Unhealthy Assimilation or Compositional Differences? Disentangling Immigrants' Mental Health Trajectories with Residence Duration

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Studies have often found that recent immigrants have better mental health than natives, whereas established immigrants have no such advantage. This could be interpreted as evidence for immigrants' mental health deteriorating with residence duration—the "unhealthy assimilation hypothesis." However, the methods used in the literature are unfit to assess whether the mental health differences between recent and established immigrants are due to individual-level deterioration in mental health, compositional differences between immigration cohorts, or selective remigration. This is because previous studies mostly rely on cross-sectional data, incur in overcontrol bias, and/or fail to disentangle variation with time since arrival from variation with age or between cohorts. In this article, I propose a novel analytical strategy to test the unhealthy assimilation hypothesis. Using fixed- and random-effect regressions stratified by immigrants' age at arrival and data from waves 1–11 of the UK household longitudinal study, I find no evidence that immigrants' mental health deteriorates with time since arrival: immigrants' mental health trajectories are in line with natives' trajectories with age, and the cross-sectional finding of more established immigrants having worse mental health is driven by differences between individuals who migrated at different times.

Introduction

It is a well-established observation in studies on immigrants' socioeconomic outcomes in destination countries that immigrants tend to be socioeconomically disadvantaged in the early months or years after arrival, and gradually improve their position in the destination country as they acquire country-specific skills over time (Chiswick, Lee, and Miller 2005). As socioeconomic

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conditions are a major determinant of mental health (Yu and Williams 1999), the baseline expectation in studies of immigrants' mental health is that immigrants would initially be worse off than natives, and then "catch up" with them over time, as their socioeconomic conditions improve. On the contrary, most evidence has so far indicated that immigrants tend to have better mental health than natives upon arrival, whereas established immigrants tend to have similar or even worse mental health than them (e.g., Dorsett, Rienzo, and Weale 2019; Montazer 2020). This finding, generally referred to as the "Healthy Immigrant Effect" (HIE) or the "Immigrants' Health Paradox" (IHP), has been largely documented in cross-sectional studies, but longitudinal evidence is scarce (see Montazer and Wheaton 2017 for an exception) and affected by substantial methodological limitations. Thus, it is still an open question whether established immigrants' worse mental health reflects individual-level mental health deterioration over time, or if it is rather driven by differences between individuals who migrated at different points in time—for example, due to differences in mental health selectivity across immigration or birth cohorts, and/or to selective remigration.

In this article, I provide a tool to answer this question. I propose an analytical strategy fit to disentangle individual-level mental health variation with time since arrival from variation with age and from differences between cohorts. I test this strategy with data from waves 1–11 of Understanding Society, also known as the United Kingdom (UK) Household Longitudinal Panel (UKHLS) (University of Essex 2021). I find that, while more established immigrants have worse mental health than recently arrived ones and are thus closer to natives' average mental health levels, there is no evidence that this is because of an individual-level mental health deterioration with residence duration. While immigrants' mental health does deteriorate over time, this deterioration is at least not worse than that experienced by UK natives of similar ages. I dedicate the last part of the article to a discussion of the possible mechanisms why this might be the case and of the limitations of my approach.

Background: immigrants' mental health trajectories in destination countries

There is a growing interest in the literature on immigrants' mental health in the destination countries (e.g., Balidemaj and Small 2019). The general expectation for immigrants' mental health trajectories over time and across generations is that these would parallel the assimilation trend in socioeconomic outcomes: at first, immigrants tend to experience a disadvantage compared to natives, but their conditions gradually improve over time (e.g., Akresh 2008; Fellini and Guetto 2019) and across generations (Drouhot and Nee 2019). This expectation is consistent with the fact that

socioeconomic conditions are a major determinant of mental health (Yu and Williams 1999). However, studies have found evidence of the opposite phenomenon: several immigrant groups in several Western destination countries have higher-than-average mental health upon arrival, whereas more established immigrants and their descendants tend to have similar or poorer mental health compared to natives without an immigration background (e.g., Dorsett, Rienzo, and Weale 2019; Holz 2022; Montazer 2018). This finding, which is consistent with trends in immigrants' physical health trajectories, has been referred to as the HIE or the IHP, the two terms being used interchangeably. In this article, I deviate slightly from previous literature and use these two terms to indicate different elements of the phenomenon, as discussed in the following paragraph.

I use the term HIE to refer to the first part of the trend, that is, immigrants' mental health advantage over natives upon arrival, which is an outcome of their positive selection on mental health and related characteristics. This selection operates both at an individual level, the "fittest" individuals deciding to emigrate, and at an institutional level, due to receiving countries' immigration policies[1] (Ichou and Wallace 2019). I instead use the term IHP to describe the second part of the trend, that is, established immigrants and second generations having worse mental health than recent immigrants. The, at first sight, paradoxical character of this finding is that the labor market position, legal status, and social integration of immigrants tend to improve over time and across generations, which should have a beneficial effect on their mental health. In addition, if immigrants tend to be in better-than-average physical and mental health at arrival, they would be expected to maintain or increase such advantage because, as hypothesized by the stress process (Pearlin et al. 1981) and cumulative advantage/disadvantage (e.g., Willson, Shuey, and Elder 2007) frameworks, their initial higher mental health resources should reduce both their vulnerability to mental health damaging events and conditions and their exposure to some of said events and conditions.

Evidence for the IHP comes predominantly from cross-sectional studies. As such, this finding could have several explanations. First, it could reflect an individual-level mental health deterioration for immigrants as they accumulate time in their residence country, in line with an "Unhealthy Assimilation" Hypothesis (UAH). Alternatively, the IHP could be driven by varying levels of selectivity in mental health across immigration cohorts or by cohort differences in mental health among natives (i.e., by variation in the strength of the HIE over time), and/or it could result from selective remigration of the healthiest immigrants. The aim of this article is to provide an analytical strategy aimed at testing the UAH, that is, whether the IHP reflects individual-level variation in mental health among immigrants. Testing the HIE, its variation over time, or alternative explanations for the IHP is beyond the scope of this article.

In the next paragraphs, I review the previous literature on the association between time since migration and mental health. Because the aim of this article is to test the UAH in relation to individual life courses, I do not review the literature studying mental health change across immigrant generations.

