducted by the end of May 2020, interviews as part of the IAB-BAMF-SOEP Survey of Refugees only started in August 2020, and 83 percent were conducted by the end of 2020. All analyses in this study are weighted with the sample weights

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provided with the survey data to compensate for distortions caused by over- or underrepresented groups, and non-response.

Outcome variables

We consider *mental health-related quality of life* and *subjective well-being* as dependent variables. Our measure of mental health-related quality of life was the Mental Component Summary Scale (MCS) from the Short-Form Health Survey (SF-12), which includes six items capturing vitality (energy vs. fatigue), social functioning, role limitations due to emotional problems, and emotional well-being over the past four weeks on a five-point scale [47]. While the MCS has been commonly been conceived of as assessing the mental health component of health-related quality of life [58, 59], it has also shown to be suitable as a screening instrument for depression and anxiety disorders [60, 61]. We formed composite MCS-12 scores ranging from 0 to 100 normalized to the 2004 SOEP wave for comparability [62]. Except the survey year 2017, when a new refreshment sample of more than 2,000 refugees was added, MCS was collected in two-year intervals from 2010 until 2020, providing one pandemic-time survey date (between January 30th 2020 and February 15th 2021).

Our measure of subjective well-being is a single item on global life satisfaction, a well-established 11-point scale ranging from 0 (completely dissatisfied with life) to 10 (completely satisfied with life). Life satisfaction is generally conceived as the cognitive component of subjective well-being (e.g. [63]). Life satisfaction was collected annually, yielding pandemic-time observations between January 30th 2020 and February 15th 2021.

Vulnerability factor variables

The vulnerability factors to be examined were measured using the following variables: Gender and having children under the age of 16 living in the same household were grouped in a variable *gender and children* with the following categories: (1) men without children (reference

category), (2) men with children, (3) women without children, and (4) women with children. To measure *living arrangements*, we contrasted living without a partner (including single, married or in a registered partnership living separately, widowed) with cohabiting with a partner (irrespective of marriage).

Age was grouped into the following five categories: (1) 16-25 years (reference category), (2) 26-45 years, (3) 46-59 years, (4) 60-74 years, or (5) 75 + years old. The age group of 16-25-year-olds represents young adults in education or early career. The second age group comprising persons aged between 26-45 includes working adults. Those aged between 46-59 represent a middle age group with a potentially more established and stable career path. Two last groups aged between 60–74 and those aged 75 and above are those most at risk of severe courses of disease due to COVID-19 infection [64, 65].

The variable for *migration background* is derived based on country of birth and legal status at arrival. The variable includes the following categories: (1) native-born ethnic majority (reference category), (2) immigrant (no refugee), (3) descendant of immigrant (no refugee), (4) refugee.

Employment status includes the following categories: (1) full-time, part-time employed or other (training/apprenticeship, sheltered workshop) (reference), (2) marginally employed (which is characterized by low absolute remuneration – e.g., with a maximum of 450 EUR in 2019 as defined by law – and short working hours), (3) self-employed, (4) unemployed (not working but job-seeking), and (5) inactive (retired or those not working but not job seeking).

An indicator for pre-existing (i.e., pre-pandemic) *mental health risks* was coded to one for those who reported having received a diagnosis of depression or burnout at some point in their lives, and zero otherwise. An indicator for pre-existing *physical health risks* was coded to one for those who reported having been diagnosed with asthma, cardiopathy, cancer, stroke, or

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hypertension at some point in their lives, and zero otherwise. Pre-existing conditions were coded such that they were carried forward from the first report and no conditions were carried backward.

To ensure the correct order of changes in time, we lagged the vulnerability factor values for employment status and health status from the last pre-pandemic survey wave to prevent reverse causality issues. We included corresponding dummy variables indicating missing information to capture item non-response in vulnerability factor variables.

Control variables

We account for potential confounders that may vary by vulnerability factors and simultaneously shape mental health-related quality of life and life satisfaction. Specifically, we control for the *highest educational degree* aggregated into: (1) lower secondary education (reference category), (2) secondary or short-cycle non-tertiary education, (3) bachelor's degree or equivalent, and (4) master's degree or doctorate. We further control for square meters of *living space* per person (linear and squared) to account for the household's availability of private space per person. Additionally, we control for *district type* in which the respondent resides categorized into (1) independent large city (reference category), (2) urban district, (3) rural district with some density, and (4) sparsely populated rural district [66]. We control for the average *unemployment rate* in the local labor market region in the interview month to account for the local economic situation. Since Germany's counties and independent cities are connected by commuter linkages so that local labor markets extend beyond the boundaries of 401 administrative districts, we use the 141 functional local labor markets defined by Kosfeld and Werner [67]. To control for temporal trends, we include *survey year* fixed effects and the calendar *month of the interview*. Note that in the analyses on life satisfaction we include yearly dummies from 2010 (reference) to 2020. Since the MCS was surveyed in two-year intervals,

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we consider 2-year dummies. Tables A1-A3 in the appendix show descriptive statistics for the vulnerability factors and control variables.

Statistical analyses

All analyses were conducted in Stata version 17.0. Our analyses of the different vulnerability factors were two-part: we separated analyses pertaining to structural factors and those pertaining to pre-existing health conditions. In the analyses pertaining to structural vulnerability factors, we applied pooled Ordinary Least Squares (OLS) models (with standard errors clustered at person-level) regressing MCS score and life satisfaction on the vulnerability factor variables, one interaction term per model of each vulnerability factor variable by the survey year variable, and control variables. Correspondingly, we calculated one model per vulnerability factor variable for each outcome variable to include only a single interaction term per model.

We analyzed pre-existing health risks as vulnerability factors separately from the other factors because of their uniquely close relationship with the outcome variables. Another reason is reduced sample size, as information on pre-existing health risks is unavailable for most refugees. These pooled OLS models predicting MCS or life satisfaction included dummies for physical or mental health risks, one interaction term per model of physical or mental health risks by the survey year variable, as well as all remaining structural vulnerability factors and further controls.

We calculated predictive margins for the outcome variables for each vulnerability factor sub-group from the regression results. Specifically, we estimated the following regressions separately for each of the five vulnerability factor groups $V \in \{GENDCHILD, LIVARR, AGEGRP, MIG, EMPL\}$:

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$$Y_{i,r,t,v} = \boldsymbol{\alpha}v1[\boldsymbol{surveyyear} = \boldsymbol{t}] + \beta v GENDCHILD_{i,t} + \gamma v LIVARR_{i,t} + \delta v AGEGRP_{i,t} + \zeta v MIG_{i,t} + \eta v EMPL_{i,t} + \boldsymbol{\theta}v1[\boldsymbol{surveyyear} = \boldsymbol{t}] \times V_{i,t} + \boldsymbol{\vartheta} \boldsymbol{X}_{i,t} + \boldsymbol{\iota}\boldsymbol{X}_{r,t} \quad ,$$

where Y is either MCS or life satisfaction of individual i in region r in survey year t and bolt font indicates vectors. Concerning vulnerability factors, *GENDCHILD* relates to gender and children, *LIVARR* to living arrangements, *AGEGRP* to age group, *MIG* to migration status and *EMPL* to employment status. $X_{i,t}$ denotes individual control variables and $X_{r,t}$ regional control variables. Note that individual vulnerability factors vary in the pre-pandemic period, while for the post-pandemic period, employment status and health status are fixed to the last observed pre-pandemic values. The main coefficient of interest θ refers to the interaction effects of the survey year dummies with the vulnerability factor v.

RESULTS

Development of MCS and life satisfaction in the German population

We begin by examining the overall development of the MCS and life satisfaction in the German population in the recent decade. As shown in Figure 1, in the pandemic year 2020, the average MCS significantly declined to a level below previous survey waves since 2010. We find a 0.7-point reduction in mean MCS (on the theoretical scale between 0 to 100) in the population in 2020 compared to the last pre-pandemic measure (2018). While this decline points to a possible pandemic-related impact on mental health-related quality of life, it is not a marked change in the overall time course and could be a continuation of declines seen since 2016. At the same time, we do not observe any change in the population average life satisfaction from 2019 to 2020. Considering the general upward trend of life satisfaction between 2010 and 2020, the absence of change may be linked to a pandemic-related attenuation. In the following, we examine whether the observed trends differ between population subgroups with different vulnerabilities to the pandemic.

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– Figure 1 –

Development of MCS by vulnerability factors

As shown in Figure 2, most sociodemographic groups show a significant decline in estimated MCS from 2018 to 2020 (see Table A4 in the Appendix for the corresponding regression coefficients): (1) women with and without children as well as men without children, (2) those cohabiting with a partner as well as those living without a partner, (3) all age groups, (4) the native-born ethnic majority as well as immigrants and their descendants (but not refugees) and (5) those in full-/ part-time employment, self-employed and those who are inactive (Table A5 reports the main (non-interacted) effect of the dummy variable 1[survey year = 2020] for varying base-categories in vulnerability factor variables). Likewise, following Figure 3, (6) those with and without certain pre-existing physical health risks and (7) persons without certain pre-existing mental health risks show a significant decline in the estimated MCS (see Table A6 for the corresponding regression coefficients). Yet, in the context of the overall trajectories since 2010, the MCS declines from 2018 to 2020 in the outlined groups are not of a remarkable magnitude or otherwise particularly striking.

– Figure 2 –

– Figure 3 –

Five groups did not show estimated MCS declines from 2018 to 2020: (1) men with children, (2) the marginally employed and (3) unemployed group, (4) refugees, and (5) those with prior mental health risks. For the marginally employed individuals, we observed declines as well, yet, these were statistically insignificant; however, it should be noted that the sample size in this group is small and limits statistical power. There is no evidence from the overall time trajectories that the absence of a decline in the other four groups may represent an attenuation of a previous upward trend. Even though these groups' MCS may have improved without the

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pandemic, it can be ruled out that the pandemic led to a decline from previous levels. Note that individuals with prior mental health risks exhibit by far the lowest MCS of all groups throughout the observation period; the unemployed exhibit the second lowest levels of MCS.

Development of life satisfaction by vulnerability factors

In contrast to the results for the MCS, most sociodemographic groups do not show pronounced changes in estimated life satisfaction from 2019 to 2020 (see Figure 4 and Tables A7, A8). The only exceptions were decreases in life satisfaction among the youngest age group (ages 16-25), full-/ part-time employed, the self-employed, and those without pre-existing physical health risks. Persons living without a partner, the two oldest age groups (ages 60-74 and 75 and over), those inactive in the labor market, and the unemployed group exhibit significant increases in life satisfaction from 2019 to 2020. Pre-existing physical or mental risks are associated with a significant increase in life satisfaction from 2019 to 2020. In contrast, persons without pre-existing physical risks show some deterioration in the same period (See Figure 5 and Table A9).

– Figure 4 –

– Figure 5 –

Looking at the overall time trajectories of estimated life satisfaction in Figures 4 and 5, none of the significant increases or decreases from 2019 to 2020 appear particularly striking in the context of the observation period between 2010 and 2020. In most groups, life satisfaction has increased gradually over these ten years. Thus, the absence of a change from 2019 to 2020 could represent pandemic-related attenuations, while significant increases may be the continuation of ongoing trends. Increases for persons without a partner, the oldest two age groups, and persons with pre-existing physical or mental risks visually do not stand out against the trend of increasing life satisfaction before 2019. However, these increases are still

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unexpected, given that they are all found within hypothesized vulnerable groups and not their hypothesized non-vulnerable counterparts. The increases among inactive and unemployed persons appear slightly more marked in the time course. Concerning the observed significant declines, the overall time trends provide context as follows: in the youngest age group and the employed group, decreases are relativized by year-to-year fluctuations of similar magnitudes before 2019. However, the youngest age does reach a life satisfaction score estimate numerically below most previous estimates in the observation period. For the self-employed, it is quite striking that the decrease goes against a general trend of increase. The significant reduction in life satisfaction from 2019 to 2020 among persons without prior physical health risks also happens against an overall increasing trend; however, 2016 to 2017 saw an even slightly greater decline.

While life satisfaction results are largely inconclusive in light of longer time trends, it is noteworthy that despite the pandemic, several hypothesized vulnerable groups showed an increase in life satisfaction, and many groups exhibit no change, demonstrating the clear absence of a pandemic-related life satisfaction breakdown in most subgroups. Overall, only four out of 24 groups (youngest age group; full-/ part-time employed; self-employed; without pre-existing physical health risks) may have experienced pandemic-related declines in life satisfaction compared to the year before.

DISCUSSION

Using panel data, we examined the development of mental health-related quality of life (measured using the Mental Component Summary Scale, MCS) and subjective well-being (indicated by life satisfaction) in more than 20,000 individuals in Germany before and during the pandemic (2010-2020). We found a decline in the MCS population average from 2018 to 2020. With regard to just the early phases of the pandemic, our results are in line with previous

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findings for Germany indicating increased symptoms of depression and anxiety between April 2020 and June 2020 [28, 36] compared to 2019 as well as April and May 2020 compared to a pre-pandemic baseline (2014-2019) [45], but in contrast to a study finding declining symptoms in this period [42]. While the mean MCS score in 2020 is below any mean score observed since 2010, this finding needs to be evaluated in light of previous trends suggesting a decline from 2016 to 2018. Further research is therefore needed to disentangle the potential effects of the pandemic from general time trends. Our results for life satisfaction also stress the importance of longitudinal analyses and the consideration of ongoing time trends. While our finding of no change in life satisfaction in 2020 supports resilience, we observed a rising trend in life satisfaction in our data before 2020. Hence, the absence of a decline from 2019 to 2020 may represent a pandemic-related attenuation.

Overall, our findings of declines in MCS scores and the absence of declines in life satisfaction demonstrate the importance of considering several indicators for a deeper understanding of developments in pandemic times. One caveat in comparing these two measures is that they differ regarding temporal specifications. With the MCS, respondents are asked to report on the last four weeks *("How often in the last four weeks…")* while the assessment of life satisfaction is formulated more generally *(translated from the German version: "How satisfied are you currently, all in all, with your life")*. These temporal specifications may be particularly important in fast-moving times like the pandemic, especially given that most observations included in our analyses were collected in the very early phases of the pandemic, i.e., possibly before any effects were experienced as longer-lasting or more far-reaching.

