

# Regional deprivation is associated with the distribution of vulnerable asylum seekers: a nationwide small area analysis in Germany

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## ABSTRACT

**Background** Newly arriving asylum seekers in many European Union countries are assigned a place of residence based on administrative quota. This may have important consequences for the exposure to contextual health risks. We assessed the association between regional deprivation and the distribution of asylum seekers in Germany considered as vulnerable (women, children <7 years, persons >64 years) because of their increased health needs.

**Methods** Using nationally representative data, we analysed the rates of observed to expected numbers of asylum seekers and vulnerable subgroups in Bayesian spatial models. Regional deprivation was measured by the German Index of Multiple Deprivation. The analyses were performed at the district level (N=402) and adjusted for district population size, effects of federal states as well as spatial effects.

**Results** Of the 224 993 asylum seekers, 38.7% were women, 13.8% children aged <7 years and 19.8% aged >64 years. The adjusted number of asylum seekers (totals and vulnerable subgroups) was higher in more deprived districts (Q3, Q4 and Q5) relative to districts in the lowest deprivation quintile (Q1). The adjusted rate ratios for districts with highest relative to those with lowest deprivation were 1.26 (1.03-1.53) for women, 1.28 (1.04-1.58) for children aged <7 years and 1.50 (1.08-2.08) for older asylum seekers.

**Conclusion** The adjusted number of vulnerable asylum seekers was higher in districts with medium and highest deprivation compared with districts with lowest deprivation. The disproportionate distribution was highest for older asylum seekers and children <7 years. Vulnerable subgroups tend to be exposed to more deprived places of residence, which may further increase health risks and healthcare needs.

## INTRODUCTION

Newly arriving asylum seekers in Germany are relocated *between* the 16 federal states based on administrative quota (*Königsteiner Schlüssel*). The quota considers state-level tax income and population size to achieve fairness between federal states in the distribution of the 'economic burden' arising from the health and humanitarian needs of asylum seekers.

A similar mechanism is under discussion at European Union (EU) level: to achieve a 'fair' distribution<sup>1</sup> of asylum seekers among EU member states, the European Commission considers the

implementation of a compulsory relocation scheme of asylum seekers based on criteria such as gross domestic product, population size and unemployment rates.<sup>2</sup>

Asylum seekers in Germany must stay in state-mandated reception centres up to 6 months and are then relocated to districts and municipalities *within* the respective federal state based on administrative criteria.<sup>3</sup> The assignment from states to districts does not follow the same principles as the distribution between states, nor does it follow a common approach across the country. The decision on the principles of dispersal is decentralised, and each state decides which criteria to apply for dispersal to districts or whether to apply 'objective' criteria at all. Asylum seekers who receive social transfers according to the Asylum-Seekers' Benefits Act (*AsylbLG*) must usually reside in the assigned district or municipality. Moving house to other municipalities, districts or federal states is only possible under specific circumstances (eg, for family reunion or health reasons) and requires formal approval by local authorities following a bureaucratic application procedure.

It is well established that contextual characteristics of the place of residence, such as neighbourhood socioeconomic disadvantage, impact on individual health status<sup>4-8</sup> and access to health care.<sup>9</sup> Characteristics of the place of residence have also been shown to play an important role in the context of migrants' health.<sup>7 10-12</sup> The characteristics of the assigned place of residence could thus have important implications for asylum seekers' health, particularly for more vulnerable subgroups such as women, children or older persons.

We assess here the association between regional deprivation of the place of residence and the distribution of asylum seekers who receive social transfers and could be considered as vulnerable, such as women, children <7 years and older asylum seekers aged 65 years and above.

## METHODS

### Design and study population

We used nationally representative data on all asylum seekers in Germany subject to social transfers in 2013 (*Asylbewerberleistungsstatistik*) to conduct a cross-sectional small area analysis at the district level (N=402) that according to the Nomenclature of Territorial Units for Statistics (NUTS) corresponds to NUTS 3 level. We included all



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## Research report

asylum seekers receiving social transfers for existential welfare services (*Regelleistungsempfänger*). We defined women, children <7 years and asylum seekers aged 65 years and above as vulnerable subgroups in the sense that these groups can be expected to have higher healthcare needs and may be more prone to unfavourable influences of the place of residence.