Most studies model mental health to be linearly associated with time since migration. Such studies, partially because of data limitations, often only distinguish immigrants between "recent" and "established," generally using 10 years since arrival in the destination country as cutoff (e.g., Dorsett, Rienzo, and Weale 2019), or modeling time since arrival as a continuous variable with a linear association with mental health/distress (e.g., Montazer 2018, 2020). Instead, other studies found support for a nonlinear pattern, in line with the idea of a "U-shaped" trajectory in immigrants' mental health. Some studies find that immigrants from low-GDP countries to Canada experience increases in mental distress in the first five years of their residence and then enter a "recovery" phase, whereas other immigrants experience little or no variation in mental health in the first five years of their stay, and then a reduction of mental distress (Montazer, Wheaton, and Noh 2016; Montazer and Wheaton 2017). Yang (2020) also finds partial support for a U-shaped pattern in the association between mental health and time since arrival, as she finds that, in Canada, the association between time since arrival and mental distress is positive (more established immigrants have higher levels of distress) up to the 17th year of residence, after which longer residence duration is associated with better mental health.

As mentioned above, almost all previous studies on the association between time since migration and mental health are cross-sectional and thus unable to test whether such association is due to compositional effects (e.g., differences between birth and immigration cohorts, selective remigration) or to individual-level variation. To the best of my knowledge, only one study, using Canadian data, has analyzed the association between mental health and time since arrival using panel data (Montazer and Wheaton 2017). This study, however, does not properly disentangle variation with age from variation with time since arrival, as I discuss in the section "Measuring immigrants' mental health trajectories". In addition, all previous studies control for factors *mediating* the "effect" of time since arrival on mental health, leading to overcontrol bias.

In the next sections, I, first, discuss the methodological issues for testing the UAH and their potential solutions. Then, I propose an analytical approach that deals with the mentioned issues.

Methodological issues: Age-period-cohort and time since arrival

One step back: Age, cohorts, and mental health

The difficulties in measuring immigrants' mental health variation over time in the destination country, as distinct from variation with age and between cohorts, are an extension of the broader puzzle of how to disentangle age, period, and cohort effects when studying mental health trajectories in the general population. In the next section, I use inputs from the latter debate to identify the challenges and solutions in the measurement of immigrants' mental health trajectories.

First, I will briefly summarize the main findings concerning the association between age, cohorts, and mental health in the general population. Arguably, the most established finding in studies on life course mental health (or happiness or life satisfaction) is that the latter follow a U-shaped curve throughout the adult life course, reaching their bottom around age 40—what has been brought up as support for the idea of a middle-age crisis. This finding is broadly supported by cross-sectional studies across several countries (see for a review Blanchflower, Graham, and Piper 2023).

The longitudinal evidence is, however, mixed: some studies have argued that the findings of a U-curve in mental health are due to failure in disentangling age and cohort effects (Bell 2014; Kratz and Brüderl 2021) and to overcontrol bias (Bartram 2020; Kratz and Brüderl 2021)—see the next section for a detailed discussion of these methodological issues. Studies adopting a within-individual approach to the study of life-course mental health and refraining from controlling for mediating factors have often found the "U-shaped" curve to be due to cohort differences in *levels* of mental health (Bell 2014; Li 2016), and that, at the within-individual level, mental health deteriorates throughout the adult life course, although more steeply in young adulthood and old age (Bell 2014; Frijters and Beatton 2012; Kratz and Brüderl 2021; Li 2016; Zhang and Zhao 2021). Yet other studies have found support for the U-curve in life satisfaction trajectories even at the within-individual level (Cheng, Powdthavee, and Oswald 2017).

Measuring immigrants' mental health trajectories

The main limitation of previous studies on immigrants' mental health trajectories in destination countries is that many of them rely on cross-sectional data. While a cross-sectional approach is valid if the aim is to describe the association between age, mental health, and immigrant status at a specific time, it cannot be used to infer how individuals' mental health varies as they age or with time since arrival. This is due to two issues: (i)

confounding bias and (ii) selection bias in (re)migration, mortality, and survey attrition.

The first problem, confounding bias, refers to the fact that differences in mental health between people with different age and time since arrival might be due not only to the effect of age or of time since arrival but also to differences between birth cohorts, immigration cohorts, and between individuals who migrated at different ages. Birth cohorts differ in their average mental health because of early life experiences, that can affect individuals' expectations and initial mental health resources. Immigration cohorts might differ in their mental health levels and trajectories because of their composition (in terms of selectivity, gender, geographical origin, reason to migrate), in the destination-country environment (e.g., labor market opportunities, social and legal reception, presence of a community of conationals) they encountered upon arrival (cf. Hamilton, Palermo, and Green 2015). Age at arrival might also be independently associated with mental health and its development over time because of differences in expectations and experiences that immigrants arriving at different ages might have (Montazer 2018).

Birth cohort and age are perfectly collinear in cross-sectional data, and so are immigration cohort and time since arrival, making it impossible to estimate variation with age net of differences between birth cohorts, or variation with time since arrival net of differences between immigration cohorts. Consequently, established immigrants having worse mental health than recently arrived ones might be due to a detrimental impact of length of stay on mental health, but it might also be driven by a more positive selection in mental health (i.e., a stronger HIE) among the recent immigration cohorts. In addition, time since arrival corresponds to the difference between age and age at arrival so that it is impossible to control for all three in the same model.

The second set of problems is bias due to selective remigration (or outmigration), mortality, and survey attrition. Immigrants have high rates of remigration, either to return to their origin country or to move to a third country (see Dustmann and Görlach 2016), which makes them much more likely to migrate out of their destination country compared to natives. In addition, immigrants' remigration decisions correlate with their socioeconomic conditions (e.g., Bijwaard, Schluter, and Wahba 2014; Caron and Ichou 2020) and physical health (e.g., Arenas et al. 2015; Lu and Qin 2014) in the destination countries, and therefore, quite likely, with their mental health. Another general issue when analyzing mental health trajectories over the life course is that mental health is associated with longevity. If the association between mental health and mortality differs between immigrants and natives, this might lead to wrong conclusions about the differences in the life-course trajectories between these two groups. A similar source of bias might be selective survey nonresponse and attrition, as both

are affected by mental health-related factors, such as education, wealth, and some physical health conditions (e.g., Banks, Muriel, and Smith 2011).

Both confounding and selection bias can be at least partially dealt with using panel data analysis. The best (although still not optimal) way to deal with selection bias is using fixed-effect panel regression, that is, focusing exclusively on variation at the individual level. Coefficients in random-effect regressions represent a weighted average between within- and between-individual variation and are thus more biased by selective mortality and survey attrition than coefficients in fixed-effect regressions (see, e.g., Kratz and Brüderl 2021).