With regard to the examined candidate vulnerability factors, most of our findings did not match our expectations. Starting with the vulnerability factor of gender and children, MCS deteriorated in all considered subgroups, except for fathers, whereas none of these groups experienced life satisfaction deterioration. Our results, therefore, only partly conform to

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previous studies consistently reporting pandemic-related worsened mental health for women [8, 13] and mothers [31]. However, our findings contradict our expectations to find declines for parents (compared to non-parents). However, the stable MCS levels among fathers conform to previous studies pointing to fathers' increased family satisfaction after changing to short-time work [41]. Spending more time with family, e.g., through working from home policies and school and childcare facility closures, without bearing most of the childcare burden [5], may have dampened the negative effects of the pandemic for fathers. Overall, consideration of gender and parental status proved crucial in understanding potential pandemic impacts from the gender perspective.

Our analyses for the vulnerability indicator for living arrangements revealed declines in MCS in both groups and even a significant increase in life satisfaction among individuals living without a partner compared to no change among those cohabiting with a partner. Additional results provided in Figure A1 in the Appendix show similar developments when comparing persons living alone with those living with others in the household (irrespective of partnership) based on the number of persons in the household. Taken together, these results only partly support our expectations. Both groups' mental health declines may hint at different risks in both groups: On the one hand, decreased MCS of those living without a partner might reflect the challenges imposed by the pandemic. Social isolation and loneliness due to social distancing has been highlighted as a key concern for mental health during the pandemic [68], and being single has been previously linked to greater loneliness during the pandemic [37]. On the other hand, decreased MCS of individuals cohabiting with a partner might be related to external stress due to the pandemic, such as autonomy-connection tensions [69]. This external stress is associated with an increased risk of marital dissolution and challenges the partnership as such, exacerbating existing problems or creating new ones [70, 71]. Our findings of a potential attenuation of life satisfaction among those living with a partner but not among those living

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without a partner may also relate to these stressors. In sum, these results, and the challenge they pose for interpretation highlight the complexity of potential risk and resilience factors.

We found MCS declines from 2018 to 2020 for all age groups, contrary to our hypotheses of an increased risk for decline among the youngest and the eldest. For life satisfaction, we found increases from 2019 to 2020 for the older age groups (60-74 and 75+), contrary to our hypotheses, and decreases for 16–25-year-olds, in keeping with our hypotheses. These declines in life satisfaction and those in MCS of the youngest age group support the previous literature showing high psychological distress for young adults during the pandemic [26, 27]. Early adulthood functions as a critical period and includes necessary steps for interpersonal development like identity formation, separation from childhood family or significant decisions for education and career development [72, 73]. Social isolation measures and school closures drastically affected the daily life of young adults.

For the vulnerability factor immigration status, we found deteriorating MCS from 2018 to 2020 for all (including those of the native-born ethnic majority) except refugees and no change in life satisfaction from 2019 to 2020 for any of these groups. Our results for refugees are consistent with Entringer et al. [46], who found no increase in refugees' psychological distress from 2016 or 2019 to 2020. At this point, it remains unclear whether the results are due to changes in refugee population compositions, as those with poorer mental health were more likely to have left Germany [46]. Our results for life satisfaction also contrast Goßner, Kosyakova and Laible [25], who revealed negative effects for the specific event of the second nationwide lockdown in Germany on refugees' life satisfaction. Hence, a closer look at specific time periods might yield different results. The absence of significant drops in refugees' MCS in our analyses could be attributed to different underlying factors. First, refugees' mental health may improve over time in the host country as post-migration stressors decrease and individuals become better adapted to the new environment [74], mitigating or eliminating any potential

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negative pandemic effects. Second, refugee populations may also be more resilient to stressors (such as the pandemic) because of their previous experiences and personal characteristics [75]. It should also be noted that different field periods might limit comparability between groups by migration status. However, these differences do not affect the finding of an absence of pandemic-related declines in the refugee population.

Our findings for MCS and life satisfaction among employed (negative effects) and unemployed (positive or no effects) individuals resonate with the results for the UK showing increased mental distress for individuals employed before the pandemic and no such effect for those unemployed or inactive [27]. However, we do not examine the possible impact of becoming unemployed during the pandemic, which has been associated with heightened depression symptoms in Germany [76]. The negative trend for the self-employed group in both the MCS and life satisfaction is consistent with findings for the UK highlighting psychological distress among the self-employed during the pandemic [77]. Financial worries seem to mediate the pandemic's impact on mental distress [78, 79], as the self-employed were more likely to expect income losses during the pandemic and were less likely to be considered in government assistance programs. Contrary to our expectations, the marginally employed exhibited no MCS declines. However, the observation numbers for this group are small yielding low statistical power. Mixed results were also found for the inactive with decreasing MCS and increasing life satisfaction from the last pre-pandemic observation to 2020. We take from these results that the choice of measure for psychological well-being needs to be carefully considered and the use of multiple measures is critical to check the robustness of results.

Contrary to our expectations, there was no discernible difference in MCS trajectories between individuals with pre-existing physical health risks and those without in 2020. Patterns in life satisfaction were the direct opposite of our hypothesis, as the group with pre-existing physical health conditions displayed an increase between 2019 and 2020, while the other group

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experienced a decrease. Though the former group's increase in life satisfaction could potentially be attributed to a pre-existing upward trend observed since 2016, the absence of any potential pandemic effects is still surprising, considering the heightened risk of severe COVID-19 cases [15] in this group. A potential explanation for these results is that the pre-existing conditions were defined as self-reported past diagnoses, and some subset of individuals in this group had fully recovered (long) before the pandemic wave survey, and thus did not perceive a greater threat from COVID-19. Alternatively, these individuals' overall well-being may have improved due to recovery or even just with time having passed since diagnosis, thereby masking potential deleterious effects of the pandemic.

For individuals with pre-existing mental health risks, we found no change in the MCS from 2018 to 2020 and an improvement in life satisfaction from 2019 to 2020. Given the previous developments over the years, neither finding stands out, making the pandemic impact on pre-existing mental health risks unclear. At the same time, we find a decline in the MCS and no change in life satisfaction for individuals without pre-existing mental health risks. While these results contrast our expectations and some previous literature [80, 81, 8], a systematic review and meta-analysis present comparable results revealing no evidence of a change in symptoms at the beginning of the pandemic among those with pre-existing mental health conditions, while overall increases in symptoms were found compared to pre-pandemic levels [11]. The authors of this meta-analysis argue that this may be due to the positive impacts of lifestyle changes linked to transmission mitigation measures for this group as well as to regression to the mean effects, whereby recovery processes result in improvements in mental health outcomes over time in those with pre-existing conditions. Likewise, increased mental health problems at the beginning of the pandemic were noted among persons without a pre-existing clinical depression diagnosis compared to no change among persons with such diagnosis in the UK [82] and even

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improvements in those with the most severe mental health disorder burden in the Netherlands [83].

The results of the development of MCS during the pandemic raise the question of clinical relevance. Among all groups, the MCS declines from the last pre-pandemic observation by no more than about one point on the theoretical 100-point scale. Although this average decline is of small magnitude, some groups may experience effects that are of clinical relevance. To explore the clinical relevance of our findings, we dichotomized the MCS according to a threshold identified as clinically relevant in previous studies of the SF-12-based MCS. Specifically, the cutoff value of 45 has been found to have high predictive accuracy of depression and anxiety disorders, e.g., in the Australian general population comparing the MCS-12 to physician diagnoses [60] and in six European countries, where scores on the MCS-12 were compared with a WHO-issued method (CIDI 3.0) for determining mental disorders in in-depth interviews [61]. The replications of our main results are shown in Tables A10, A11 (regressions) and Figures A2, A3 (corresponding predictive margins) in the Appendix. Conforming to our main results, fathers, those living without a partner, refugees, and persons with pre-existing mental health risks are less likely to fall below the threshold of 45 during the pandemic than their corresponding comparison groups if there were above this threshold before. For the comparison groups, the probability of falling below the clinically relevant threshold increases by four to five percentage points.

Limitations

We need to address some limitations. First, the distribution of interview modes in SOEP has changed during the pandemic due to legal contact restrictions and voluntary self-protection measures of respondents and interviewers [84]. The survey methodology literature has found effects of survey mode, particularly when collecting health data [85], with face-to-face surveys leading to a higher response rate [86] and fewer reports on mental health problems [87]. In the

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2020 survey, the switch to telephone interviews (CAPI-TEL) was above average among refugee respondents, while self-administered interviews were not offered to these groups. Among other respondents, the share of CAPI interviews decreased from 68 to 39 percent from 2019 to 2020 and self-administered interviews increased to just under one-third [84]. Against this background, it cannot be ruled out that a) changes in survey mode pre- versus peri-pandemic may affect time trends in the observed indicators, and that b) different adjustments in interview mode between refugees and non-refugees may distort the group comparisons in health indicators.

Second, our data is representative of adult individuals living in private households in Germany. Since healthy individuals are over-represented in such surveys [88], it is to be expected that individuals who are not encountered privately due to particularly severe courses of illness (e.g., due to hospitalization) are systematically underrepresented in our sample. During the 2020 field period (January 2020 to February 2021), about 10 percent were hospitalized [4]. However, with just over 2.2 million reported cases of infection by the end of January 2021 [89], only a small share of the population had contact with the virus, even taking into account unreported cases that may be many times higher. Hence, we expect the bias due to such systematic wave drop-outs to be small and consider the pandemic effects we measured as representing conservative lower limits.

Third, since a substantial share of observations came from before phase I of the pandemic in Germany, and most of the rest of our data only captures the initial phase of the pandemic, these may have resulted in underestimation of any pandemic-related effects on mental health and subjective well-being. On the one hand, the first year of the pandemic may have been particularly stressful in some regards (lack of knowledge of the virus' biology and health risk, first-time contact restrictions etc.). On the other hand, there is some empirical evidence for mental health declines, particularly in later stages, starting from late 2020 [42]. We are also

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unable to assess any potential changes within 2020 to examine, for example, the potential impacts of lockdown given that the overwhelming majority of our data in the pandemic survey wave was collected before the restrictions under the first lockdown were gradually relaxed.

Fourth, we cannot make a concluding statement regarding the resilience of the most vulnerable groups. They could reflect an individual psychological state resulting from pre-pandemic hardships, which taught them coping strategies, or reflect successful political measures implemented to alleviate hardships. It may also be that efforts to contain the spread of the virus even conferred some advantages to specific groups, for example, by decelerating life in different ways. In order to disentangle micro and macro effects in this respect, a quasi-natural experimental design between regions that implemented different anti-COVID-19 measures would be necessary.

Fifth, certain relevant vulnerability factors were beyond the scope of this study, primarily due to data limitations. For instance, while income or wealth levels have a strong correlation with the examined employment dimensions, they were not explicitly included in this study, despite their potential relevance to mental health and well-being during the pandemic. Furthermore, we were unable to assess the impact of pandemic-related changes to employment, such as remote working or job loss.

CONCLUSION

The present study adds to a growing literature on mental health and well-being development in the first pandemic year. It is among the rare studies that are nationally representative, longitudinal, include representative estimates from migrant and refugee populations, and stands out for its 10-year pre-pandemic observation period. Yearly or biannual estimates this far back in time before the pandemic allow for a more comprehensive contextualization and assessment of the significance of any potential pandemic-related changes.

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From a broader perspective, our results reveal three points. First, the findings for pandemic impact must be contextualized into longer-term developments. As we show, changes from the last pre-pandemic observation to 2020 were several times put into a different perspective when considering overall time trends. Second, our study shows pronounced differences between vulnerability groups, confirming that the pandemic did affect some subgroups disproportionally, and that vulnerability factors are worthy of consideration. Third, given the cases where we found different effects on mental health compared to life satisfaction, our study shows the importance of considering other measures to assess the psychological impact of stressful events such as the pandemic.

Our results indicate resilience in certain populations that were initially presumed to be most vulnerable to pandemic-induced stressors, highlighting the need for future research to delve into the underlying mechanisms. Putting aside the aforementioned limitations, our findings imply that vulnerability to novel stressors cannot be anticipated and that measures to protect mental health and well-being in crises may need to be more broadly targeted. Preventive measures to increase resilience could include the provision of educational material to improve mental health literacy, and information on developing self-help strategies, mindfulness skills, and positive coping mechanisms [90, 91]. Alongside these preventive measures, it remains crucial to ensure the availability of psychological support for individuals who experienced lasting pandemic-related declines in mental health and well-being.

CONTRIBUTORS

PJ, YK, CK, and LW conceived the study and planned the analyses with feedback from SH, JJ, EH, TMTT, and MB. PJ and YK conducted the analyses. PJ, YK, CK, LW and LG wrote the manuscript. JJ, EH, MB and SH provided feedback on the manuscript. All authors read and approved the final manuscript.

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COMPETING INTERESTS

None declared

RESEARCH ETHICS

This study involves human participants but was not approved by an Ethics Committee or Institutional Board. The study uses secondary survey data that is generally available for researchers upon registration with the research data center at the German Institute for Economic Research (DIW) in Berlin. Respondents are informed that their participation in the survey is voluntary and that they will not suffer any disadvantages if they do not participate. Before the data are delivered to researchers, appropriate measures are taken to ensure the anonymity of the respondents.

DATA AVAILABILITY STATEMENT

The data analyzed in this study is subject to the following licenses/ restrictions: This article uses data from the SOEP-CORE (DOI: https://www.doi.org/10.5684/soep.core.v37eu), the IAB-BAMF-SOEP Survey of Refugees (DOI: 10.5684/soep.iab-bamf-soep-mig.2020) and the IAB-SOEP Migration Sample (DOI: 10.5684/soep.iab-soep-mig.2020). The German SOEP is an ongoing representative yearly panel survey of private households in Germany at the German Institute for Economic Research (DIW). The IAB-BAMF-SOEP Survey of Refugees is a representative longitudinal survey conducted jointly by the Institute for Employment Research (IAB), the research data center of the Federal German Office for Migration and Refugees

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(BAMF), and the German SOEP at the DIW. The IAB-SOEP Migration Sample is a longitudinal survey representative of the migrant population in Germany conducted jointly by the IAB in Nuremberg and the German SOEP at the DIW Berlin. Data access was provided via a Scientific Use File supplied by the Research Data Centre (FDZ) of the DIW. All documentation concerning both surveys, including questionnaires and data manuals, are made available by the DIW (https://www.diw.de/en/diw_01.c.603160.en/integrated_studies.html). Due to German Data Protection legislation, we cannot make the original data or the generated dataset available. Researchers can, however, apply for data access via the DIW. The computer codes for data preparation and analyses are available upon request. This study design and analysis was not preregistered.