### Statistical analysis

We first assessed the distribution of asylum seekers at district level by calculating ratios of observed ( $O$ ) to expected ( $E$ ) numbers of asylum-seekers (total and vulnerable subgroups), whereas  $E$  was calculated based on the underlying German district population size. Quintiles of the  $O/E$  ratios were mapped cartographically. We then analysed the association between regional deprivation and the distribution of asylum seekers (total and vulnerable subgroups) using Bayesian spatial models fit by the integrated nested Laplace approximation (INLA) approach.<sup>13</sup>

We used the German Index of Multiple Deprivation<sup>14</sup> for the year 2010 (GIMD 2010), a contextual measure of regional deprivation, as exposure variable. The GIMD includes seven domains of area deprivation: income (of the population), employment, education, municipal or district revenue, social capital, environment and security.<sup>15</sup> The GIMD 2010 was constructed based on 412 districts. An administrative reform in 2011 merged 18 districts in one federal state into eight districts. To account for this, we calculated a population-weighted score for the merged districts based on the GIMD 2010. We grouped areas into quintiles based on their underlying GIMD value without changing the respective quintile cut-offs. Comparing the quintiles of 402 districts with GIMD 2010 quintiles showed that this procedure had no relevant impact on the categorisation of districts. Districts with the lowest deprivation corresponded to the lowest GIMD quintile (Q1) and those with the highest deprivation to the highest GIMD quintile (Q5). The effect of the exposure on the number of asylum seekers (totals and vulnerable subgroups) was assessed in four different models, each adjusted for district population size, structured and unstructured spatial effects and fixed-effects of 16 federal states.

For each area (district  $i$ ), we assumed:

$$y_i \sim \text{Poisson}(\lambda_i) \quad \lambda_i = E_i \rho_i \quad \log(\rho_i) = \eta_i,$$

so that the mean  $\lambda_i$  is defined in terms of the rate  $\rho_i$  and the expected number of cases  $E_i$ . Then we specified a log-linear model on the linear predictor  $\eta_i$ :

$$\eta_i = \alpha + \beta_1 \text{GIMDQ}_{2i} + \dots + \beta_4 \text{GIMDQ}_{5i} + \beta_5 \text{STATE}_{2i} + \dots + \beta_{19} \text{STATE}_{16i} + u_i + v_i,$$

where  $\alpha$  is the intercept,  $\beta_1$  to  $\beta_{19}$  are fixed effects,  $\text{GIMDQ}_2$  to  $\text{GIMDQ}_5$  are the deprivation quintiles of district  $i$ ,  $\text{STATE}_2$  to  $\text{STATE}_{16}$  are dummy variables for the federal states (thus,  $\text{STATE}_1$  is used as the reference),  $u_i$  is a district-specific effect modelled as exchangeable (unstructured) and  $v_i$  is a spatially structured effect (Besag-York-Mollié model). Rate ratios (RRs) and corresponding 95% credible intervals (CrI) were obtained for the deprivation effects. Data were missing in 16 districts, predominantly in eastern Germany, with respect to the subgroup of asylum seekers aged 65 years and above. These districts were omitted from the specific analysis.

To further explore a North-West/South-East pattern that emerged in univariate descriptive analyses of  $O/E$  ratios, we assessed the potential additional effects of two dichotomous geographic variables, 'North-South' and 'East-West', first separately and then jointly with and without their interaction, in the above-described models. We classified districts in Baden-Württemberg, Bavaria, Saarland and Southern parts of Rhineland-Palatinate and Hesse as 'South' and the remainder as 'North'. Districts in the former German Democratic Republic (including the whole of Berlin) were classified as 'East' and the remainder was classified as 'West'.