As for confounding bias, it is possible, in a random effects model, to estimate variation with age net of that by birth cohort, or variation with time since arrival net of that by immigration cohort. However, it is still not possible to control for all variables of interest (immigration cohort, birth cohort, age at arrival, age, and time since arrival), because of collinearity. In a fixed-effect approach, there is no need to control for time-constant characteristics such as birth cohort, immigration cohort, and age at arrival. However, it is also not possible to measure variation with age and variation with time since arrival at the same time, as these are perfectly collinear within individuals.

Another methodological issue found in most previous studies on immigrants' mental health trajectories is overcontrol bias, that is, controlling for variables that act as mediators in the association between age or time since arrival and mental health, such as family structure or socioeconomic status (e.g., Montazer 2018, 2020; Montazer, Wheaton, and Noh 2016). The variation in age or in time since arrival does not *per se* have an effect on mental health: mental health evolves as people age (or spend time in the destination country) because of the cumulation of positive and negative life experiences over time (cf. Pearlin 2010). Thus, changes in family structure or socioeconomic status are not *confounders* in the association between age or time since arrival and mental health; they are core *mechanisms* of life-course variation in mental health.

Consequently, to properly describe mental health trajectories, we should exclusively control for characteristics affecting mental health that are prior, in this case, to migration (cf. Bartram 2020; Kratz and Brüderl 2021). These include gender, birth cohort, immigration cohort, and, ideally, premigration socioeconomic conditions and mental health upon arrival. Importantly, race or ancestry should not be included as control variables because these do not intrinsically affect mental health[2]: a large part of the association between race/ancestry and mental health is a consequence of discrimination and/or cultural dissonance, which are features of the interaction between individuals and their environment in the destination country, and thus mechanisms of mental health variation over time. Also, labor market position at the time of the survey is not a good proxy for

premigration socioeconomic status: immigration often comes with socioe-
conomic downgrading, and, although immigrants' labor market position
tends to improve with time since arrival, it rarely matches premigration
(e.g., Fellini and Guetto 2019) or natives' average levels (Zwysen and
Demireva 2018), especially for racialized groups.

Disentangling age and time since migration

As discussed in the paragraphs above, panel data analysis, specifically
fixed-effect panel regressions, allows studying within-individual variation
while minimizing the bias due to confounding and selective mortality,
(re)migration, and survey attrition. However, because within-individual
variation over time since arrival is perfectly collinear to within-individual
variation in age, it is impossible, in a fixed-effect panel regression, to study
the former while controlling for the latter. Therefore, it is necessary to iden-
tify a control group to approximate how immigrants' mental health would
evolve with age if it were unaffected by time since arrival.

The common strategy is to use natives as a control group, thus using
their mental health trajectories with age as the baseline to which immi-
grants' trajectories with time since arrival are compared. This approach is
however complicated, especially in fixed-effects panel regressions, by the
need to identify a common starting point for both trajectories. The only
previous longitudinal study testing the IHP (Montazer and Wheaton 2017)
deals with this issue by comparing immigrants' mental health trajectory
with time spent in the destination country, using *age at arrival* as the starting
point, to natives' mental health trajectory with age, using *age 18* as the start-
ing point. The issue with this approach is that immigrants vary considerably
in their ages at arrival, and mental health is generally found to vary nonlin-
early with age, as discussed in the section "One step back: age, cohorts, and
mental health". Consequently, this approach could lead to finding differ-
ent mental health trajectories between immigrants and natives even if the
two groups had identical mental health trajectories with age, that is, if the
variation in immigrants' health over time in the destination country were
entirely due to age.

In this article, I propose a new approach to disentangle age and time
since arrival when studying immigrants' mental health trajectories in a
destination country. As in Montazer's and Wheaton's article (2017), I
use natives as the control group, as their mental health trajectories over
the life course represent the "typical" mental health variation with age
in the UK context. This does not imply the assumption that immigrants
would have had similar mental health trajectories as UK natives had they
never migrated or had they migrated to a different country, but merely
expecting that the context of destination would affect immigrants and

natives in similar ways in absence of immigrant-specific experiences such as discrimination, bureaucratic burden, or cultural dissonance.

My approach differs from other studies using natives as the control group in that I stratify the analyses by immigrants' age at arrival and then compare immigrants' mental health trajectory with age to natives'. In this way, because the time since arrival corresponds to the difference between age and age at arrival, and because age at arrival is constant within each stratum, the immigrants-natives difference in mental health trajectories with age can be interpreted as the variation due to time since arrival.

Data, methods, and variables

Data

I use data from waves 1–11 of Understanding Society, also known as UKHLS (University of Essex 2021), restricting the whole sample to individuals aged between 18 and 60 years old, and, concerning immigrants, to those who migrated to the UK after 18 years of age. Understanding Society is a panel survey conducted yearly in the UK since 2009. Each data collection round lasted around two years, and an ethnic and minority boost (EMB) and an immigrant and ethnic minority boost (IEMB) samples were introduced in waves 1 and 6, respectively, targeting individuals with Indian, Pakistani, Bangladeshi, Black Caribbean, or Black African origins (both EMB and IEMB) and immigrants (IEMB only). While the sample is not fully representative of the immigrant population in the UK, it does not deviate excessively from this population in the distribution of educational titles, gender, and reasons to migrate (Lynn et al. 2018).

After excluding individuals aged less than 18 and more than 60, immigrants who arrived in the UK younger than 18, individuals with missing information on the relevant variables (see section "Variables" for details), individuals observed only in one wave, and individuals who did not participate in wave 6, the full analytical sample is composed of 24,205 individuals (of which 2,647 immigrants) and 180,538 person-years (16,470 immigrant-years). Each respondent is observed for between 2 and 11 waves, the median number of observations per individual being eight among natives and six among immigrants (ref. Table A1 in online Appendix A).

Given the timeline of the survey (conducted yearly but with about two years of fieldwork), the time interval between one interview and the next for each respondent ranges from one to 24 months. However, considering only interviews from consecutive waves, 99.5 percent of both immigrants' and natives' interviews were collected between 8 and 16 months after the previous one, and 80 percent of the natives' interviews and 77 percent of the immigrants' interviews were conducted 11–13 months after the previous one.

Methods

Part one: Replication of previous literature's results. The analyses are structured in three parts. In the first part of the analyses I adopt a design similar to the most common analytical strategy adopted by cross-sectional studies on the topic, in order to test whether the IHP is found in the data I use: using a hierarchical linear model with observations clustered within individuals (corresponding to a random effects panel regression; I use the two terms interchangeably), I investigate the association between mental health and immigrants' time since arrival to the UK (in years) using natives as the reference group. The control variables included in the model are age (squared), gender, birth cohort, and educational qualifications, and the models have random slopes for the years since migration variable.