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Figure 1: MCS and life satisfaction between 2010-2020

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

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Figure 2: Predictive margins for MCS by sociodemographic vulnerability factors

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Predictive margins partial out the main effects of vulnerability factor variables from other panels and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

Figure 3: Predictive margins for MCS by pre-existing health conditions

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Predictive margins partial out the main effects of sociodemographic vulnerability factor variables and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

Figure 4: Predictive margins for life satisfaction by sociodemographic vulnerability factors

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Predictive margins partial out the main effects of vulnerability factor variables from other panels and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

Figure 5: Predictive margins for life satisfaction by pre-existing health conditions

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Predictive margins partial out the main effects of sociodemographic vulnerability factor variables and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

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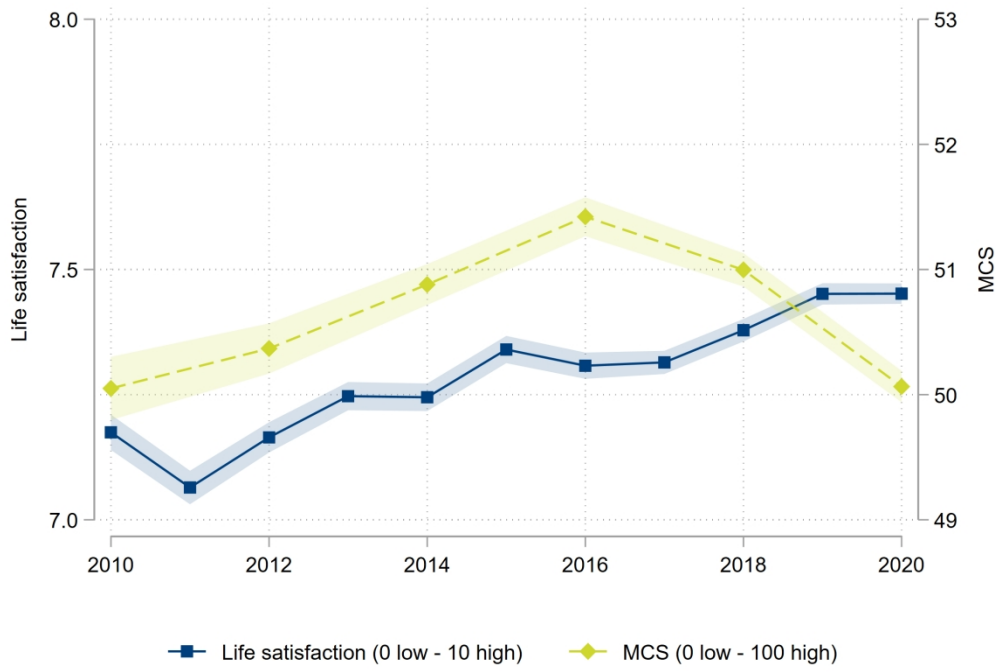

Figure 1: MCS and life satisfaction between 2010-2020
Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

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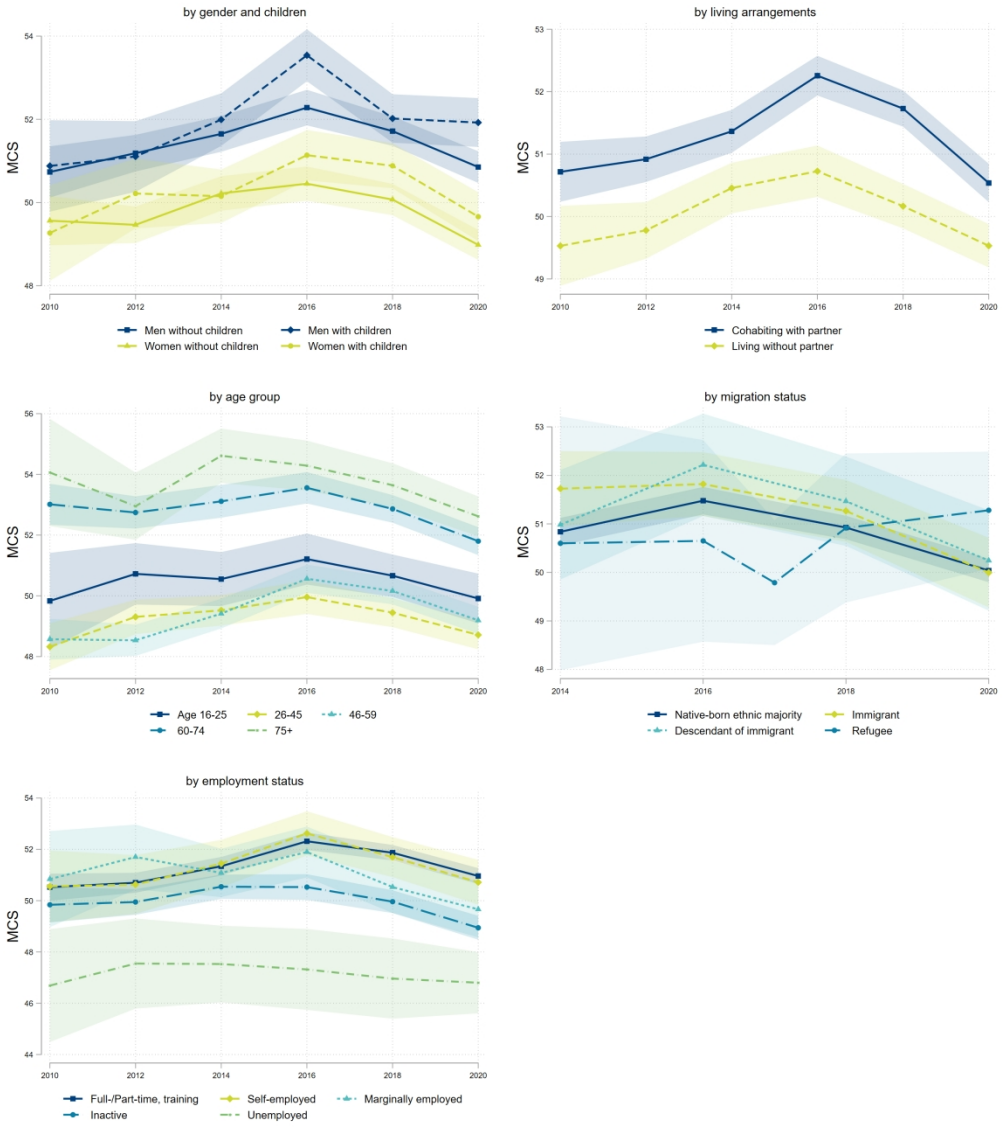

Figure 2: Predictive margins for MCS by sociodemographic vulnerability factors
Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.
Notes: Predictive margins partial out the main effects of vulnerability factor variables from other panels and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

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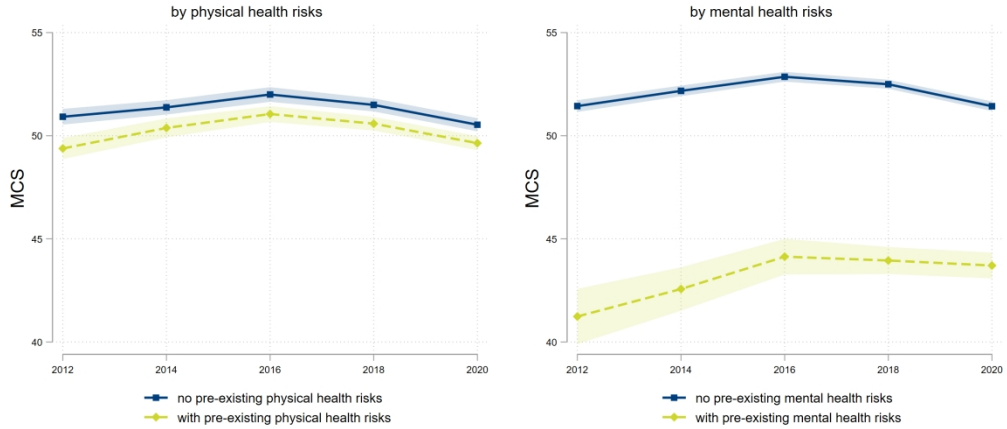

Figure 3: Predictive margins for MCS by pre-existing health conditions
Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.
Notes: Predictive margins partial out the main effects of sociodemographic vulnerability factor variables and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

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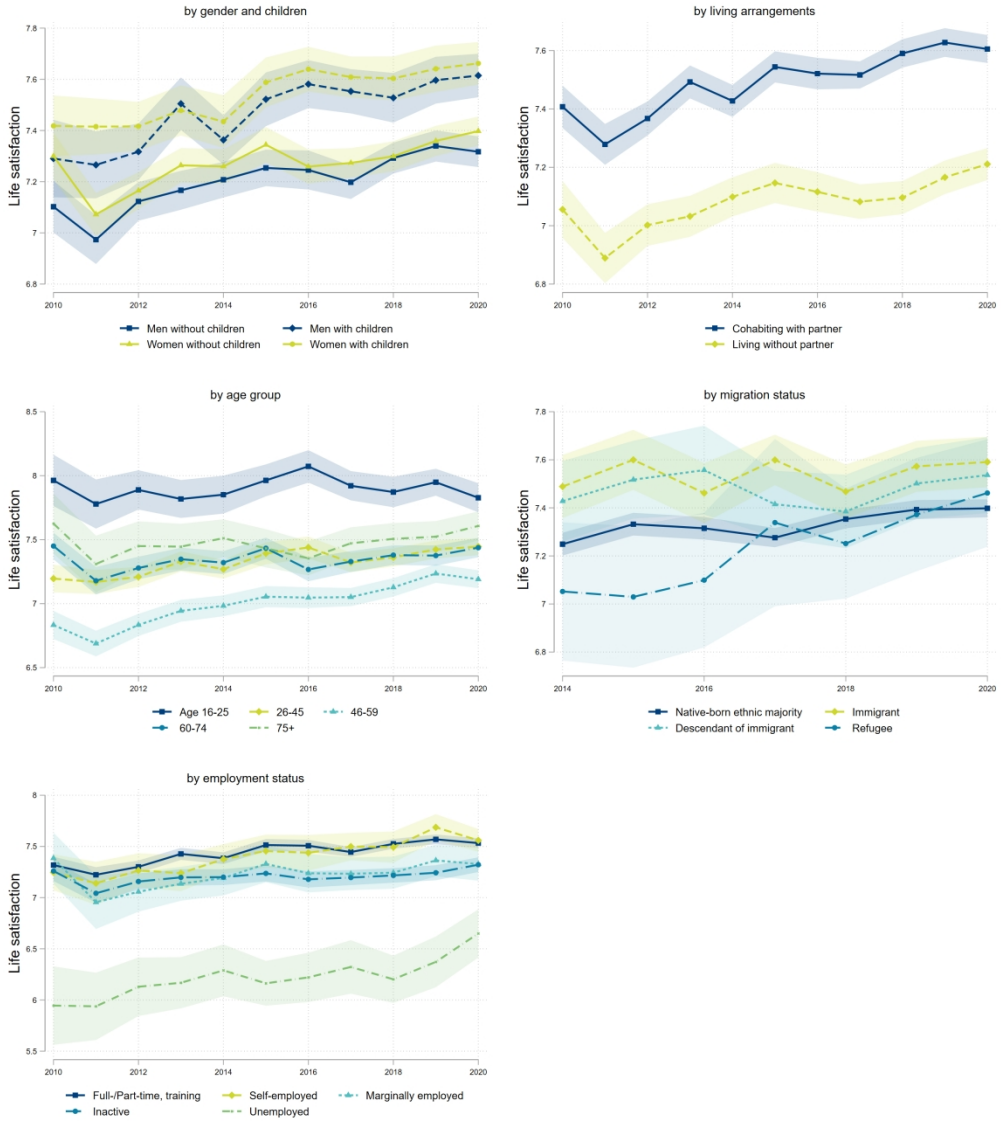

Figure 4: Predictive margins for life satisfaction by sociodemographic vulnerability factors
Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.
Notes: Predictive margins partial out the main effects of vulnerability factor variables from other panels and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

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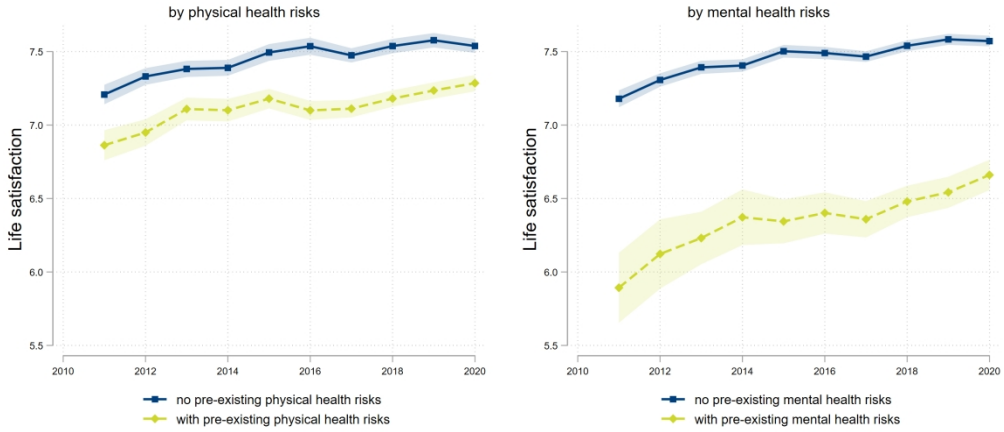

Figure 5: Predictive margins for life satisfaction by pre-existing health conditions
Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.
Notes: Predictive margins partial out the main effects of sociodemographic vulnerability factor variables and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

1905x819mm (38 x 38 DPI)