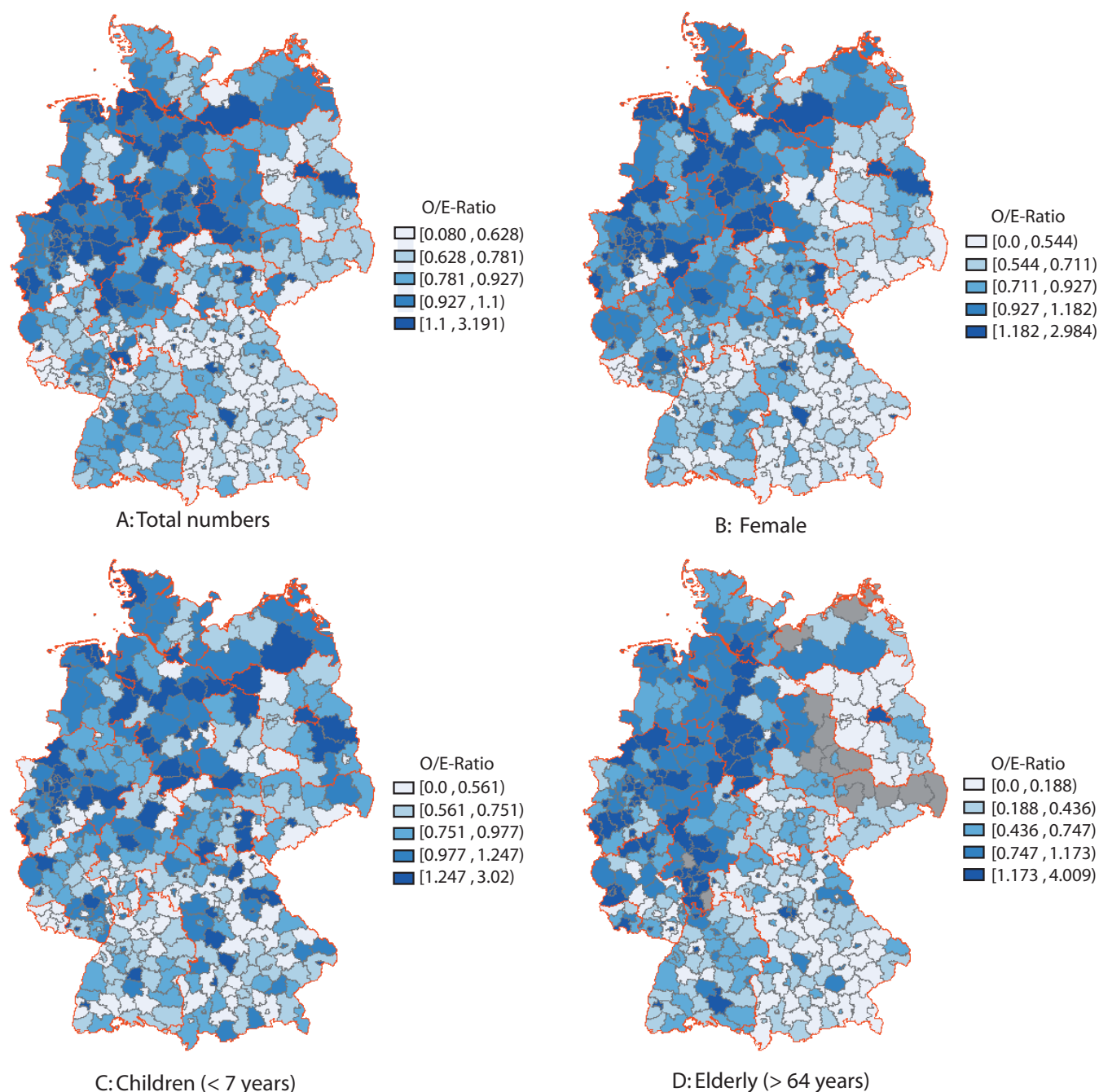
The analyses were performed using the R language and environment for statistical computing (V3.3.1), and models were fit using the package 'R-INLA'.<sup>16 17</sup>