Part two: Mental health trajectories from age at arrival to age 60. In the second part of the analysis, I use an alternative method to estimate the effect of time since arrival on immigrants' mental health based on the approach outlined in section "One step back: age, cohorts, and mental health": I use fixed-effects models to compare immigrants' and natives' mental health trajectories from immigrants' age of arrival to age 60. In this part, I run two sets of models. In the first (set A), I restrict the immigrants' sample to those who migrated between the age of 18 and 24 (35 percent of the immigrants in the sample). In the second (set B), I restrict the immigrants' sample to those who arrived between 25 and 34 years of age (46 percent of the immigrants in the sample), and the whole sample to individuals older than 25. For comparison, I run similar models using random-effects panel regressions controlling for gender, birth cohort, and educational level and with random slopes for age.

In this way, within each set, age and time since arrival are almost collinear for immigrants: for example, in set A, immigrants aged 40 have lived in the UK for between 22 and 16 years, while in set B, for between 15 and 6 years. If time since arrival is detrimental to mental health (i.e., for the UAH to be supported), I should find that age has a stronger negative (or weaker positive) effect for immigrants than for natives. If this is not the case, the IHP might be the result of differences in mental health between immigrants who arrived in different years, rather than of individual-level deterioration in mental health with time since migration.

Part three: Mental health trajectories by birth cohort. The second part of the analysis (described above) provides an overview of the mental health trajectories of immigrants and natives from age 18(25) to age 60. However, each individual in the sample is observed for a maximum of 11 times (the median being eight observations for natives and six for immigrants; ref. Table A1 in online Appendix A). Thus, different segments of the mental health

trajectories described in the second part of the analyses are based on information from individuals born and migrated in different years. For example, in set A (immigrants who migrated between age 18 and age 24), individuals aged 25 were born between the years 1983 and 1995 and migrated (when applicable) between 2001 and 2015, whereas individuals aged 55 were born between 1953 and 1965 and migrated between 1973 and 1989.

To be able to observe potential differences in levels and trajectories of mental health between birth and immigration cohorts, in the third part of the analyses I use a method that has been previously used to investigate life-course differences in health by education (Leopold and Leopold 2018): I use hierarchical linear models with random intercepts and random slopes for age to estimate the variation of mental health by age, interacted with birth cohort (categorical), and with immigrant status. The same models are replicated using fixed-effects panel regressions; whenever the coefficients or statistical significance of mental health variation with age differ between the random-effects and the fixed-effects model, I consider the latter to be more accurate.

Weights. The UKHLS is designed to be used with weights. Therefore, all the analyses are weighted using cross-sectional weights provided for wave 6, the wave in which many immigrants were added to the survey sample. These weights compensate for the complex sampling design of the survey, in which some groups and some geographical regions are overrepresented, for selection into nonresponse, and for attrition since wave 1. These weights do not, however, correct for selective attrition since wave 6 or missingness in the target variables, which can be an issue especially for the immigrants in the sample. However, while using longitudinal weights would correct for selective attrition, it would also imply considering only individuals who participated in all the data collection waves and result in having too few and selected immigrants in the final sample to have any meaningful analysis. This would be particularly problematic because the aim of the article is not to estimate the average mental health trajectories of immigrants who stay permanently in the UK, but rather to assess what is the average yearly mental health variation for immigrants who have different residence durations in the UK. For this, it is important that all immigrants, including those who might have remigrated or died after the interview, are included in the analyses, as their experiences are relevant for the scope of assessing the average mental health variation with time since migration.

Further analyses (reported in online Appendix C) indicate that immigrants have higher rates of attrition and of missingness in the mental health variables compared to natives, especially when considering only individuals with poor mental health in wave 1. While this is a problem in setups using cross-sectional analyses or random-effects regressions, it would only bias results in fixed-effects regressions if the *variation* in mental health were

differently associated with missingness and attrition between immigrants and natives. Based on the information available, I do not find a difference between immigrants and natives in the association between mental health variation over time and attrition (analyses reported in online Appendix C).

Additional analyses. I run two sets of additional analyses. First, to investigate heterogeneities in immigrants' mental health trajectories with time since arrival, I replicate the fixed-effect regressions from the second part of the analyses (ref. section "Part two: mental health trajectories from age at arrival to age 60"), stratifying the models first by immigrants' race/ancestry groups and then by gender (ref. online Appendix B). In the analyses stratified by race/ancestry, I additionally exclude nonwhite natives, to assess whether including racial/ethnic minorities in the reference group substantially affects the estimated baseline mental health trajectory with age. The results in the main text hold for each group, and excluding nonwhite natives does not affect the estimated mental health trajectories for natives (see online Appendix B for details).

In the second set, I replicate the second part of the analyses additionally controlling for factors mediating the "effect" of time since migration on mental health. These include race/ancestry (in the random-effect regressions only), employment status, marital status, and number of children in the household (ref. online Appendix D). The main aim of these additional analyses is to assess what would arise from overcontrolling. I find that adding mediating variables (overcontrolling) does not affect the conclusions regarding the differences in mental health trajectories between immigrants and natives (see online Appendix D for details).

Variables

The dependent variable is *mental health*, measured through the Short Form-12 (SF-12) Mental Component Summary (MCS), which is designed to range from 0 (worst) to 100 (best) and to have a mean of 50 and a standard deviation of 10. The SF-12 is a 12-item questionnaire including questions about physical and mental health and how these have affected the respondent's life in the four weeks prior to the interview. The SF-12 MCS is computed by weighting each of the SF-12 items according to a standard scoring algorithm (see for details Ware et al. 2002). The items that contribute the most to the SF-12 MCS include (how much of the time in the past four weeks…): "have you accomplished less than you would like as a result of any emotional problems, such as feeling depressed or anxious?," "have you felt calm and peaceful?," "did you have a lot of energy?," "have you felt downhearted and depressed?," and "has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives)?" The answer options range from 1 "All of the time" to

4 "A little of the time." The SF-12 questionnaire was administered at each wave of data collection, except in wave 6 to IEMB respondents.