APPENDIX

Table A1: Descriptive statistics on vulnerability and control variables

	mean	sd	min	max	N
Survey year: 2010	5.35	22.50	0.00	100.00	184,275
2011	5.59	22.97	0.00	100.00	184,275
2012	6.46	24.58	0.00	100.00	184,275
2013	7.00	25.51	0.00	100.00	184,275
2014	7.84	26.88	0.00	100.00	184,275
2015	8.63	28.08	0.00	100.00	184,275
2016	9.61	29.48	0.00	100.00	184,275
2017	10.43	30.56	0.00	100.00	184,275
2018	11.63	32.06	0.00	100.00	184,275
2019	12.87	33.48	0.00	100.00	184,275
2020	14.61	35.32	0.00	100.00	184,275
Men without children	38.37	48.63	0.00	100.00	184,185
Men with children	9.73	29.64	0.00	100.00	184,185
Women without children	40.54	49.10	0.00	100.00	184,185
Women with children	11.36	31.73	0.00	100.00	184,185
Age: 16-25	7.83	26.86	0.00	100.00	184,275
26-45	30.10	45.87	0.00	100.00	184,275
46-59	28.37	45.08	0.00	100.00	184,275
60-74	23.22	42.22	0.00	100.00	184,275
75+	10.48	30.64	0.00	100.00	184,275
Highest educational degree: Lower secondary	12.58	33.16	0.00	100.00	182,839
Short cycle non-tertiary	62.23	48.48	0.00	100.00	182,839
Bachelor or equivalent	15.27	35.97	0.00	100.00	182,839
Master or Doctoral	9.93	29.91	0.00	100.00	182,839
Cohabiting with partner	52.70	49.93	0.00	100.00	183,605
Living without partner	47.30	49.93	0.00	100.00	183,605
Native-born ethnic majority	82.92	37.63	0.00	100.00	184,236
Immigrant	10.89	31.15	0.00	100.00	184,236
Descendant of immigrant	4.51	20.76	0.00	100.00	184,236
Refugee	1.67	12.82	0.00	100.00	184,236

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Employment: Full-/Part-time, training	51.41	49.98	0.00	100.00	182,729
Self-employed	5.60	23.00	0.00	100.00	182,729
Marginally employed	4.87	21.53	0.00	100.00	182,729
Inactive	34.14	47.42	0.00	100.00	182,729
Unemployed	3.98	19.55	0.00	100.00	182,729
Living space per person in household (square meters): < 16	1.18	10.80	0.00	100.00	184,275
16-30	20.30	40.22	0.00	100.00	184,275
31-45	29.86	45.76	0.00	100.00	184,275
46-60	22.34	41.65	0.00	100.00	184,275
61-75	12.62	33.21	0.00	100.00	184,275
> 75	13.70	34.39	0.00	100.00	184,275
Pre-existing physical health risks	44.46	49.69	0.00	100.00	158,560
Pre-existing mental health risks	13.44	34.11	0.00	100.00	160,089
District-type: Independent large city	31.55	46.47	0.00	100.00	181,788
Urban district	36.55	48.16	0.00	100.00	181,788
Rural district with some density	16.56	37.17	0.00	100.00	181,788
Sparsely populated rural district	15.34	36.04	0.00	100.00	181,788
Unemployment rate in local labor market region	6.46	2.66	1.40	19.48	181,632

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

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Table A2: MCS by vulnerability/control variable and year

Survey year:	2018			2019			2020		
	Mean	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**
Men without children	51.90	9.56	6,389	46.76	12.47	25	51.10	10.05	7,957
Men with children	51.42	8.75	3,620	51.95	10.74	37	51.10	8.52	4,212
Women without children	50.39	10.55	6,960	50.57	13.58	8	49.33	10.42	8,179
Women with children	49.63	9.24	4,317	53.22	7.80	40	48.25	9.96	4,702
Age: 16-25	49.69	9.64	2,265	44.66	11.63	24	48.60	10.07	2,449
26-45	49.81	9.63	7,142	52.90	9.92	60	48.94	9.74	8,039
46-59	50.64	10.16	6,146	47.41	14.19	21	49.67	10.30	7,407
60-74	52.58	9.65	4,125	54.62	8.31	4	51.63	10.05	5,077
75+	52.56	9.98	1,650	53.21		1	51.73	10.09	2,086
Educational degree: Lower secondary	50.14	10.59	3,706	48.45	10.84	79	49.07	10.82	4,224
Short cycle non-tertiary	51.15	9.93	11,797	57.50	8.63	18	50.13	10.20	13,569
Bachelor or equivalent	51.02	9.82	3,477	51.80	11.00	13	50.29	9.68	4,254
Master or Doctoral	51.18	8.93	2,155			0	50.74	9.12	2,802
Cohabiting with partner	51.95	9.28	12,446	51.40	11.05	85	50.81	9.67	14,707
Living without partner	50.01	10.43	8,795	48.12	10.67	24	49.28	10.48	10,244
Native-born ethnic majority	51.09	9.94	15,274			0	50.20	10.08	17,657
Immigrant	50.87	9.51	2,601			0	49.63	10.29	2,850
Descendant of immigrant	50.39	9.79	1,156			0	49.05	10.41	1,445
Refugee	49.71	10.60	2,293	50.78	10.98	110	49.98	9.18	3,102
Employment: Full-/Part-time, training	51.10	9.10	10,851	49.28	10.99	27	50.28	9.37	11,779
Self-employed	51.92	8.82	1,073	43.63		1	51.16	9.47	1,937
Marginally employed	50.41	10.31	1,076	63.03	2.73	2	49.22	10.88	1,140
Inactive	51.34	10.62	6,857	50.85	10.97	80	50.46	10.63	7,208
Unemployed	45.72	12.84	1,471			0	45.74	11.69	1,499
Living space per person in household (square meters): < 16	48.28	10.26	915	50.46	10.37	33	48.69	11.25	1,124
16-30	50.33	9.86	6,450	51.30	10.66	69	49.19	9.98	7,014
31-45	50.65	9.90	6,076	39.57	15.22	5	50.26	10.02	6,856
46-60	51.33	10.10	3,797	63.40		1	49.72	10.15	4,576
61-75	51.68	9.66	2,064	57.59		1	51.08	10.11	2,601
> 75	51.73	9.70	2,026	59.35		1	50.74	10.12	2,887
Pre-existing physical health risks	51.12	10.38	8,680			0	50.25	10.51	9,534
Pre-existing mental health risks	43.70	12.00	3,030			0	43.23	11.61	3,397

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District-type: Independent large city	50.56	10.10	6,487	49.30	12.66	28	49.91	10.10	6,966
Urban district	51.32	9.89	7,454	52.32	11.99	41	50.57	9.91	8,203
Rural district with some density	51.28	9.42	3,701	50.70	8.61	30	50.19	9.83	3,988
Sparsely populated rural district	50.83	9.96	3,686	51.30	9.09	11	49.84	10.27	3,970

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: MCS is scaled from 0 to 100.

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Table A3: Life satisfaction by vulnerability/control variable and year

Survey year:	2018			2019			2020		
	Mean	**SD**	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**	**N**
Men without children	7.32	1.70	6,489	7.39	1.70	7,616	7.36	1.72	8,131
Men with children	7.63	1.47	3,698	7.70	1.48	4,047	7.70	1.38	4,277
Women without children	7.32	1.74	7,070	7.39	1.73	7,795	7.42	1.70	8,352
Women with children	7.60	1.59	4,383	7.66	1.63	4,560	7.66	1.53	4,791
Age: 16-25	7.53	1.65	2,330	7.61	1.57	2,517	7.47	1.67	2,495
26-45	7.45	1.56	7,274	7.53	1.58	7,651	7.54	1.51	8,154
46-59	7.25	1.77	6,214	7.37	1.72	7,078	7.32	1.71	7,543
60-74	7.38	1.72	4,188	7.39	1.75	4,808	7.45	1.72	5,200
75+	7.40	1.74	1,677	7.43	1.81	1,970	7.51	1.77	2,167
Educational degree: Lower secondary	7.13	1.86	3,836	7.18	1.97	4,134	7.18	1.93	4,339
Short cycle non-tertiary	7.33	1.71	11,937	7.41	1.67	12,970	7.41	1.68	13,842
Bachelor or equivalent	7.56	1.50	3,537	7.62	1.57	4,039	7.66	1.43	4,323
Master or Doctoral	7.67	1.48	2,175	7.81	1.46	2,664	7.76	1.36	2,839
Cohabiting with partner	7.59	1.58	12,628	7.65	1.59	14,049	7.61	1.57	15,008
Living without partner	7.16	1.76	8,967	7.25	1.77	9,924	7.28	1.73	10,439
Native-born ethnic majority	7.37	1.68	15,462	7.43	1.68	17,282	7.43	1.66	17,993
Immigrant	7.46	1.67	2,644	7.56	1.70	2,677	7.55	1.64	2,915
Descendant of immigrant	7.47	1.73	1,177	7.57	1.71	1,348	7.57	1.74	1,473
Refugee	7.07	1.82	2,395	7.20	1.87	2,713	7.28	1.78	3,173
Employment: Full-/Part-time, training	7.51	1.49	10,970	7.58	1.48	11,935	7.52	1.50	11,938
Self-employed	7.53	1.70	1,085	7.76	1.52	1,970	7.62	1.48	1,972
Marginally employed	7.30	1.66	1,090	7.43	1.64	1,162	7.39	1.73	1,164
Inactive	7.31	1.82	7,022	7.35	1.86	7,418	7.42	1.79	7,406
Unemployed	5.99	2.24	1,516	6.22	2.33	1,539	6.47	2.21	1,538
Living space per person in household (square meters): < 16	7.08	1.87	961	7.41	1.98	1,048	7.32	1.88	1,151
16-30	7.34	1.73	6,568	7.47	1.70	6,755	7.48	1.67	7,161
31-45	7.39	1.65	6,156	7.45	1.67	6,571	7.42	1.65	6,971
46-60	7.34	1.72	3,853	7.37	1.72	4,443	7.35	1.69	4,688
61-75	7.39	1.66	2,085	7.47	1.65	2,469	7.54	1.61	2,652
> 75	7.48	1.65	2,060	7.56	1.64	2,738	7.56	1.65	2,936
Pre-existing physical health risks	7.18	1.78	8,778	7.24	1.79	9,504	7.29	1.77	9,761
Pre-existing mental health risks	6.40	2.10	3,083	6.49	2.07	3,346	6.58	2.03	3,462

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District-type: Independent large city	7.38	1.72	6,584	7.45	1.70	7,099	7.47	1.67	7,110
Urban district	7.42	1.68	7,589	7.53	1.64	8,334	7.49	1.63	8,342
Rural district with some density	7.35	1.66	3,782	7.36	1.74	4,061	7.39	1.63	4,074
Sparsely populated rural district	7.31	1.68	3,728	7.34	1.74	4,036	7.35	1.72	4,045

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Life satisfaction is scaled from 0 to 10.

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Table A4: OLS regressions of mental health on sociodemographic vulnerability factors

Vulnerability factor:	Gender, children	Living arrangements	Age	Migration status	Employment
	(1)	(2)	(3)	(4)	(5)
Surveyyear 2010 (ref: 2018)	-0.981***	-1.014***	-0.830	-0.771***	-1.343***
	(0.325)	(0.260)	(0.860)	(0.226)	(0.284)
Surveyyear 2012	-0.530**	-0.812***	0.061	-0.575***	-1.171***
	(0.243)	(0.199)	(0.593)	(0.166)	(0.219)
Surveyyear 2014	-0.066	-0.365**	-0.111	-0.088	-0.527***
	(0.234)	(0.179)	(0.521)	(0.156)	(0.201)
Surveyyear 2016	0.566***	0.527***	0.548	0.553***	0.446**
	(0.209)	(0.160)	(0.456)	(0.145)	(0.184)
Surveyyear 2020	-0.864***	-1.193***	-0.750*	-0.886***	-0.909***
	(0.191)	(0.149)	(0.424)	(0.126)	(0.165)
Men with children (ref: men w/o children)	0.304	0.661***	0.632**	0.670***	0.627**
	(0.345)	(0.249)	(0.249)	(0.250)	(0.249)
Surveyyear 2010 # Men with children	-0.159				
	(0.684)				
Surveyyear 2012 # Men with children	-0.384				
	(0.546)				
Surveyyear 2014 # Men with children	0.039				
	(0.423)				
Surveyyear 2016 # Men with children	0.954**				
	(0.395)				
Surveyyear 2020 # Men with children	0.767**				
	(0.387)				
Women without children	-1.645***	-1.667***	-1.660***	-1.667***	-1.672***
	(0.257)	(0.202)	(0.202)	(0.202)	(0.202)
Surveyyear 2010 # Women without children	0.473				
	(0.435)				
Surveyyear 2012 # Women without children	-0.077				
	(0.336)				
Surveyyear 2014 # Women without children	0.214				
	(0.318)				
Surveyyear 2016 # Women without children	-0.185				
	(0.303)				
Surveyyear 2020 # Women without children	-0.226				

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	(0.267)				
Women with children	-0.833**	-1.145***	-1.167***	-1.140***	-1.170***
	(0.333)	(0.264)	(0.264)	(0.264)	(0.264)
Surveyyear 2010 # Women with children	-0.634				
	(0.689)				
Surveyyear 2012 # Women with children	-0.135				
	(0.526)				
Surveyyear 2014 # Women with children	-0.665				
	(0.423)				
Surveyyear 2016 # Women with children	-0.311				
	(0.371)				
Surveyyear 2020 # Women with children	-0.359				
	(0.361)				
Living without partner (ref: cohabiting with partner)	-1.236***	-1.564***	-1.243***	-1.235***	-1.238***
	(0.194)	(0.237)	(0.194)	(0.194)	(0.194)
Surveyyear 2010 # Living without partner		0.378			
		(0.401)			
Surveyyear 2012 # Living without partner		0.425			
		(0.308)			
Surveyyear 2014 # Living without partner		0.655**			
		(0.279)			
Surveyyear 2016 # Living without partner		0.033			
		(0.263)			
Surveyyear 2020 # Living without partner		0.558**			
		(0.236)			
Age 26-45 (ref: 16-25)	-1.233***	-1.232***	-1.218***	-1.227***	-1.222***
	(0.296)	(0.296)	(0.416)	(0.296)	(0.295)
Surveyyear 2010 # 26-45			-0.292		
			(0.973)		
Surveyyear 2012 # 26-45			-0.199		
			(0.688)		
Surveyyear 2014 # 26-45			0.187		
			(0.597)		
Surveyyear 2016 # 26-45			-0.035		
			(0.529)		
Surveyyear 2020 # 26-45			0.018		
			(0.483)		
46-59	-0.943***	-0.938***	-0.502	-0.930***	-0.936***
	(0.323)	(0.323)	(0.427)	(0.322)	(0.322)