### RESULTS

Of the 224 993 asylum seekers registered at the end of the year 2013, 38.7% were women (all ages), 13.8% were children aged <7 years (both sexes) and 19.8% were older persons of both sexes aged 65 years and above. The  $O/E$  ratios of the total numbers of asylum seekers at district level ranged from 0.08 to 0.63 in the lowest and from 1.10 to 3.19 in the highest deprivation quintile (figure 1A). The lowest quintile of  $O/E$  ratios ranged from nearly 0 to 0.54 for women, 0.56 for children and 0.19 for older persons. The highest quintile of  $O/E$  ratios ranged from 1.18 to 2.98 for women, from 1.25 to 3.02 for children and from 1.17 to 4.01 for older persons (figure 1B–D).

After full adjustment for federal state effects and spatial effects, the RR for the number of asylum seekers (totals) in districts with deprivation quintiles Q3, Q4 and Q5 was, respectively, 1.13 (95% CrI 1.01 to 1.25), 1.19 (1.06 to 1.33) and 1.21 (1.03 to 1.41) compared with least deprived districts (Q1). The RR of the adjusted number of female asylum seekers in districts with GIMD quintiles Q4 and Q5 was 1.20 (1.04 to 1.38) and 1.26 (1.03 to 1.53) relative to least deprived districts (Q1). Comparing medium deprived with least deprived districts, the adjusted RRs were 1.11 for female asylum-seekers (0.97 to 1.27) and 1.16 for children (1.01 to 1.34) (figure 2). The adjusted RR for children in districts with GIMD quintiles Q4 and Q5 (relative to Q1) were 1.23 (1.06 to 1.43) and 1.28 (1.04 to 1.58), respectively. The adjusted RR for older persons in districts with GIMD quintiles Q3, Q4 and Q5 (relative to Q1) were 1.13 (0.91 to 1.40), 1.41 (1.13 to 1.77) and 1.50 (1.08 to 2.08), respectively. No evidence of an association was found comparing districts in the second deprivation quintile (Q2) with those in the least deprived districts (Q1) with respect to all four outcomes (total numbers of asylum seekers, women, children and older asylum seekers). After adjustment for regional deprivation and federal state, the North-West/South-East pattern observed in univariate descriptive analyses of  $O/E$  ratios disappeared and was not visible anymore in plots of the estimated spatial effects (see online supplementary appendix figure A1). The models could generally not be improved by incorporating additional variables on the geographic location ('North-South', 'East-West' and the interaction between both). Merely weak evidence on a North-South gradient was found in the subgroup of children, as judged by the CrI of the regression coefficient. However, this neither affected inferences on the deprivation effects nor their magnitude to a relevant extent.

The RR of numbers of asylum seekers (totals and all vulnerable groups) at federal state level—jointly adjusted for GIMD, district population size and spatial effects—were higher than the reference (the economically relatively well-off Baden-Württemberg)



**Figure 1** Ratios of observed to expected numbers of asylum seekers based on the underlying district population size, Germany, 2013. O/E ratio, ratio of observed to expected; O/E ratio <1, the observed numbers are smaller than the expected; O/E ratio >1, the observed numbers are higher than the expected. N=402 districts. Grey areas: no observations.