The main explanatory variables are those indicating the respondents' time since arrival, age, and whether they are immigrants. *Time since arrival* is only used in the first part of the analysis, and it is a categorical variable with natives as the reference category, and five categories for immigrants' length of stay: 0–4, 5–9, 10–14, 15–19, and 20 and more years. *Age* is modeled as having a quadratic effect on mental health. In the third part of the analysis, the *age* variable is recoded so that 0 corresponds to the youngest age for the birth cohort: 0 corresponds to 18 (in set B, to 25) for those born between 1985 and 2002 (in set B, between 1985 and 1995), 25 for those born between 1975 and 1984, 35 for those born between 1965 and 1974, and 45 for those born between 1948 and 1965. *Immigrant* is a dichotomous variable. As previously mentioned, this variable indicates all immigrants who arrived in the UK at 18 years old or older in the first part of the analyses. In the second and third parts, it refers to immigrants who arrived in the UK between the ages of 18 and 24 (set A) or between the ages of 25 and 34 (set B).

Finally, sex, birth cohort, and educational level are used as control variables in all the random effects models. *Sex* is a dichotomous variable, coded as time constant based on respondents' answers in the first available data collection. The *birth cohort* is used as a continuous variable in the first and second parts of the analyses (centered on 1980) and grouped into six categories in the third part in set A and five in set B. The categories are (born between) 1948–1964, 1965–1974, 1975–1984, 1985–2002 (1985–1995 for set B). *Educational level* is a categorical variable indicating whether the highest educational qualification attained is tertiary, lower than tertiary, secondary, or lower than secondary.

The summary statistics of the relevant variables are presented in Table A1 in online Appendix A separately by migration status (native or immigrant) and age at arrival/age range (all, set A, set B).

Results

Figure 1 presents the results from the random effects regression of mental health on immigrants' time since arrival (natives being the reference category), net of age, gender, birth cohort, and educational level. The full model is reported in Table A2 in the online Appendix. This model supports both the HIE and the IHP: recent immigrants have a mental health advantage over natives, and the longer the time since arrival, the smaller the advantage. While the mental health advantage of immigrants compared to natives, net of the controlled characteristics, amounts to 2.9 points in the SF12 MCS for immigrants who arrived in the UK in the four years prior to the interview,

FIGURE 1   Gaps in mental health (SF-12 MCS) between immigrants with different residence durations and natives. The model (random-effects panel regression with random slopes for the years since arrival variable) controls for gender, age (squared), birth cohort, and educational level. UKHLS waves 1–11. Full model in Table A2
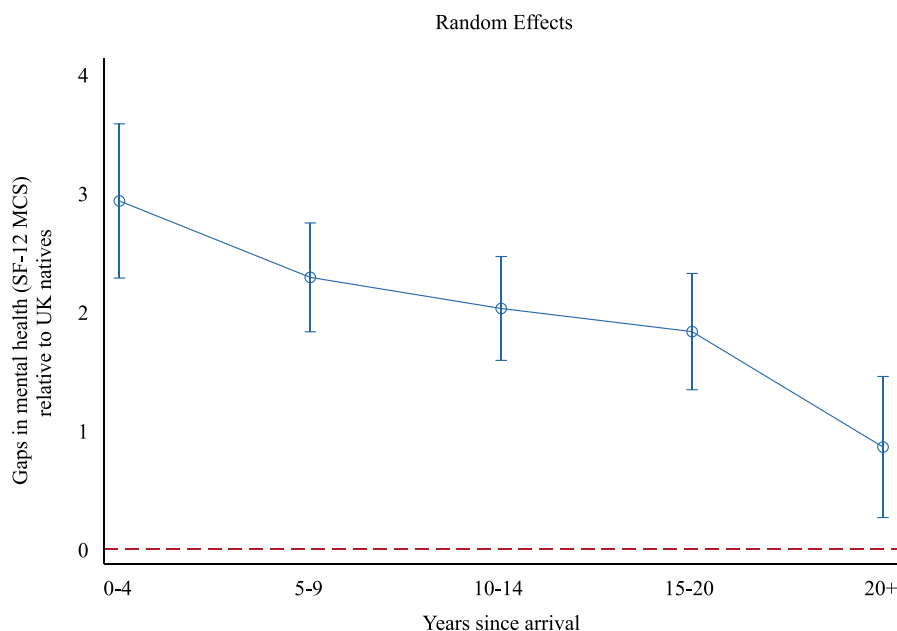
the same advantage is only 0.9 points for immigrants who spent more than 20 years in the UK.

Moving to the second part of the analysis, Figure 2 shows results for set A (comparison between natives and immigrants who migrated at age 18–24). When looking at Figures 2–5, please keep in mind that each respondent in the sample is observed for a maximum of 11 waves and that the mental health trajectories represented are not meant to estimate the average mental health variation of a "typical" individual from age 20 to age 60 but rather they summarize in a single figure the average yearly variation in mental health that people of different ages experienced in the period of observation (2009–2021).

Neither the random- nor the fixed-effects models report statistically significant differences between the mental health trajectories of immigrants and natives (cf. the first two models in Table A3 in online Appendix A). While in the random-effects model (left panel in Figure 2) at least the direction of the effects seems to be in line with the one presented in Figure 1, in the fixed-effects model (right panel in Figure 2) immigrants' mental health is predicted to deteriorate *less quickly* than natives', although the difference in the association of age and mental health between immigrants and natives is only statistically significant at the 90 percent threshold (cf.

FIGURE 2 **Mental health (SF-12 MCS) variation with age by immigrant status. The random-effects model (left) controls for gender, birth cohort, and educational level and has random slopes for age. Results for set A: the age range is 18–60 and immigrants arrived between 18 and 24. UKHLS waves 1–11. Full models in Table A3 (first and second models)**
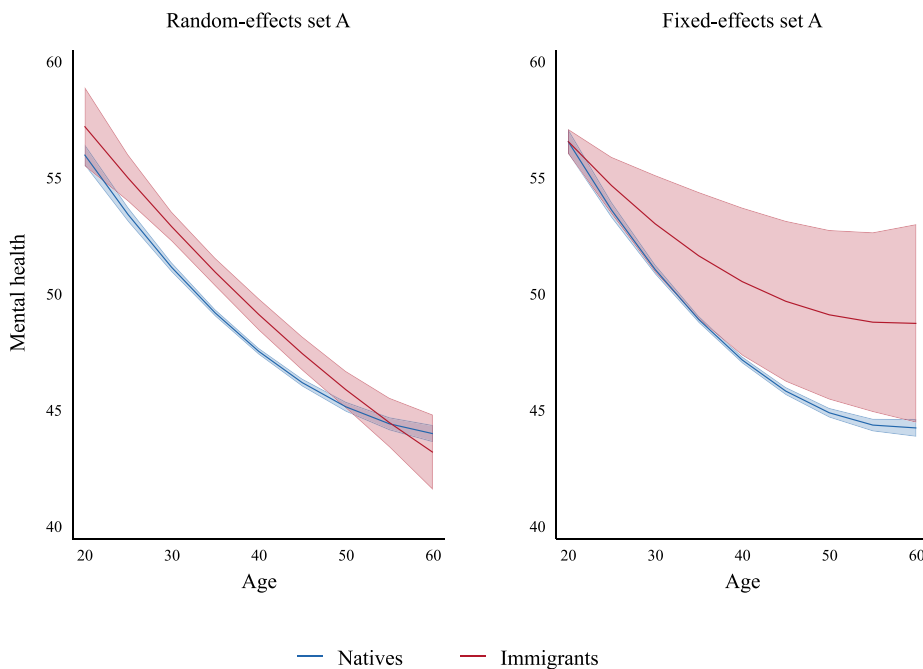