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Surveyyear 2010 # 46-59			-0.759		
			(0.934)		
Surveyyear 2012 # 46-59			-1.685**		
			(0.659)		
Surveyyear 2014 # 46-59			-0.636		
			(0.582)		
Surveyyear 2016 # 46-59			-0.146		
			(0.513)		
Surveyyear 2020 # 46-59			-0.217		
			(0.475)		
60-74	2.295***	2.292***	2.200***	2.300***	2.270***
	(0.337)	(0.337)	(0.437)	(0.337)	(0.337)
Surveyyear 2010 # 60-74			0.980		
			(0.932)		
Surveyyear 2012 # 60-74			-0.180		
			(0.662)		
Surveyyear 2014 # 60-74			0.360		
			(0.587)		
Surveyyear 2016 # 60-74			0.147		
			(0.519)		
Surveyyear 2020 # 60-74			-0.312		
			(0.479)		
75+	3.038***	3.017***	2.981***	3.029***	3.114***
	(0.413)	(0.413)	(0.519)	(0.413)	(0.416)
Surveyyear 2010 # 75+			1.249		
			(1.247)		
Surveyyear 2012 # 75+			-0.753		
			(0.823)		
Surveyyear 2014 # 75+			1.081		
			(0.692)		
Surveyyear 2016 # 75+			0.097		
			(0.611)		
Surveyyear 2020 # 75+			-0.276		
			(0.541)		
Immigrant (ref: native-born ethnic majority)	0.248	0.251	0.249	0.342	0.249
	(0.277)	(0.277)	(0.277)	(0.347)	(0.276)
Surveyyear 2010 # Immigrant				-0.487	
				(0.699)	
Surveyyear 2012 # Immigrant				-0.165	

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				(0.586)	
Surveyyear 2014 # Immigrant				0.547	
				(0.446)	
Surveyyear 2016 # Immigrant				-0.000	
				(0.394)	
Surveyyear 2020 # Immigrant				-0.385	
				(0.388)	
Descendant of immigrant	0.360	0.363	0.358	0.542	0.355
	(0.398)	(0.398)	(0.399)	(0.486)	(0.399)
Surveyyear 2010 # Descendant of immigrant				-0.921	
				(1.652)	
Surveyyear 2012 # Descendant of immigrant				-0.264	
				(0.948)	
Surveyyear 2014 # Descendant of immigrant				-0.396	
				(0.671)	
Surveyyear 2016 # Descendant of immigrant				0.198	
				(0.642)	
Surveyyear 2020 # Descendant of immigrant				-0.335	
				(0.578)	
Refugee	0.258	0.299	0.300	-0.009	0.341
	(0.679)	(0.681)	(0.678)	(0.794)	(0.679)
Surveyyear 2010 # Refugee				1.183	
				(3.525)	
Surveyyear 2012 # Refugee				-0.965	
				(1.618)	
Surveyyear 2014 # Refugee				-0.228	
				(1.358)	
Surveyyear 2016 # Refugee				-0.820	
				(1.055)	
Surveyyear 2020 # Refugee				1.252*	
				(0.746)	
Self-employed (ref: full-/part-time, training)	-0.036	-0.048	-0.035	-0.045	-0.171
	(0.305)	(0.305)	(0.305)	(0.305)	(0.422)
Surveyyear 2010 # Self-employed					0.201
					(0.816)
Surveyyear 2012 # Self-employed					0.102
					(0.668)
Surveyyear 2014 # Self-employed					0.274
					(0.590)

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Surveyyear 2016 # Self-employed					0.479
					(0.534)
Surveyyear 2020 # Self-employed					-0.072
					(0.518)
Marginally employed	-0.583*	-0.584*	-0.572*	-0.575*	-1.338**
	(0.317)	(0.317)	(0.316)	(0.317)	(0.537)
Surveyyear 2010 # Marginally employed					1.653
					(1.096)
Surveyyear 2012 # Marginally employed					2.343***
					(0.816)
Surveyyear 2014 # Marginally employed					1.079
					(0.730)
Surveyyear 2016 # Marginally employed					0.919
					(0.697)
Surveyyear 2020 # Marginally employed					0.038
					(0.660)
Inactive	-1.498***	-1.491***	-1.520***	-1.492***	-1.907***
	(0.233)	(0.233)	(0.233)	(0.233)	(0.288)
Surveyyear 2010 # Inactive					1.221***
					(0.463)
Surveyyear 2012 # Inactive					1.158***
					(0.342)
Surveyyear 2014 # Inactive					1.109***
					(0.312)
Surveyyear 2016 # Inactive					0.121
					(0.309)
Surveyyear 2020 # Inactive					-0.110
					(0.267)
Unemployed	-4.293***	-4.285***	-4.266***	-4.289***	-4.908***
	(0.444)	(0.445)	(0.445)	(0.445)	(0.815)
Surveyyear 2010 # Unemployed					1.071
					(1.245)
Surveyyear 2012 # Unemployed					1.758
					(1.165)
Surveyyear 2014 # Unemployed					1.095
					(1.056)
Surveyyear 2016 # Unemployed					-0.089
					(1.098)
Surveyyear 2020 # Unemployed					0.748

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					(0.912)
Educational degree: Short cycle non-tertiary (ref: lower secondary)	0.563**	0.555**	0.570**	0.554**	0.569**
	(0.276)	(0.276)	(0.277)	(0.276)	(0.276)
Bachelor or equivalent	0.586*	0.581*	0.594*	0.581*	0.592*
	(0.343)	(0.343)	(0.343)	(0.343)	(0.343)
Master or Doctoral	0.964***	0.965***	0.979***	0.967***	0.977***
	(0.354)	(0.354)	(0.354)	(0.354)	(0.354)
Living space per person in household (square meters)	0.022***	0.022***	0.022***	0.023***	0.022***
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Squared	-0.000**	-0.000**	-0.000**	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment rate in local labor market region (month of interview)	0.017	0.018	0.017	0.017	0.016
	(0.036)	(0.036)	(0.036)	(0.036)	(0.036)
District-type: Urban district (ref: independent large city)	0.018	0.013	0.010	0.012	0.015
	(0.221)	(0.221)	(0.221)	(0.221)	(0.221)
Rural district with some density	-0.230	-0.231	-0.228	-0.231	-0.236
	(0.276)	(0.276)	(0.276)	(0.276)	(0.276)
Sparsely populated rural district	-0.367	-0.370	-0.357	-0.368	-0.368
	(0.262)	(0.262)	(0.262)	(0.263)	(0.263)
Person-Year observations	88,258	88,258	88,258	88,258	88,258
Person observations	22,020	22,020	22,020	22,020	22,020
R2 adjusted	0.045	0.045	0.045	0.045	0.045
Dep. var. mean	50.835	50.835	50.835	50.835	50.835
Command	regress	regress	regress	regress	regress
Model	ols	ols	ols	ols	ols

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Standard errors clustered at person-level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

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Table A5: OLS regressions of mental health on sociodemographic vulnerability factors (with varying base-categories)

Gender and children					
Base-category:	Men w/o children	Men w/ children	Women w/o children	Women w/ children	
Main effect of survey year 2020 (ref: 2018)	-0.864***	-0.097	-1.089***	-1.223***	
	(0.191)	(0.325)	(0.192)	(0.311)	
Living arrangements					
	Cohabiting w/ partner	Living w/o partner			
Main effect of survey year 2020 (ref: 2018)	-1.193***	-0.635***			
	(0.149)	(0.184)			
Age group					
Base-category:	16-25	26-45	46-59	60-74	75+
Main effect of survey year 2020 (ref: 2018)	-0.750*	-0.732***	-0.967***	-1.062***	-1.026***
	(0.424)	(0.236)	(0.223)	(0.230)	(0.338)
Employment status					
Base-category:	Full-/Part-time, training	Self-employed	Marginally employed	Inactive	Unemployed
Main effect of survey year 2020 (ref: 2018)	-0.909***	-0.981**	-0.870	-1.019***	-0.161
	(0.165)	(0.490)	(0.638)	(0.208)	(0.882)
Migration status					
Base-category:	Native-born ethnic majority	Immigrant	Descendant of immigrant	Refugee	
Main effect of survey year 2020 (ref: 2018)	-0.886***	-1.272***	-1.222**	0.365	
	(0.126)	(0.371)	(0.568)	(0.738)	

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: The regression models correspond to our main analyses in Figure 2, i.e. we partial out the main effects of all vulnerability factor variables and control variables as well as the interactions of the vulnerability factor variable (as denoted in the corr. table row) with survey year dummies. The reported results in the table correspond to the regression coefficients of a non-interacted dummy variable 1[survey year = 2020]. From col. 1-5, we change the base-categories of vulnerability factor variables.

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Table A6: OLS regressions of mental health on pre-COVID health risks

Vulnerability factor:	Physical health (1)	Mental health (2)
Surveyyear 2012 (ref: 2018)	-0.574***	-1.059***
	(0.220)	(0.163)
Surveyyear 2014	-0.119	-0.322**
	(0.202)	(0.150)
Surveyyear 2016	0.504***	0.364***
	(0.185)	(0.134)
Surveyyear 2020	-0.961***	-1.064***
	(0.168)	(0.124)
Pre-existing physical health risks	-0.910***	
	(0.238)	
Surveyyear 2012 # Pre-existing physical health risks	-0.628*	
	(0.347)	
Surveyyear 2014 # Pre-existing physical health risks	-0.085	
	(0.304)	
Surveyyear 2016 # Pre-existing physical health risks	-0.036	
	(0.267)	
Surveyyear 2020 # Pre-existing physical health risks	0.018	
	(0.233)	
Pre-existing mental health risks		-8.546***
		(0.352)
Surveyyear 2012 # Pre-existing mental health risks		-1.654**
		(0.721)
Surveyyear 2014 # Pre-existing mental health risks		-1.060*
		(0.573)
Surveyyear 2016 # Pre-existing mental health risks		-0.177
		(0.453)
Surveyyear 2020 # Pre-existing mental health risks		0.820**
		(0.354)
Immigrant (ref: native-born ethnic majority)	0.253	-0.019
	(0.284)	(0.263)
Descendant of immigrant	0.336	-0.066
	(0.399)	(0.360)
Refugee	-0.015	-0.235
	(0.834)	(0.733)
Educational degree: Short cycle non-tertiary (ref: lower secondary)	0.599**	0.475*
	(0.287)	(0.258)
Bachelor or equivalent	0.387	0.268
	(0.353)	(0.318)
Master or Doctoral	0.927**	0.546
	(0.362)	(0.334)
Living space per person in household (square meters)	0.021***	0.028***
	(0.008)	(0.007)
squared	-0.000**	-0.000***
	(0.000)	(0.000)
Unemployment rate in local labor market region (month of interview)	0.038	0.002
	(0.038)	(0.035)
District-type: Urban district (ref: independent large city)	-0.001	-0.281
	(0.224)	(0.204)
Rural district with some density	-0.303	-0.572**
	(0.279)	(0.256)
Sparsely populated rural district	-0.413	-0.624**
	(0.266)	(0.242)
Person-Year observations	71,001	71,848
Person observations	18,817	18,685
R2 adjusted	0.045	0.130
Dep. var. mean	50.978	51.084

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Command	regress	regress
Model	ols	ols

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Standard errors clustered at person-level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

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Table A7: OLS regressions of life satisfaction on sociodemographic vulnerability factors

Vulnerability factor:	Gender, children	Living arrangements	Age	Migration status	Employment
Surveyyear 2010 (ref: 2019)	-0.237***	-0.220***	0.014	-0.167***	-0.251***
	(0.055)	(0.041)	(0.113)	(0.036)	(0.045)
Surveyyear 2011	-0.366***	-0.349***	-0.170	-0.313***	-0.346***
	(0.052)	(0.038)	(0.109)	(0.033)	(0.041)
Surveyyear 2012	-0.217***	-0.260***	-0.060	-0.202***	-0.269***
	(0.043)	(0.033)	(0.090)	(0.028)	(0.035)
Surveyyear 2013	-0.173***	-0.135***	-0.131	-0.134***	-0.142***
	(0.042)	(0.032)	(0.086)	(0.028)	(0.034)
Surveyyear 2014	-0.132***	-0.200***	-0.097	-0.144***	-0.185***
	(0.039)	(0.030)	(0.087)	(0.027)	(0.032)
Surveyyear 2015	-0.086**	-0.084***	0.014	-0.061**	-0.055*
	(0.038)	(0.029)	(0.073)	(0.026)	(0.032)
Surveyyear 2016	-0.094**	-0.107***	0.124*	-0.078***	-0.063**
	(0.039)	(0.028)	(0.071)	(0.025)	(0.031)
Surveyyear 2017	-0.142***	-0.111***	-0.028	-0.117***	-0.124***
	(0.034)	(0.025)	(0.062)	(0.021)	(0.025)
Surveyyear 2018	-0.047	-0.037	-0.077	-0.040**	-0.044*
	(0.029)	(0.023)	(0.058)	(0.019)	(0.024)
Surveyyear 2020	-0.022	-0.022	-0.121**	0.005	-0.037*
	(0.027)	(0.021)	(0.055)	(0.018)	(0.022)
Men with children (ref: men w/o children)	0.257***	0.271***	0.267***	0.272***	0.270***
	(0.056)	(0.039)	(0.039)	(0.039)	(0.039)
Surveyyear 2010 # Men with children	-0.069				
	(0.102)				
Surveyyear 2011 # Men with children	0.035				
	(0.092)				
Surveyyear 2012 # Men with children	-0.063				
	(0.081)				
Surveyyear 2013 # Men with children	0.081				
	(0.074)				
Surveyyear 2014 # Men with children	-0.101				
	(0.069)				
Surveyyear 2015 # Men with children	0.011				