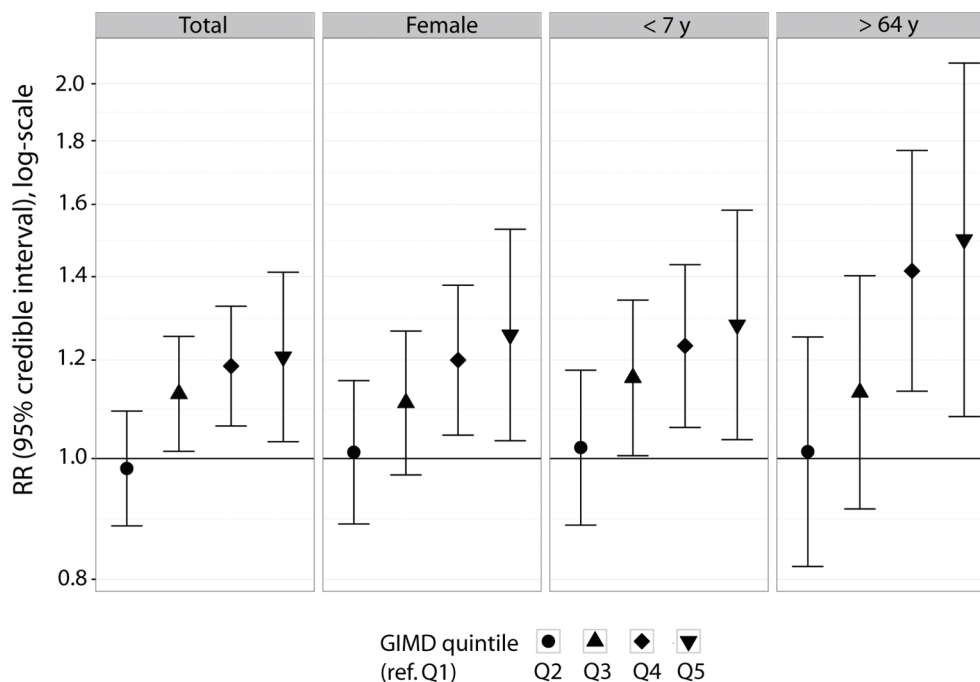
in six federal states (Berlin, Bremen, Hamburg, Lower-Saxony, North Rhine-Westphalia and Schleswig-Holstein), approximately equal to 1 in Saxony-Anhalt and lower than 1 for at least one group in six federal states (figure 3), as judged based on the 95% CrI.

## DISCUSSION

This study assessed the association between regional deprivation of the place of residence and the distribution at district level of asylum seekers who receive social transfers and could be considered as vulnerable. The adjusted total number of asylum seekers and those considered to be vulnerable was observed to be

higher in districts with medium (Q3) and higher deprivation (Q4 and Q5) compared with districts with lowest deprivation (Q1), except for older asylum seekers and women for which an association was evident only in districts with highest deprivation (Q4/Q5). The observed pattern of the distribution shows a clear social gradient between districts, with higher numbers of vulnerable asylum seekers in more deprived districts, taking into account the underlying district population size, effects of federal states and spatial effects. The association was strongest for older asylum seekers and children <7 years comparing most deprived with least deprived districts.

## Research report



**Figure 2** Adjusted rate ratios and 95% credible intervals of observed to expected numbers of asylum seekers, by population group, Germany, 2013. Total, total number of asylum seekers (both sexes, all ages); <7 years, children aged below 7 years; >64 years, older asylum seekers aged 65 years and above; female, female asylum seekers (all ages); GIMD, German Index of Multiple Deprivation; Q1-5, quintiles. Q1, reference, least deprived districts; Q5, most deprived districts; RR, rate ratio. Expected numbers were calculated based on the population size of the district. All estimates are adjusted for effects of federal states as well as structured and unstructured district level spatial effects.

Regional deprivation thus seemed to be an independent predictor of the number of asylum seekers on the district level.

The observed social gradient between districts shows that asylum seekers considered as vulnerable tend to be exposed to more deprived places of residence, which may further increase health risks and healthcare needs. The domains of deprivation included in the GIMD represent factors that can have important implications for the health and well-being of residents in these areas. Deprived areas are likely to be characterised, for example, by high unemployment and low job opportunities, low income of the population, lower social capital of the community and higher rates of criminal acts. The compulsory assignment to such places of residence by means of dispersal policies could thus be an important structural determinant of health.

Our paper provides yet another illustration of the complex interaction between residential (or spatial) segregation on the one hand and distribution of ethnic/migrant groups on the other, here relating to asylum seekers who arrived to Germany by 2013. It builds on earlier studies on spatial distribution especially from sociology, urban geography and public policy.