Table A3, second model). So, if we defined the effect of time since arrival as the difference in the mental health trajectory with age between immigrants and natives, we would conclude that time since arrival has a null effect on immigrants' mental health—or even a positive one.

The results for set B, graphically presented in Figure 3, mostly confirm those from set A. In the random-effects model (left panel in Figure 3), immigrants are found to have substantially and statistically significantly better mental health, on average, compared to natives when they are young and recently arrived. However, they seem to gradually lose this advantage over time, although the difference between immigrants and natives in the association between age (and age squared) and mental health is not statistically significant (cf. Table A3, third model). Results from the fixed-effects model (right panel in Figure 3) do not support the idea of a faster mental health deterioration for immigrants compared to natives, rejecting the UAH.

Figure 4 presents the results of the random-effects regression of mental health on the interaction between age, birth cohort, and immigrant status for set A. The model supports the HIE as immigrants from the most recent birth (and thus immigration) cohort have generally better mental health

FIGURE 3   Mental health (SF-12 MCS) variation with age by immigrant status. The random-effects model (left) controls for gender, birth cohort, and educational level and has random slopes for age. Results for set B: the age range is 25–60 and immigrants arrived between 25 and 35. UKHLS waves 1–11. Full models in Table A3 (third and fourth models)
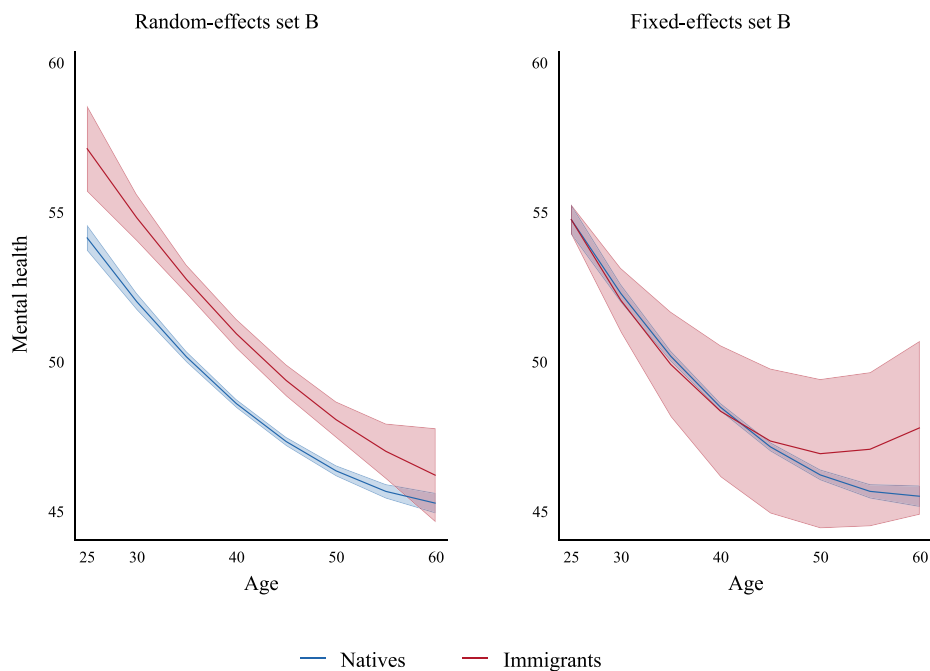

than comparable natives (cf. Table A4 in online Appendix A, first model). The model also supports the findings of the fixed-effects model for set A (cf. Figure 2, right panel) as UK natives born between 1985 and 2002 are found to experience substantially steeper mental health deterioration with age compared to their immigrant peers. This difference in the steepness of mental health deterioration between immigrants and natives born between 1985 and 2002 is not statistically significant in the random effects model (cf. Table A4, first model), but statistically significant at the 95 percent threshold in the fixed-effects one (cf. Table A4, second model).

Within the older birth cohorts, the association between age and mental health does not differ between natives and immigrants. However, immigrants born between 1948 and 1964, who migrated between the 1960s and the 1980s, have on average (slightly and nonsignificantly) worse mental health than similarly aged UK natives, which leads to the seemingly steeper mental health decline for immigrants compared to natives in models not fully disentangling between- and within-individual associations between age and mental health (ref. Figure 1 and left-hand side of Figure 2).

FIGURE 4 **Mental health (SF-12 MCS) variation with age by immigrant status and birth cohort, based on a random effects panel regression with random slopes for age. The model controls for gender and educational level. Results for set A: the age range is 18–60 and immigrants arrived between 18 and 24. UKHLS waves 1–11. Full model in Table A4 (first column)**
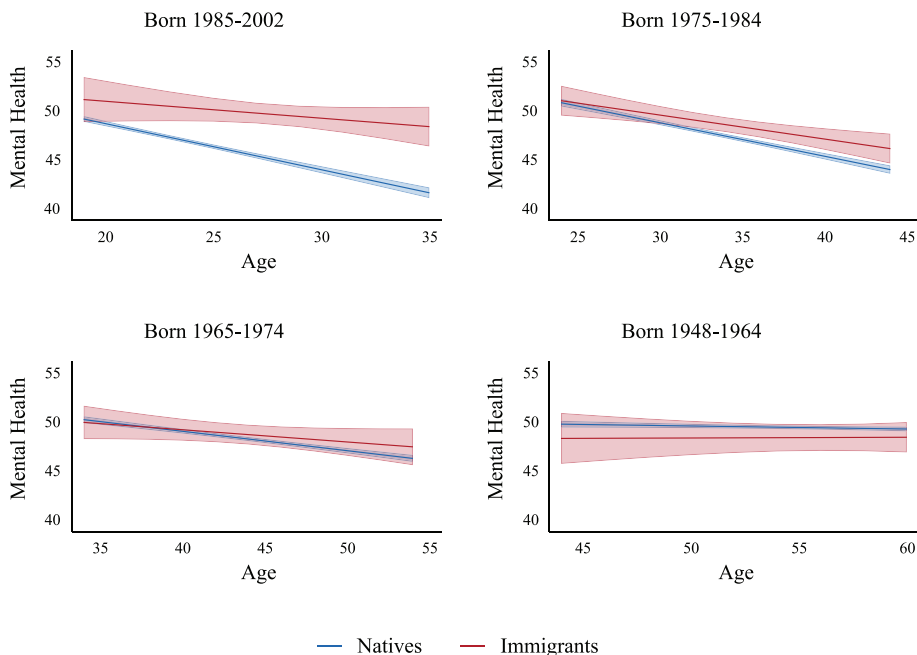
The worse mental health of established immigrants compared to natives and more recent immigrants could be due to at least three mechanisms: first, these immigrants might already have had worse mental health than natives when they migrated to the UK and then did not experience improvements in their mental health with time since arrival; second, they might have experienced steeper mental health deterioration than their native peers, and then their mental health stabilized; third, the more mentally healthy individuals of this immigration cohort might have returned to their origin country or migrated to third countries, so that only those with poor mental health are left in the UK. In any case, there is no indication that the younger cohorts of immigrants will end up having worse average mental health than the UK natives of their birth cohort.