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	(0.072)				
Surveyyear 2016 # Men with children	0.078				
	(0.066)				
Surveyyear 2017 # Men with children	0.098*				
	(0.058)				
Surveyyear 2018 # Men with children	-0.022				
	(0.057)				
Surveyyear 2020 # Men with children	0.041				
	(0.055)				
Women without children	0.020	0.062*	0.063*	0.062*	0.062*
	(0.042)	(0.033)	(0.032)	(0.033)	(0.033)
Surveyyear 2010 # Women without children	0.178**				
	(0.071)				
Surveyyear 2011 # Women without children	0.079				
	(0.066)				
Surveyyear 2012 # Women without children	0.022				
	(0.056)				
Surveyyear 2013 # Women without children	0.078				
	(0.055)				
Surveyyear 2014 # Women without children	0.032				
	(0.053)				
Surveyyear 2015 # Women without children	0.071				
	(0.052)				
Surveyyear 2016 # Women without children	-0.007				
	(0.053)				
Surveyyear 2017 # Women without children	0.056				
	(0.046)				
Surveyyear 2018 # Women without children	-0.013				
	(0.042)				
Surveyyear 2020 # Women without children	0.061				
	(0.038)				
Women with children	0.302***	0.334***	0.331***	0.335***	0.333***
	(0.055)	(0.039)	(0.039)	(0.039)	(0.039)
Surveyyear 2010 # Women with children	0.014				
	(0.087)				
Surveyyear 2011 # Women with children	0.140*				
	(0.081)				
Surveyyear 2012 # Women with children	-0.008				
	(0.072)				

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Surveyyear 2013 # Women with children	0.010				
	(0.073)				
Surveyyear 2014 # Women with children	-0.074				
	(0.069)				
Surveyyear 2015 # Women with children	0.033				
	(0.070)				
Surveyyear 2016 # Women with children	0.092				
	(0.066)				
Surveyyear 2017 # Women with children	0.109*				
	(0.057)				
Surveyyear 2018 # Women with children	0.009				
	(0.054)				
Surveyyear 2020 # Women with children	0.043				
	(0.053)				
Living without partner (ref: Cohabiting with partner)	-0.415***	-0.462***	-0.416***	-0.416***	-0.415***
	(0.030)	(0.039)	(0.030)	(0.030)	(0.030)
Surveyyear 2010 # Living without partner		0.110*			
		(0.063)			
Surveyyear 2011 # Living without partner		0.072			
		(0.058)			
Surveyyear 2012 # Living without partner		0.096*			
		(0.049)			
Surveyyear 2013 # Living without partner		0.001			
		(0.048)			
Surveyyear 2014 # Living without partner		0.133***			
		(0.046)			
Surveyyear 2015 # Living without partner		0.064			
		(0.046)			
Surveyyear 2016 # Living without partner		0.057			
		(0.045)			
Surveyyear 2017 # Living without partner		0.028			
		(0.040)			
Surveyyear 2018 # Living without partner		-0.032			
		(0.037)			
Surveyyear 2020 # Living without partner		0.067**			
		(0.033)			
Age 26-45 (ref: 16-25)	-0.549***	-0.549***	-0.526***	-0.548***	-0.548***
	(0.043)	(0.043)	(0.063)	(0.043)	(0.043)
Surveyyear 2010 # 26-45			-0.242*		

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			(0.129)		
Surveyyear 2011 # 26-45			-0.084		
			(0.121)		
Surveyyear 2012 # 26-45			-0.154		
			(0.104)		
Surveyyear 2013 # 26-45			0.037		
			(0.097)		
Surveyyear 2014 # 26-45			-0.057		
			(0.099)		
Surveyyear 2015 # 26-45			-0.045		
			(0.088)		
Surveyyear 2016 # 26-45			-0.108		
			(0.084)		
Surveyyear 2017 # 26-45			-0.074		
			(0.073)		
Surveyyear 2018 # 26-45			0.015		
			(0.068)		
Surveyyear 2020 # 26-45			0.144**		
			(0.063)		
46-59	-0.854***	-0.853***	-0.714***	-0.852***	-0.853***
	(0.048)	(0.048)	(0.065)	(0.048)	(0.047)
Surveyyear 2010 # 46-59			-0.416***		
			(0.127)		
Surveyyear 2011 # 46-59			-0.376***		
			(0.121)		
Surveyyear 2012 # 46-59			-0.342***		
			(0.102)		
Surveyyear 2013 # 46-59			-0.160		
			(0.098)		
Surveyyear 2014 # 46-59			-0.155		
			(0.098)		
Surveyyear 2015 # 46-59			-0.195**		
			(0.085)		
Surveyyear 2016 # 46-59			-0.312***		
			(0.082)		
Surveyyear 2017 # 46-59			-0.156**		
			(0.072)		
Surveyyear 2018 # 46-59			-0.031		
			(0.067)		

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Surveyyear 2020 # 46-59			0.077		
			(0.064)		
60-74	-0.541***	-0.541***	-0.573***	-0.540***	-0.544***
	(0.050)	(0.050)	(0.068)	(0.050)	(0.050)
Surveyyear 2010 # 60-74			0.060		
			(0.126)		
Surveyyear 2011 # 60-74			-0.026		
			(0.123)		
Surveyyear 2012 # 60-74			-0.037		
			(0.103)		
Surveyyear 2013 # 60-74			0.103		
			(0.100)		
Surveyyear 2014 # 60-74			0.042		
			(0.101)		
Surveyyear 2015 # 60-74			0.043		
			(0.086)		
Surveyyear 2016 # 60-74			-0.233***		
			(0.085)		
Surveyyear 2017 # 60-74			-0.019		
			(0.075)		
Surveyyear 2018 # 60-74			0.080		
			(0.069)		
Surveyyear 2020 # 60-74			0.183***		
			(0.066)		
75+	-0.424***	-0.426***	-0.426***	-0.424***	-0.415***
	(0.063)	(0.063)	(0.084)	(0.063)	(0.064)
Surveyyear 2010 # 75+			0.088		
			(0.162)		
Surveyyear 2011 # 75+			-0.043		
			(0.155)		
Surveyyear 2012 # 75+			-0.013		
			(0.131)		
Surveyyear 2013 # 75+			0.053		
			(0.123)		
Surveyyear 2014 # 75+			0.086		
			(0.114)		
Surveyyear 2015 # 75+			-0.105		
			(0.104)		
Surveyyear 2016 # 75+			-0.293***		

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			(0.099)		
Surveyyear 2017 # 75+			-0.024		
			(0.088)		
Surveyyear 2018 # 75+			0.060		
			(0.082)		
Surveyyear 2020 # 75+			0.206***		
			(0.074)		
Immigrant (ref: native-born ethnic majority)	0.198***	0.198***	0.196***	0.180***	0.197***
	(0.043)	(0.043)	(0.044)	(0.057)	(0.043)
Surveyyear 2010 # Immigrant				0.089	
				(0.111)	
Surveyyear 2011 # Immigrant				-0.024	
				(0.098)	
Surveyyear 2012 # Immigrant				-0.091	
				(0.089)	
Surveyyear 2013 # Immigrant				0.055	
				(0.074)	
Surveyyear 2014 # Immigrant				0.060	
				(0.075)	
Surveyyear 2015 # Immigrant				0.088	
				(0.072)	
Surveyyear 2016 # Immigrant				-0.033	
				(0.072)	
Surveyyear 2017 # Immigrant				0.144**	
				(0.059)	
Surveyyear 2018 # Immigrant				-0.065	
				(0.060)	
Surveyyear 2020 # Immigrant				0.013	
				(0.057)	
Descendant of immigrant	0.122**	0.123**	0.123**	0.109	0.120**
	(0.055)	(0.055)	(0.055)	(0.078)	(0.055)
Surveyyear 2010 # Descendant of immigrant				-0.355	
				(0.255)	
Surveyyear 2011 # Descendant of immigrant				0.061	
				(0.164)	
Surveyyear 2012 # Descendant of immigrant				-0.046	
				(0.131)	
Surveyyear 2013 # Descendant of immigrant				0.093	
				(0.113)	

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Surveyyear 2014 # Descendant of immigrant				0.070	
				(0.104)	
Surveyyear 2015 # Descendant of immigrant				0.076	
				(0.101)	
Surveyyear 2016 # Descendant of immigrant				0.133	
				(0.108)	
Surveyyear 2017 # Descendant of immigrant				0.030	
				(0.087)	
Surveyyear 2018 # Descendant of immigrant				-0.077	
				(0.086)	
Surveyyear 2020 # Descendant of immigrant				0.030	
				(0.078)	
Refugee	-0.093	-0.089	-0.085	-0.021	-0.092
	(0.084)	(0.084)	(0.084)	(0.122)	(0.084)
Surveyyear 2010 # Refugee				0.142	
				(0.316)	
Surveyyear 2011 # Refugee				-0.205	
				(0.322)	
Surveyyear 2012 # Refugee				-0.424	
				(0.260)	
Surveyyear 2013 # Refugee				-0.792***	
				(0.195)	
Surveyyear 2014 # Refugee				-0.176	
				(0.165)	
Surveyyear 2015 # Refugee				-0.282	
				(0.180)	
Surveyyear 2016 # Refugee				-0.195	
				(0.176)	
Surveyyear 2017 # Refugee				0.084	
				(0.184)	
Surveyyear 2018 # Refugee				-0.081	
				(0.134)	
Surveyyear 2020 # Refugee				0.085	
				(0.129)	
Self-employed (ref: full-/part-time, training)	-0.019	-0.020	-0.020	-0.019	0.117*
	(0.050)	(0.050)	(0.049)	(0.050)	(0.068)
Surveyyear 2010 # Self-employed					-0.189*
					(0.111)
Surveyyear 2011 # Self-employed					-0.201*

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					(0.120)
Surveyyear 2012 # Self-employed					-0.153
					(0.101)
Surveyyear 2013 # Self-employed					-0.306***
					(0.103)
Surveyyear 2014 # Self-employed					-0.126
					(0.093)
Surveyyear 2015 # Self-employed					-0.176*
					(0.092)
Surveyyear 2016 # Self-employed					-0.186**
					(0.094)
Surveyyear 2017 # Self-employed					-0.064
					(0.077)
Surveyyear 2018 # Self-employed					-0.149*
					(0.081)
Surveyyear 2020 # Self-employed					-0.091
					(0.062)
Marginally employed	-0.215***	-0.215***	-0.213***	-0.214***	-0.206**
	(0.046)	(0.046)	(0.046)	(0.046)	(0.082)
Surveyyear 2010 # Marginally employed					0.272*
					(0.150)
Surveyyear 2011 # Marginally employed					-0.062
					(0.158)
Surveyyear 2012 # Marginally employed					-0.038
					(0.125)
Surveyyear 2013 # Marginally employed					-0.086
					(0.117)
Surveyyear 2014 # Marginally employed					0.013
					(0.119)
Surveyyear 2015 # Marginally employed					0.021
					(0.117)
Surveyyear 2016 # Marginally employed					-0.063
					(0.117)
Surveyyear 2017 # Marginally employed					-0.006
					(0.103)
Surveyyear 2018 # Marginally employed					-0.076
					(0.093)
Surveyyear 2020 # Marginally employed					0.000
					(0.074)

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Inactive	-0.243***	-0.243***	-0.247***	-0.243***	-0.326***
	(0.035)	(0.035)	(0.035)	(0.035)	(0.046)
Surveyyear 2010 # Inactive					0.268***
					(0.069)
Surveyyear 2011 # Inactive					0.146**
					(0.064)
Surveyyear 2012 # Inactive					0.183***
					(0.056)
Surveyyear 2013 # Inactive					0.097*
					(0.054)
Surveyyear 2014 # Inactive					0.142***
					(0.052)
Surveyyear 2015 # Inactive					0.049
					(0.051)
Surveyyear 2016 # Inactive					-0.002
					(0.051)
Surveyyear 2017 # Inactive					0.077*
					(0.046)
Surveyyear 2018 # Inactive					0.018
					(0.042)
Surveyyear 2020 # Inactive					0.115***
					(0.036)
Unemployed	-1.198***	-1.198***	-1.193***	-1.200***	-1.197***
	(0.066)	(0.066)	(0.066)	(0.066)	(0.129)
Surveyyear 2010 # Unemployed					-0.176
					(0.233)
Surveyyear 2011 # Unemployed					-0.088
					(0.209)
Surveyyear 2012 # Unemployed					0.026
					(0.189)
Surveyyear 2013 # Unemployed					-0.062
					(0.175)
Surveyyear 2014 # Unemployed					0.102
					(0.175)
Surveyyear 2015 # Unemployed					-0.154
					(0.158)
Surveyyear 2016 # Unemployed					-0.089
					(0.161)
Surveyyear 2017 # Unemployed					0.075

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					(0.172)
Surveyyear 2018 # Unemployed					-0.126
					(0.146)
Surveyyear 2020 # Unemployed					0.314***
					(0.118)
Educational degree: Short cycle non-tertiary (ref: lower secondary)	0.158***	0.157***	0.161***	0.157***	0.158***
	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)
Bachelor or equivalent	0.309***	0.309***	0.314***	0.309***	0.311***
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)
Master or Doctoral	0.433***	0.431***	0.436***	0.432***	0.434***
	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)
Living space per person in household (square meters)	0.008***	0.008***	0.008***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment rate in local labor market region (month of interview)	-0.017***	-0.017***	-0.016***	-0.017***	-0.016***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
District-type: Urban district (ref: independent large city)	-0.063*	-0.063*	-0.061*	-0.063*	-0.063*
	(0.034)	(0.034)	(0.034)	(0.034)	(0.034)
Rural district with some density	-0.141***	-0.140***	-0.139***	-0.141***	-0.141***
	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
Sparsely populated rural district	-0.122***	-0.122***	-0.119***	-0.122***	-0.122***
	(0.044)	(0.044)	(0.043)	(0.044)	(0.043)
Person-Year observations	182,126	182,126	182,126	182,126	182,126
Person observations	25,549	25,549	25,549	25,549	25,549
R2 adjusted	0.065	0.065	0.066	0.065	0.065
Dep. var. mean	7.425	7.425	7.425	7.425	7.425
Command	regress	regress	regress	regress	regress
Model	ols	ols	ols	ols	ols

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Standard errors clustered at person-level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

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Table A8: OLS regressions of life satisfaction on sociodemographic vulnerability factors (with varying base-categories)

Gender and children

Base-category:	Men w/o children	Men w/ children	Women w/o children	Women w/ children
Main effect of survey year 2020 (ref: 2019)	-0.022	0.018	0.039	0.021
	(0.027)	(0.047)	(0.027)	(0.046)

Living arrangements

	Cohabiting w/ partner	Living w/o partner
Main effect of survey year 2020 (ref: 2019)	-0.022	0.045*
	(0.021)	(0.025)

Age group

Base-category:	16-25	26-45	46-59	60-74	75+
Main effect of survey year 2020 (ref: 2019)	-0.121**	0.022	-0.044	0.062*	0.084*
	(0.055)	(0.031)	(0.033)	(0.036)	(0.049)

Employment status

Base-category:	Full-/Part-time, training	Self-employed	Marginally employed	Inactive	Unemployed
Main effect of survey year 2020 (ref: 2019)	-0.037*	-0.128**	-0.036	0.078***	0.278**
	(0.022)	(0.058)	(0.071)	(0.029)	(0.116)

Migration status

Base-category:	Native-born ethnic majority	Immigrant	Descendant of immigrant	Refugee
Main effect of survey year 2020 (ref: 2019)	0.005	0.018	0.035	0.090
	(0.018)	(0.055)	(0.076)	(0.127)

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: The regression models correspond to our main analyses in Figure 4, i.e. we partial out the main effects of all vulnerability factor variables and control variables as well as the interactions of the vulnerability factor variable (as denoted in the corr. table row) with survey year dummies. The reported results in the table correspond to the regression coefficients of a non-interacted dummy variable 1[survey year = 2020]. From col. 1-5, we change the base-categories of vulnerability factor variables.