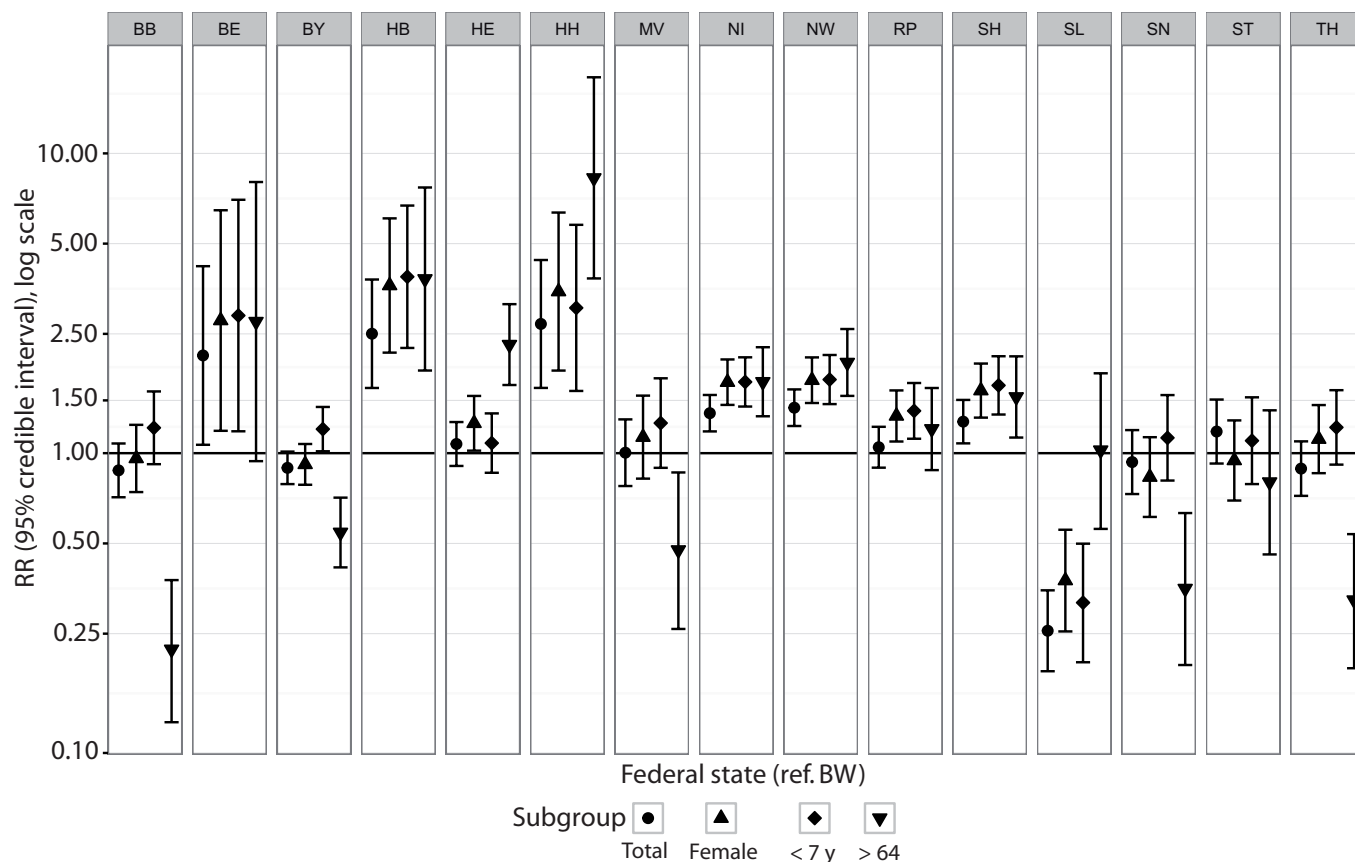
Massey and Lundy, for example, demonstrated mechanisms contributing towards ethnic segregation through selection effects in urban areas of the USA.<sup>18</sup> Acevedo-Garcia and colleagues<sup>19</sup> studied the effect of change of neighbourhood on health, be it through migration or economic pressure (such as housing prices). Their view was further developed by Jamie Pearce, a health geographer, who introduced 'place' and the history of changing places into the concept of life course epidemiology.<sup>20</sup>