Results for set B (Figure 5) again mostly confirm previous results. More recent immigrants have on average better mental health than similarly aged natives, while immigrants who were born between the 1940s and 1970s have on average similar or worse mental health compared to natives. Also similarly to the results for set B, mental health trajectories with age are mostly similar between immigrants and natives born in all

FIGURE 5 Mental health (SF-12 MCS) variation with age by immigrant status and birth cohort, based on a random effect panel regression model with random slopes for age. The model controls for gender and educational level. Results for set B: the age range is 25–60 and immigrants arrived aged between 25 and 34. UKHLS waves 1–11. Full model in Table A4 (third model)
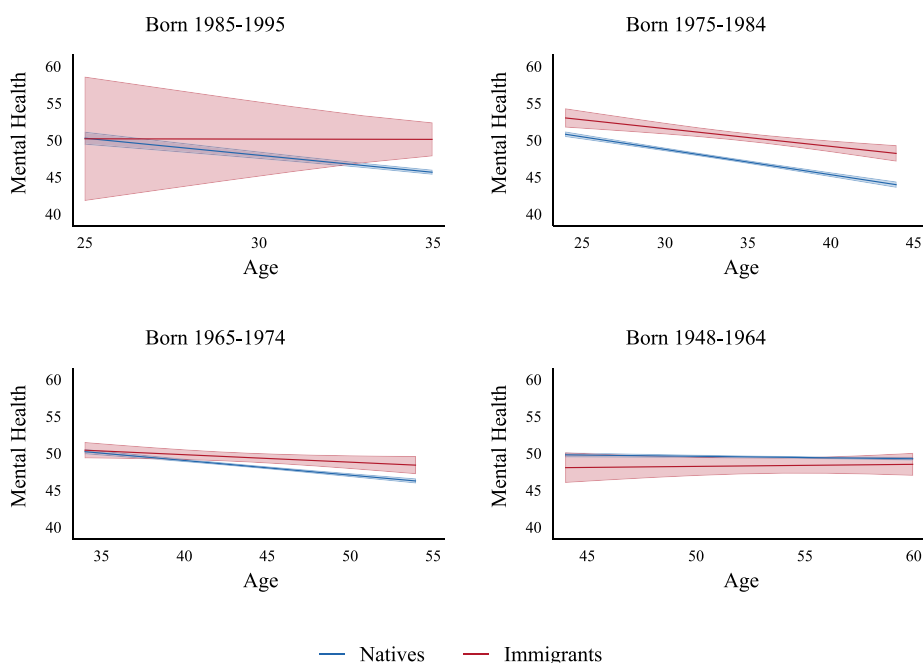
but the youngest cohort, in which immigrants have substantially, but not statistically significantly[3] (cf. Table A4, third and fourth models), less steep mental health deterioration with age compared to natives.

Discussion and conclusions

Evidence for the immigrants' paradox in mental health, or IHP, has so far almost exclusively been based on cross-sectional studies and on analytical setups not able to disentangle within-individual from between-individual variation in mental health. Consequently, previous studies were not able to assess whether the IHP reflects individual-level mental health deterioration with residence duration—what I here label the UAH—or if it is rather due to compositional differences between immigrants who arrived in different years. Even when using longitudinal data, previous studies were unable to appropriately account for mental health variation with age when assessing the impact of time since migration on mental health, due to age and time since migration being collinear at the individual level. In this article, I advance this literature by developing an analytical approach that identifies within-individual immigrants' mental health trajectories with time since

arrival, while accounting for the typical mental health trajectories with age in the destination country. This is done using natives as a control group and immigrants' age at arrival as the starting point for both trajectories.

I have applied this analytical approach to panel data collected yearly in the UK between 2009 and 2021. When analyzed using models that take both within- and between-individual variation into account, these data are in line with the IHP: longer residence duration is associated with worse mental health among immigrants so that while recent immigrants tend to have a mental health advantage over natives, long-term immigrants' mental health is on average similar or worse than that of natives. Results obtained applying my analytical approach suggest that this finding is *not* driven by individual-level mental health deterioration: immigrants' mental health does deteriorate as they reside in the UK, but this deterioration is in line with UK natives' mental health trajectory with age. Among the youngest and most recently arrived cohort, immigrants' mental health even deteriorates substantially *less steeply* than natives'. Hence, the UAH is not supported in the UK case.

This result potentially shifts the focus for future research on immigrants' mental health trajectories. Previous literature has been trying to explain the apparently stronger mental health deterioration for immigrants than for natives through higher exposure to disadvantages, such as ethnic/racial discrimination and harassment (Nandi, Luthra, and Benzeval 2020; Wallace, Nazroo, and Bécares 2016), economic insecurity and failed expectations (Engzell and Ichou 2020; Shen and Kogan 2020), increased family conflict due to economic stress (Montazer and Young 2017), and dissonant acculturation (Giguère, Lalonde, and Lou 2010). Based on this article's results, a new question might be: if immigrants tend to be more exposed to stressful life events and conditions than natives, how come their mental health seems to deteriorate at most at the same pace as that of natives? In the following paragraph, I discuss the possible mechanisms leading to this finding.