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Table A9: OLS regressions of life satisfaction on pre-COVID health risks

Vulnerability factor:	Physical health (1)	Mental health (2)
Surveyyear 2011 (ref: 2019)	-0.370***	-0.404***
	(0.038)	(0.033)
Surveyyear 2012	-0.247***	-0.277***
	(0.034)	(0.027)
Surveyyear 2013	-0.195***	-0.191***
	(0.033)	(0.027)
Surveyyear 2014	-0.188***	-0.178***
	(0.032)	(0.025)
Surveyyear 2015	-0.083**	-0.081***
	(0.032)	(0.025)
Surveyyear 2016	-0.041	-0.093***
	(0.032)	(0.024)
Surveyyear 2017	-0.103***	-0.118***
	(0.026)	(0.021)
Surveyyear 2018	-0.040*	-0.044**
	(0.024)	(0.018)
Surveyyear 2020	-0.039*	-0.012
	(0.022)	(0.017)
Pre-existing physical health risks	-0.342***	
	(0.037)	
Surveyyear 2012 # Pre-existing physical health risks	-0.039	
	(0.057)	
Surveyyear 2013 # Pre-existing physical health risks	0.069	
	(0.052)	
Surveyyear 2014 # Pre-existing physical health risks	0.054	
	(0.050)	
Surveyyear 2015 # Pre-existing physical health risks	0.027	
	(0.047)	
Surveyyear 2016 # Pre-existing physical health risks	-0.095**	
	(0.044)	
Surveyyear 2017 # Pre-existing physical health risks	-0.021	
	(0.040)	
Surveyyear 2018 # Pre-existing physical health risks	-0.015	
	(0.036)	
Surveyyear 2020 # Pre-existing physical health risks	0.089***	
	(0.033)	
Pre-existing mental health risks		-1.041***
		(0.056)
Surveyyear 2012 # Pre-existing mental health risks		-0.143
		(0.122)
Surveyyear 2013 # Pre-existing mental health risks		-0.120
		(0.094)
Surveyyear 2014 # Pre-existing mental health risks		0.008
		(0.101)
Surveyyear 2015 # Pre-existing mental health risks		-0.117
		(0.081)
Surveyyear 2016 # Pre-existing mental health risks		-0.047
		(0.075)
Surveyyear 2017 # Pre-existing mental health risks		-0.066
		(0.065)
Surveyyear 2018 # Pre-existing mental health risks		-0.019
		(0.057)
Surveyyear 2020 # Pre-existing mental health risks		0.130**
		(0.052)
Immigrant (ref: native-born ethnic majority)	0.179***	0.153***
	(0.045)	(0.043)

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Descendant of immigrant	0.110*	0.095*
	(0.057)	(0.054)
Refugee	-0.219**	-0.227**
	(0.097)	(0.095)
Educational degree: Short cycle non-tertiary (ref: lower secondary)	0.154***	0.148***
	(0.046)	(0.044)
Bachelor or equivalent	0.285***	0.297***
	(0.055)	(0.052)
Master or Doctoral	0.412***	0.390***
	(0.056)	(0.055)
Living space per person in household (square meters)	0.008***	0.009***
	(0.001)	(0.001)
squared	-0.000***	-0.000***
	(0.000)	(0.000)
Unemployment rate in local labor market region (month of interview)	-0.013**	-0.019***
	(0.006)	(0.006)
District-type: Urban district (ref: independent large city)	-0.062*	-0.095***
	(0.035)	(0.033)
Rural district with some density	-0.146***	-0.184***
	(0.042)	(0.041)
Sparsely populated rural district	-0.116***	-0.142***
	(0.044)	(0.042)
Person-Year observations	153,961	154,863
Person observations	21,961	21,818
R2 adjusted	0.072	0.109
Dep. var. mean	7.428	7.434
Command	regress	regress
Model	ols	ols

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Standard errors clustered at person-level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

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Table A10: Clinically relevant mental health risks and sociodemographic vulnerability factors, Outcome: 1[MCS > 45]

Vulnerability factor:	Gender, children	Living arrangements	Age	Migration status	Employment
Surveyyear 2010 (ref: 2018)	-0.046***	-0.033***	-0.002	-0.022**	-0.048***
	(0.015)	(0.012)	(0.036)	(0.010)	(0.013)
Surveyyear 2012	-0.025**	-0.033***	0.018	-0.019**	-0.039***
	(0.011)	(0.010)	(0.028)	(0.008)	(0.011)
Surveyyear 2014	-0.002	-0.009	0.018	0.002	-0.017*
	(0.011)	(0.008)	(0.025)	(0.007)	(0.010)
Surveyyear 2016	0.021**	0.023***	0.018	0.021***	0.021**
	(0.010)	(0.007)	(0.022)	(0.007)	(0.009)
Surveyyear 2020	-0.040***	-0.051***	-0.050**	-0.039***	-0.040***
	(0.009)	(0.007)	(0.021)	(0.006)	(0.008)
Men with children (ref: men w/o children)	0.025	0.037***	0.035***	0.037***	0.036***
	(0.015)	(0.011)	(0.011)	(0.011)	(0.011)
Surveyyear 2010 # Men with children	-0.003				
	(0.034)				
Surveyyear 2012 # Men with children	-0.009				
	(0.026)				
Surveyyear 2014 # Men with children	-0.003				
	(0.021)				
Surveyyear 2016 # Men with children	0.021				
	(0.019)				
Surveyyear 2020 # Men with children	0.031*				
	(0.019)				
Women without children	-0.072***	-0.063***	-0.063***	-0.063***	-0.064***
	(0.011)	(0.008)	(0.008)	(0.008)	(0.008)
Surveyyear 2010 # Women without children	0.051***				
	(0.020)				
Surveyyear 2012 # Women without children	0.014				
	(0.016)				
Surveyyear 2014 # Women without children	0.019				
	(0.015)				

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Surveyyear 2016 # Women without children	0.002				
	(0.014)				
Surveyyear 2020 # Women without children	-0.003				
	(0.013)				
Women with children	-0.026*	-0.033***	-0.034***	-0.033***	-0.034***
	(0.015)	(0.011)	(0.011)	(0.011)	(0.011)
Surveyyear 2010 # Women with children	-0.007				
	(0.032)				
Surveyyear 2012 # Women with children	-0.019				
	(0.026)				
Surveyyear 2014 # Women with children	-0.016				
	(0.020)				
Surveyyear 2016 # Women with children	-0.009				
	(0.018)				
Surveyyear 2020 # Women with children	-0.004				
	(0.018)				
Living without partner (ref: cohabiting with partner)	-0.051***	-0.066***	-0.051***	-0.051***	-0.051***
	(0.008)	(0.010)	(0.008)	(0.008)	(0.008)
Surveyyear 2010 # Living without partner		0.017			
		(0.018)			
Surveyyear 2012 # Living without partner		0.024			
		(0.015)			
Surveyyear 2014 # Living without partner		0.026*			
		(0.013)			
Surveyyear 2016 # Living without partner		-0.001			
		(0.012)			
Surveyyear 2020 # Living without partner		0.026**			
		(0.011)			
Age 26-45 (ref: 16-25)	-0.056***	-0.056***	-0.049**	-0.056***	-0.056***
	(0.013)	(0.013)	(0.019)	(0.013)	(0.013)
Surveyyear 2010 # 26-45			-0.041		
			(0.041)		
Surveyyear 2012 # 26-45			-0.037		
			(0.032)		
Surveyyear 2014 # 26-45			-0.013		

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			(0.028)		
Surveyyear 2016 # 26-45			-0.002		
			(0.025)		
Surveyyear 2020 # 26-45			0.012		
			(0.024)		
46-59	-0.071***	-0.071***	-0.054***	-0.070***	-0.071***
	(0.014)	(0.014)	(0.019)	(0.013)	(0.013)
Surveyyear 2010 # 46-59			-0.058		
			(0.040)		
Surveyyear 2012 # 46-59			-0.077**		
			(0.031)		
Surveyyear 2014 # 46-59			-0.046*		
			(0.027)		
Surveyyear 2016 # 46-59			0.008		
			(0.024)		
Surveyyear 2020 # 46-59			0.011		
			(0.024)		
60-74	0.029**	0.029**	0.018	0.029**	0.028**
	(0.014)	(0.014)	(0.020)	(0.014)	(0.014)
Surveyyear 2010 # 60-74			0.022		
			(0.039)		
Surveyyear 2012 # 60-74			-0.009		
			(0.031)		
Surveyyear 2014 # 60-74			0.007		
			(0.028)		
Surveyyear 2016 # 60-74			0.009		
			(0.025)		
Surveyyear 2020 # 60-74			0.022		
			(0.024)		
75+	0.060***	0.059***	0.061***	0.060***	0.062***
	(0.017)	(0.017)	(0.023)	(0.017)	(0.017)
Surveyyear 2010 # 75+			0.041		
			(0.048)		
Surveyyear 2012 # 75+			-0.035		
			(0.037)		

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Surveyyear 2014 # 75+			0.013 (0.031)		
Surveyyear 2016 # 75+			0.005 (0.028)		
Surveyyear 2020 # 75+			0.002 (0.026)		
Immigrant (ref: native-born ethnic majority)	0.003 (0.012)	0.003 (0.012)	0.003 (0.012)	0.003 (0.016)	0.003 (0.012)
Surveyyear 2010 # Immigrant				-0.010 (0.036)	
Surveyyear 2012 # Immigrant				-0.025 (0.028)	
Surveyyear 2014 # Immigrant				0.023 (0.020)	
Surveyyear 2016 # Immigrant				0.008 (0.017)	
Surveyyear 2020 # Immigrant				-0.002 (0.019)	
Descendant of immigrant	0.004 (0.016)	0.004 (0.016)	0.004 (0.016)	0.014 (0.021)	0.003 (0.016)
Surveyyear 2010 # Descendant of immigrant				-0.078 (0.063)	
Surveyyear 2012 # Descendant of immigrant				0.006 (0.043)	
Surveyyear 2014 # Descendant of immigrant				-0.015 (0.032)	
Surveyyear 2016 # Descendant of immigrant				0.022 (0.027)	
Surveyyear 2020 # Descendant of immigrant				-0.029 (0.025)	
Refugee	-0.018 (0.029)	-0.016 (0.029)	-0.016 (0.028)	-0.037 (0.039)	-0.014 (0.028)
Surveyyear 2010 # Refugee				-0.029 (0.203)	
Surveyyear 2012 # Refugee				-0.085	

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				(0.090)	
Surveyyear 2014 # Refugee				-0.025	
				(0.072)	
Surveyyear 2016 # Refugee				-0.028	
				(0.065)	
Surveyyear 2020 # Refugee				0.085**	
				(0.036)	
Self-employed (ref: full-/part-time, training)	-0.007	-0.008	-0.007	-0.007	0.004
	(0.013)	(0.013)	(0.013)	(0.013)	(0.019)
Surveyyear 2010 # Self-employed					-0.005
					(0.039)
Surveyyear 2012 # Self-employed					-0.029
					(0.031)
Surveyyear 2014 # Self-employed					-0.017
					(0.030)
Surveyyear 2016 # Self-employed					-0.007
					(0.027)
Surveyyear 2020 # Self-employed					-0.012
					(0.026)
Marginally employed	-0.041***	-0.041***	-0.041***	-0.041***	-0.066***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.024)
Surveyyear 2010 # Marginally employed					0.076
					(0.048)
Surveyyear 2012 # Marginally employed					0.090**
					(0.036)
Surveyyear 2014 # Marginally employed					0.065*
					(0.034)
Surveyyear 2016 # Marginally employed					0.010
					(0.034)
Surveyyear 2020 # Marginally employed					-0.020
					(0.030)
Inactive	-0.069***	-0.069***	-0.070***	-0.069***	-0.088***
	(0.009)	(0.009)	(0.009)	(0.009)	(0.012)
Surveyyear 2010 # Inactive					0.060***
					(0.020)