More specifically, our study contributes to the yet small body of evidence concerning the social and health consequences of dispersal policies among migrants by means of natural experiments, taking into account the characteristics of the area environment. Previous studies have mainly assessed the effect of European refugee dispersal policies on labour markets<sup>21-23</sup> and

educational outcomes.<sup>24</sup> The results of the analysis of labour market outcomes speak against mandatory dispersal policies to promote labour market integration.<sup>22, 23</sup> Few studies have exploited the quasi-experimental feature of dispersal policies to assess health outcomes. One of these has assessed the association between neighbourhood income inequality (based on the Gini coefficient) and the risk of being admitted to hospitals among refugees in Sweden and found no statistically significant effect of the exposure on the outcome.<sup>25</sup> Another study from Sweden created a historical cohort to test the hypothesis that neighbourhood deprivation affects the development of type 2 diabetes among refugees quasi-randomly assigned to neighbourhoods throughout the country.<sup>26</sup> The study provides evidence that exposure to high neighbourhood deprivation (compared with low deprivation) increases the risk for diabetes<sup>26</sup>—an association that has also been found in Germany among the general population.<sup>14, 27</sup>

The conjecture outlined above is strengthened by the finding from a study on ethnic German resettlers who return-migrated to Germany after the collapse of the Soviet Union: migrants assigned to cities or districts designated as 'poverty poles' experienced a higher mortality than those assigned to well-off cities or districts.<sup>7</sup> Our paper thus confirms and further develops the phenomenon of forced or self-selected segregation that is likely to have largely negative effects on health. While this phenomenon has long been observed in health geography and migration studies, it is still disregarded by policymakers.

Our findings also have important equity implications for the allocation system of asylum seekers in Germany: it is often assumed that the current relocation quota, which considers state-level tax income and population size to achieve a weighted distribution of newly arriving asylum seekers, creates a 'fair' distribution<sup>28</sup> with larger and wealthier states receiving higher numbers of asylum seekers. The quota, however, only considers



**Figure 3** Adjusted rate ratios and 95% credible intervals of observed to expected numbers of asylum seekers, by federal state and population group, Germany, 2013. All estimates adjusted for regional deprivation, district population size and spatial effects. Each subgroup was used as distinct outcome in four separate models. BB, Brandenburg; BE, Berlin; BW, Baden-Württemberg; BY, Bavaria; HB, Bremen; HE, Hesse; HH, Hamburg; MV, Mecklenburg-Western Pomerania; NI, Lower Saxony; NW, North Rhine-Westphalia; RP, Rhineland-Palatinate; SH, Schleswig-Holstein; SL, Saarland; SN, Saxony; ST, Saxony-Anhalt; TH, Thuringia.

*flows* (ie, incoming asylum seekers) at state level and is neither concerned with underlying needs (eg, age, sex or morbidity) nor with the distribution at district or municipality levels. While the distribution of *flows* may be considered as 'fair' from the perspective of the quota, our analysis reveals that *stocks* of total numbers and vulnerable groups at district level were inequitably distributed towards more deprived areas. This has clear implications from the aspect of solidarity in healthcare, since the district and municipality level carries the costs for existential needs of asylum seekers including healthcare. Stocks were distributed very heterogeneously even at federal state level in fully adjusted models, which confirms previous concerns that needs do not follow numbers of asylum seekers in relocation schemes based on *fix a priori* quota.<sup>28</sup>

### Strengths and limitations

We used nationally representative, best available data on asylum seekers in the year 2013 to assess the role of regional deprivation as predictor of the distribution of vulnerable asylum seekers. The applied statistical approach accounted for spatial effects at the federal state and district level and allowed to estimate the effect of regional deprivation, which was measured by an established index. The data were, however, aggregated, and stratification across more than one criterion was not possible. This means that the associations between GIMD and the distribution of subgroups (eg, women) may be confounded by other sociodemographic characteristics (eg,

age). Other important characteristics that may contribute to the heterogeneity in the observed to expected ratios, such as country of origin, or type of accommodation, were not available at district level. Although we have no evidence that our data are severely biased or confounded, further explanatory factors may improve the estimates for GIMD effects. The data are also limited by the lack of health-related data, so that it was not possible to assess potential associations of GIMD with health outcomes in asylum seekers. Our analysis was comprehensive, but it constitutes a retrospective snapshot of the distribution in question. Data covering a longer period of time, for example, 5 years, would be needed to generate more generalisable results. Such data at district level stratified by age or sex was however not available except for the year 2013. Better data