According to the stress process model (Pearlin et al. 1981) and to the cumulative advantage/disadvantage framework (e.g., Pearlin 2010; Willson, Shuey, and Elder 2007), life-course inequalities in mental health (or in mental distress) depend mainly on two factors: exposure to stress sources, such as specific events or prolonged life conditions; and availability of resources, such as coping and social support, that can reduce vulnerability to said exposure. Thus, while immigrants are more likely to experience some mental health-deteriorating events and conditions, they might be less vulnerable to them than natives, due to their positive selection in mental health (the HIE), or to resources such as community support. In addition, immigrants might be more exposed to some mental health-promoting events and conditions (e.g., close family ties, birth of children), and/or have higher mental health gains from those, compared to natives, possibly because of

cultural differences in the relevance of different life domains (work, family, religion) for one's well-being.

Another important implication for future research is that, if there is no evidence supporting the UAH, then other mechanisms must be driving the cross-sectional finding of the IHP. As mentioned in the Results section, these might include increasing strength of the HIE over time, for example, due to increasingly restrictive immigration policies, or selective return- or onward- migration. The latter mechanism is particularly theoretically relevant for a life-course, dynamic approach to migration. Following the stress process model mentioned in the previous paragraph, migrants might use remigration as a coping strategy, that is, to prevent or alleviate negative impacts on mental health of their life in the current destination country. This might especially be the case for more recent migrants, for whom the costs attached to remigration might be lower. These mechanisms could not be investigated in this article, due to its reliance on data covering a relatively short period of time and in which immigrants' mental health levels at arrival are seldom observed.

This article contributes to the literature on immigrants' mental health trajectories by developing an analytical approach to empirically test the UAH using panel data and by showing that, based on the evidence from the UKHLS waves 1–11 (years 2009–2021), the IHP does not seem to be driven by individual-level mental health deterioration among immigrants. However, it presents some important limitations that need mentioning.

The first set of limitations derives from the data used to test the analytical approach proposed in this article. As previously mentioned, these include a relatively small number of immigrants, many of whom were only introduced in the sixth wave of data collection. Consequently, I could not fully investigate differences in mental health trajectories across immigration cohorts, due to the small overlap in the age (years since arrival) range of observation between cohorts.

Another data-related limitation concerns potential period effects: between 2009 and 2021, the period covered by the data at hand, the UK went through several major events—the Great Recession and the following austerity measures, Brexit, and the Covid-19 outbreak—which are known to have increased the prevalence of mental health issues in the population overall, and in certain subgroups in particular. For example, the Great Recession and its aftermath especially hit people with low levels of education and those out of employment (Barr, Kinderman, and Whitehead 2015), whereas Brexit had a stronger negative impact on young and highly educated native individuals (Hervy et al. 2022; Rienzo 2024). In contrast, non-EU immigrants were found to experience improvements in mental health following the 2016 European Union Referendum (Brexit), perhaps due to an expected reduction in their disadvantage compared to EU immigrants in the job market (Rienzo 2024). These factors might partially

account for the stronger mental health deterioration among UK natives, especially in the youngest cohort, in the observed period, especially if the same events could have led more immigrants to re-migrate. Therefore, a lack of support for the UAH in the UK in this specific time frame does not exclude that processes of unhealthy assimilation are or have been at work in other contexts or periods.

Other limitations concern the analytical approach itself. First, it does not allow weighting for attrition, as doing so would require excluding immigrants who remigrated or died—who are substantially relevant to the research question—from the analyses. Second, it does not entirely succeed in comparing immigrants to natives *with similar* (*initial*) *characteristics*. As immigrants are not a random sample of their origin society (cf. Borjas 1987), we should not, ideally, compare them to a random sample of their destination one. Given that immigrants tend to have an initial advantage over natives in terms of mental health (the HIE), we should compare them to a similarly positively selected group of natives—that is, to a group of natives that had similar levels of mental health as immigrants when the latter arrived in the UK. Such an approach would not have been possible in this article, given the small number of immigrants observed in the few years after arrival and the relatively short observation period. It is therefore a challenge for future research to build on the analytical approach proposed here to account for differences in mental health selectivity between immigrants and natives.

Something to keep in mind is that the analytical approach used in this article uses natives' mental health trajectories with age as baseline to which immigrants' mental health trajectories with time since arrival are compared, thus allowing identifying the "effect" of time since arrival as the difference in age trajectories between immigrants (who migrated around a certain age) and natives. The advantages of this approach are that it allows (a) identifying a control group within the data that are generally available and (b) assessing whether life *in the destination country* is particularly challenging for immigrants' emotional well-being, or if it is simply detrimental to everyone's mental health, although perhaps for partially different reasons depending on migration status.

However, a *different* research question would be whether migration tends to improve or to damage an individual's mental health, relative to never leaving their origin country. The only appropriate way to answer this question would be to compare immigrants not to natives in their country of destination but to nonmigrants with similar characteristics in their countries of origin. Indeed, mental health trajectories are shaped by the context in which individuals live, as the latter determines the timing and type of, and risks of exposure to, the life events and conditions affecting mental health over the life course.

A concluding remark is that, by saying that immigrants might have specific resources that enable them to maintain relatively good levels of

mental health despite their exposure to a vast array of mental health damaging conditions and experiences, I do not mean to understate the gravity of such conditions and experiences. Rather, I think that the results of this article should be a reminder that we should not (implicitly) expect an immigrant disadvantage whenever we look at immigrants–natives differences in a certain outcome, which is what we often do when referring to immigrants' advantages as "paradoxes." Indeed, a striking result from this article is that UK natives, the majority of whom are not exposed to stressful experiences such as racial discrimination/harassment or acculturative stress, experience strong mental health deterioration as they age, with the young generations faring worse than the older ones.

Acknowledgments

Notes

1 Immigration policies affecting immigrants' selection in mental health might include, for example, those favoring married immigrants (as married individuals tend to have better mental health than unmarried ones) or simply the complexity/instability of the visa requesting/renovating processes, that might discourage less motivated and optimistic individuals to apply in the first place.

2 While race and/or ancestry do not affect mental health, they might affect its measurement. The measurement used in this article (SF-12 MCS, see the Variables section) has been deemed acceptable for cross-ethnic comparisons in the UK, although it resulted problematic for ethnic minority members with insufficient English language proficiency (Jenkinson et al. 2001), that is, (recent) immigrants. Therefore, controlling for race/ancestry would not correct for this measurement issue. In addition, the bias deriving from ethnic differences in the mental health reports would affect the level of mental health more than its variation, which is the focus of this article.

3 This is likely because of the small number of immigrants in this group ($N = 45$).

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