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Surveyyear 2012 # Inactive					0.035**
					(0.016)
Surveyyear 2014 # Inactive					0.048***
					(0.014)
Surveyyear 2016 # Inactive					0.004
					(0.014)
Surveyyear 2020 # Inactive					0.007
					(0.013)
Unemployed	-0.164***	-0.164***	-0.163***	-0.164***	-0.191***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.029)
Surveyyear 2010 # Unemployed					0.031
					(0.055)
Surveyyear 2012 # Unemployed					0.076*
					(0.044)
Surveyyear 2014 # Unemployed					0.058
					(0.040)
Surveyyear 2016 # Unemployed					0.006
					(0.040)
Surveyyear 2020 # Unemployed					0.025
					(0.037)
Educational degree: Short cycle non-tertiary (ref: lower secondary)	0.015	0.014	0.015	0.015	0.015
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Bachelor or equivalent	0.024*	0.023*	0.024*	0.024*	0.024*
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Master or Doctoral	0.044***	0.043***	0.044***	0.044***	0.044***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Living space per person in household (square meters)	0.001***	0.001***	0.001**	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
squared	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment rate in local labor market region (month of interview)	-0.001	-0.001	-0.001	-0.002	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
District-type: Urban district (ref: independent large city)	-0.002	-0.002	-0.002	-0.002	-0.002
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Rural district with some density	-0.003	-0.003	-0.003	-0.003	-0.003

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	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Sparsely populated rural district	-0.010	-0.011	-0.010	-0.010	-0.010
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Person-Year observations	88,258	88,258	88,258	88,258	88,258
Person observations	22,020	22,020	22,020	22,020	22,020
R2 adjusted	0.028	0.028	0.029	0.028	0.029
Dep. var. mean	0.753	0.753	0.753	0.753	0.753
Command	regress	regress	regress	regress	regress
Model	ols	ols	ols	ols	ols

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Outcome variable is the dummy-recoded MCS (1: MCS > 45; 0: MCS <= 45). Standard errors clustered at person-level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

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Table A11: Clinically relevant mental health risks and pre-COVID health risks, 1[MCS > 45]

Vulnerability factor:	Physical health	Mental health
Surveyyear 2012 (ref: 2018)	-0.031***	-0.041***
	(0.010)	(0.008)
Surveyyear 2014	-0.005	-0.009
	(0.009)	(0.007)
Surveyyear 2016	0.015*	0.011*
	(0.009)	(0.006)
Surveyyear 2020	-0.045***	-0.045***
	(0.008)	(0.006)
Pre-existing physical health risks	-0.051***	
	(0.010)	
Surveyyear 2012 # Pre-existing physical health risks	0.004	
	(0.016)	
Surveyyear 2014 # Pre-existing physical health risks	0.007	
	(0.014)	
Surveyyear 2016 # Pre-existing physical health risks	0.009	
	(0.012)	
Surveyyear 2020 # Pre-existing physical health risks	0.008	
	(0.011)	
Pre-existing mental health risks		-0.337***
		(0.015)
Surveyyear 2012 # Pre-existing mental health risks		-0.057*
		(0.032)
Surveyyear 2014 # Pre-existing mental health risks		-0.031
		(0.026)
Surveyyear 2016 # Pre-existing mental health risks		0.018
		(0.020)
Surveyyear 2020 # Pre-existing mental health risks		0.031*
		(0.017)
Immigrant (ref: native-born ethnic majority)	0.002	-0.008
	(0.012)	(0.011)
Descendant of immigrant	0.005	-0.008
	(0.017)	(0.015)
Refugee	-0.027	-0.023
	(0.034)	(0.028)
Educational degree: Short cycle non-tertiary (ref: lower secondary)	0.016	0.012
	(0.012)	(0.011)
Bachelor or equivalent	0.015	0.014
	(0.014)	(0.013)
Master or Doctoral	0.043***	0.029**
	(0.015)	(0.014)
Living space per person in household (square meters)	0.001**	0.001***
	(0.000)	(0.000)
squared	-0.000	-0.000**
	(0.000)	(0.000)
Unemployment rate in local labor market region (month of interview)	-0.001	-0.002
	(0.002)	(0.001)
District-type: Urban district (ref: independent large city)	-0.001	-0.012
	(0.009)	(0.008)
Rural district with some density	-0.004	-0.014
	(0.011)	(0.010)
Sparsely populated rural district	-0.013	-0.018*
	(0.011)	(0.010)

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Person-Year observations	71,001	71,848
Person observations	18,817	18,685
R2 adjusted	0.031	0.096
Dep. var. mean	0.761	0.764
Command	regress	regress
Model	ols	ols

Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Outcome variable is the dummy-recoded MCS (1: MCS > 45; 0: MCS <= 45). Standard errors clustered at person-level in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

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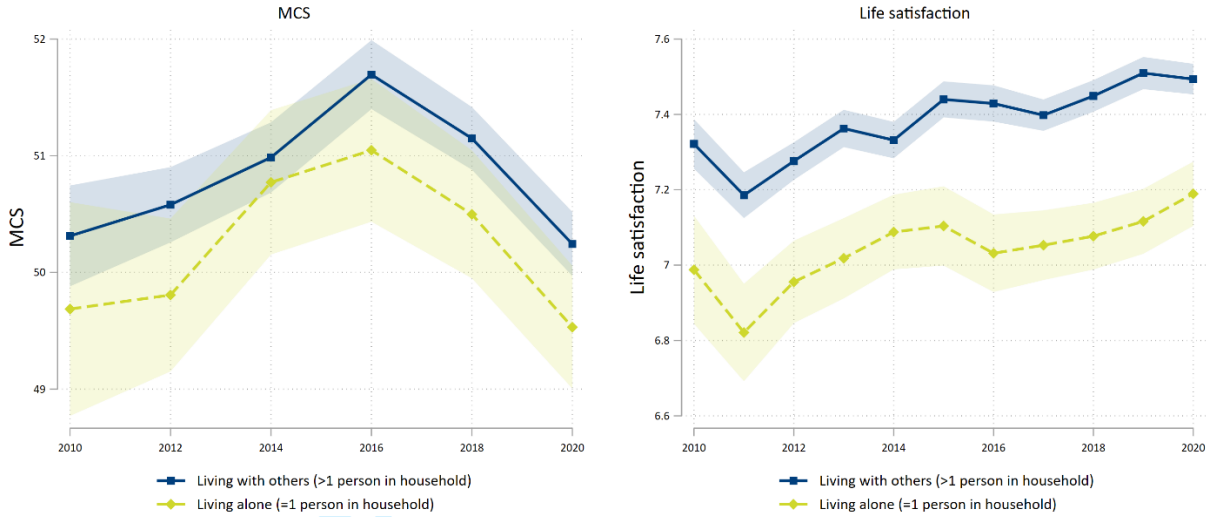
Figure A1: Predictive margins for MCS and life satisfaction by number of persons in the household



Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Predictive margins partial out the main effect of living alone and all control variables. Shaded areas denote the 95% confidence intervals.

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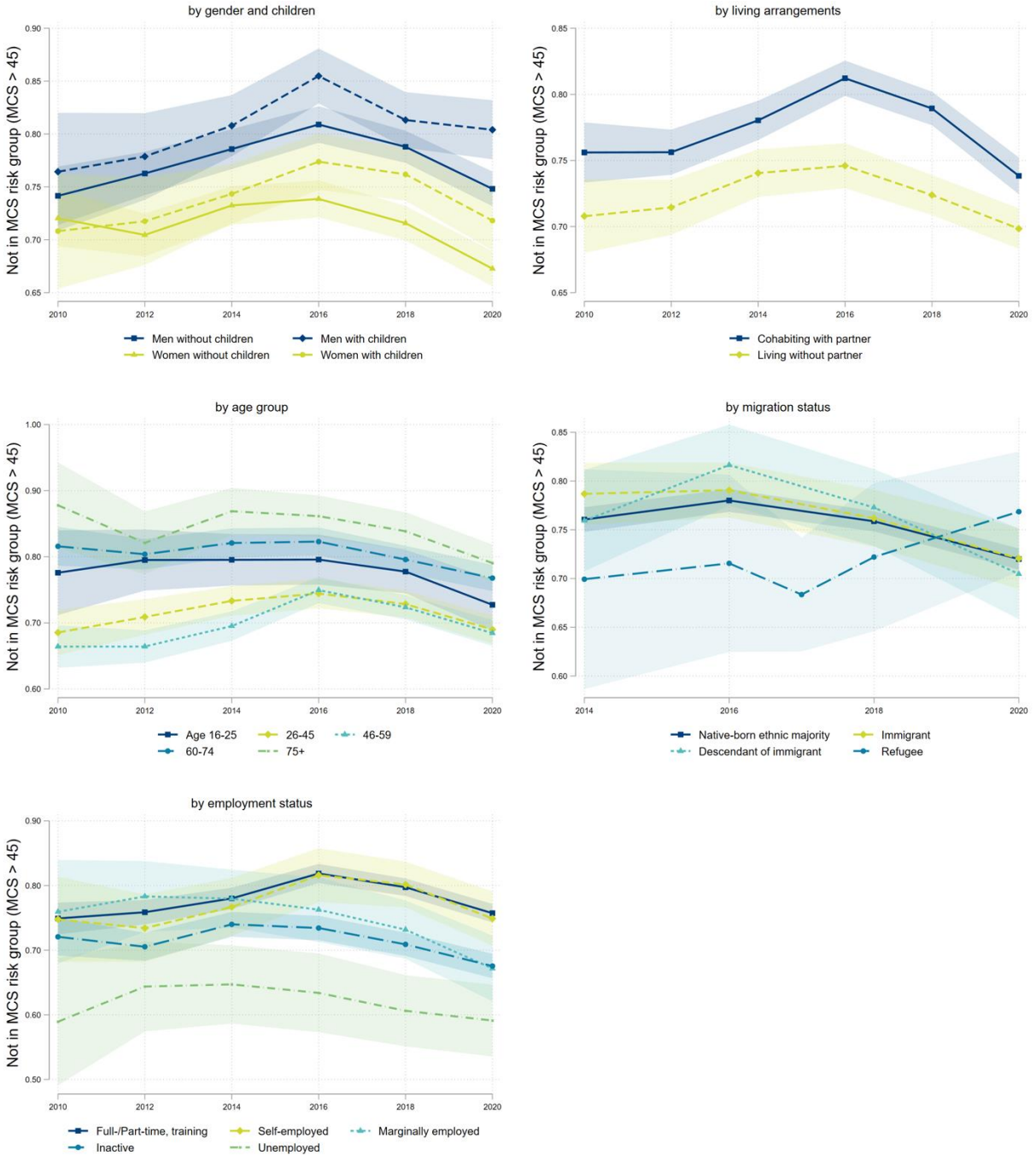
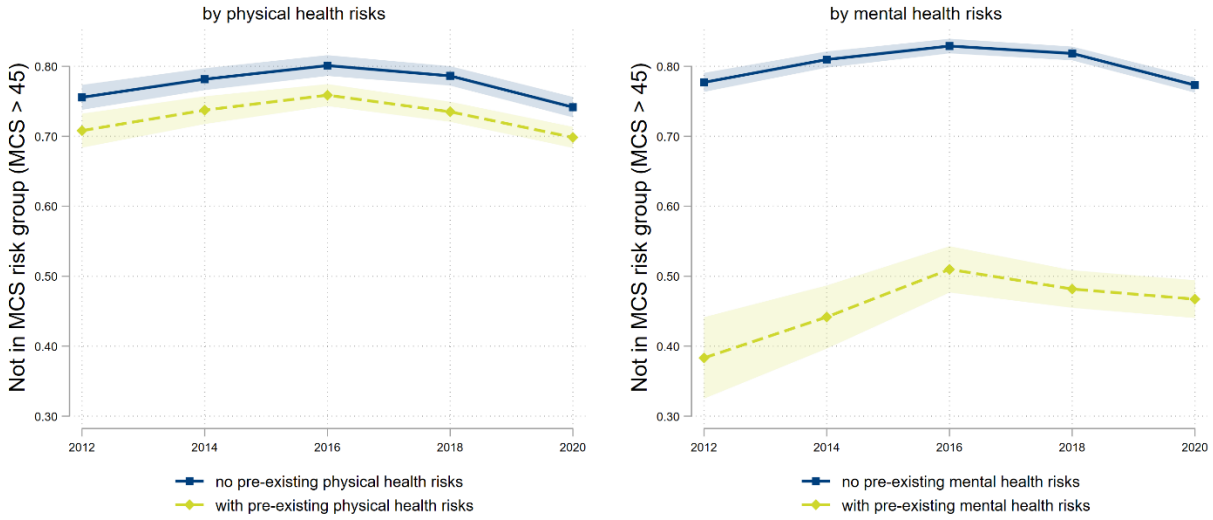
Figure A2: Predictive margins for clinically relevant mental health risks and sociodemographic vulnerability factors, Outcome: 1[MCS > 45]



Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Outcome variable is the dummy-recoded MCS (1: MCS > 45; 0: MCS <= 45). Predictive margins partial out the main effects of sociodemographic vulnerability factor variables and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

Figure A3: Predictive margins for clinically relevant mental health risks and pre-COVID health risks, Outcome: 1[MCS > 45]



Source: SOEP-Core (v37), IAB-SOEP Migration Sample 2013-2020, IAB-BAMF-SOEP Survey of Refugees 2016-2020, weighted.

Notes: Outcome variable is the dummy-recoded MCS (1: MCS > 45; 0: MCS <= 45). Predictive margins partial out the main effects of sociodemographic vulnerability factor variables and all control variables as discussed above. Shaded areas denote the 95% confidence intervals.

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STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	8
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	9
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9
Bias	9	Describe any efforts to address potential sources of bias	11
Study size	10	Explain how the study size was arrived at	8
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	10
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	12
		(*b*) Describe any methods used to examine subgroups and interactions	12
		(*c*) Explain how missing data were addressed	11
		(*d*) If applicable, explain how loss to follow-up was addressed	8
		(*e*) Describe any sensitivity analyses	22
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	8
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13, Tab. A1
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) Summarise follow-up time (eg, average and total amount)	7
Outcome data	15*	Report numbers of outcome events or summary measures over time	8

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Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (*b*) Report category boundaries when continuous variables were categorized (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	11, Fig. 1-5, 10
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	14-16
Discussion			
Key results	18	Summarise key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	21
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	24
Generalisability	21	Discuss the generalisability (external validity) of the study results	23
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	25

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

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