### What is already known on this subject

- ▶ Asylum seekers in many countries are assigned a place of residence based on administrative criteria.
- ▶ The contextual characteristics of the place of residence can have important implications for health and well-being of individuals.
- ▶ No studies have yet analysed the association between regional deprivation of the place of residence and the distribution of asylum seekers in receiving countries.

## Research report

## What this study adds

- ▶ Nationally representative estimates of the effect of regional deprivation on the distribution of asylum seekers in Germany.
- ▶ Insights into the differential effects of regional deprivation on vulnerable subgroups, such as women, children < 7 years and older asylum seekers.
- ▶ Evidence that vulnerable asylum seekers, especially older persons and children <7 years, tend to be exposed to more deprived places of residence, which may further increase their health risks and healthcare needs.

at small area level are needed to assess the health and healthcare situation in asylum-seeking populations. This would also help to better operationalise the concept of 'vulnerability', which we applied in crude categories to the group of asylum seekers based on sex or age.

We used NUTS 3 units for the construction of the GIMD on district level. These units consist of city states, urban districts/independent cities and rural districts. The size of these units is rather heterogeneous, and it would be ideal to use homogenous small area statistical units like super output areas in England or data zones in Scotland. However, there are no such areas available in Germany yet. In former studies on area deprivation in the UK heterogeneous ward units were used for analyses. In order to approach the problem of heterogeneity, one possible solution could be the use of the shrinkage estimation method<sup>29</sup> in future GIMD versions. Another important issue relates to the time-relation of exposures and outcomes: while the GIMD is based on 2010 data, the number of asylum seekers per district is from 2013. However, the GIMD has been shown to be relatively stable comparing versions from 2006 and 2010 (unpublished). This is in line with findings from a Scottish study that suggests that there are only very few substantial changes in a period of just a few years when using an index of multiple deprivation.<sup>30</sup>

A further limitation relates to the coverage of asylum seekers by federal statistics: the used data source covers all asylum seekers subject to social transfers, but not all asylum seekers automatically receive transfers. Economically well-off asylum seekers and those already integrated into the regular job market do not receive social transfer and are not covered by the federal statistics. Although there is no information on this subgroup in federal statistics, this group is rather the exception than the rule so that coverage in the statistics can be assumed to be relatively high.

## CONCLUSION

Vulnerable subgroups of Germany's asylum seeker population tend to be exposed to more deprived places of residence. As a consequence, health risks and healthcare needs may be higher in these areas. Healthcare planners need to be aware of this association to develop targeted healthcare programmes or measures for prevention and health promotion. Our findings have implications in terms of equity and solidarity in providing the resources needed to meet the health and humanitarian needs of asylum seekers. Therefore, the dispersal mechanism needs to be carefully checked and adjusted at the below-state level. Further research is needed to assess actual health outcomes to establish whether there are similar effects *within* other EU member states and to investigate the situation at EU level where the implementation of a 'fair' distribution system *between* member states is considered.

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**Contributors** KB: conceived the study, interpreted the results and wrote the first and final draft of the manuscript. OR: contributed to the study design, interpreted the results and critical revision of the manuscript. JS: interpreted the results and critical revision of the manuscript. WM: support using the GIMD, interpreted the results and critical revision of the manuscript. CS: important contributions to the study design, conceived and performed the statistical analysis, interpreted the results and critical revision of the manuscript.

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**Patient consent** The study is based on aggregated data.

**Provenance and peer review** Not commissioned; externally peer reviewed.

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