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## Neighborhood deprivation and mental health among immigrants to Sweden

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To the Editor:

Neighborhood socioeconomic deprivation has been associated with worsened mental health,<sup>1–4</sup> but previous studies may suffer from confounding due to self-selection, in that individuals with poor mental health are more likely to reside in deprived neighborhoods (eFigure 1).<sup>5</sup> Refugees in particular are uniquely vulnerable to mental health problems, due to their involuntary and sudden displacement.<sup>6,7</sup>

We leveraged a natural policy experiment where incoming refugees were dispersed quasi-randomly to neighborhoods across Sweden (see eAppendix 1). We estimated the effect of neighborhood deprivation on mental health among refugees. We compared these estimates to the association among non-refugee immigrants who were not subject to the dispersal policy to evaluate the possibility of selection bias in correlational analyses.

We constructed a dataset using Swedish registers.<sup>8</sup> We included adult immigrants who arrived in Sweden during 1987–1991, when the dispersal policy was in effect (Supplemental Methods, eFigures 2–3).

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**Conflicts of interest:** None declared.

**Data access:** The data are not available for replication because the Swedish registry database is provided to us under a data use agreement which requires that we do not disclose individual-level data.

The outcome was date of diagnosis with depression and/or anxiety. We created an index of neighborhood deprivation, split into tertiles, and examined (1) neighborhood deprivation on arrival and (2) neighborhood deprivation 10 years after.<sup>9</sup> While the former is likely to be unconfounded among quasi-randomly assigned refugees, the latter is likely to reflect self-selection among refugees, making estimates more comparable to those among non-refugee immigrants. Baseline covariates included: age, gender, education, marital status, family size, region of placement, region of origin, and year of arrival.

Cox models were used to estimate the association of neighborhood deprivation (1) on arrival and (2) 10 years later with diagnosis of depression/anxiety. We stratified by refugees versus non-refugee immigrants and adjusted for the covariates above. We included fixed effects for initially assigned municipality (see eAppendix 2). We also examined differences by gender.

Our sample included 48,056 refugees and 97,254 non-refugee immigrants (eTable 1). Over two-thirds were under 35. Refugees were more likely to be male, with lower educational attainment and larger families. Most refugees were from Iran (27%) and the Middle East and North Africa (27%). Diagnosis of depression and/or anxiety was higher in refugees (39%) than non-refugee immigrants (20%) (see eAppendix 3).

Among non-refugee immigrants, moderate-deprivation neighborhoods on arrival were associated with greater depression/anxiety compared with low-deprivation neighborhoods (hazard ratio [HR] 1.04, 95% confidence interval [CI] 1.00, 1.09) (Figure). Meanwhile, refugees placed in high-deprivation neighborhoods on arrival had lower rates of depression/anxiety (HR 0.96, 95%CI 0.92, 1.00). Estimates were close to the null, and thus susceptible to being explained by small amounts of bias.

Among non-refugee immigrants, neighborhood deprivation 10 years after arrival was more strongly associated with depression/anxiety (high-deprivation HR 1.12, 95%CI 1.07, 1.17; moderate-deprivation HR 1.10, 95%CI 1.06, 1.15). Among refugees, the association of neighborhood deprivation 10 years after arrival with depression/anxiety was 1.03 (95%CI 0.98, 1.08) for both high- and moderate-deprivation neighborhoods.

Among non-refugee immigrants, the association of high neighborhood deprivation on arrival and 10 years after arrival was greater for men (HR 1.28, 95%CI 1.18, 1.38) than women (HR 1.06, 95%CI 1.01, 1.12). Among refugees, the association of high neighborhood deprivation 10 years after arrival was greater for women (HR 1.07, 95%CI 0.99, 1.16) than men (HR 0.98, 95%CI 0.91, 1.06) (eFigure 4, eAppendix 4).

We used a natural experiment and longitudinal Swedish registers to study the association of neighborhood deprivation with mental health among refugees and non-refugee immigrants, contrasting quasi-experimental and correlational approaches. For refugees quasi-randomly assigned to neighborhoods, high neighborhood deprivation on arrival was associated with lower depression/anxiety, although effect estimates were close to the null and thus susceptible to small amounts of bias (e.g., due to misclassification or under-diagnosis). For neighborhood deprivation 10 years after arrival, estimates for refugees started to resemble those of non-refugee immigrants, perhaps due to the growing role of self-selection. Among non-refugee immigrants, high neighborhood deprivation on arrival and 10 years after arrival

were consistently associated with depression and/or anxiety, perhaps because self-selection is likely to play a larger role in the absence of quasi-random placement.

There are two major explanations for our findings. First, quasi-experimental neighborhood assignment may reduce confounding due to selection. Prior studies have shown strong associations between neighborhood deprivation and mental health.<sup>1,3-5</sup> These estimates may be confounded by unobserved socioeconomic and health characteristics (eFigure 1).<sup>2,10</sup> Refugees were able to move neighborhoods after their initial placement. By comparing estimates among refugees on arrival to estimates 10 years later, we found that estimates 10 years after arrival start to resemble those of non-refugee immigrants, suggesting that the coefficients in non-refugee immigrants may in part represent self-selection (see eAppendix 4).

A second explanation is that immigration status may lead to differential effects. Refugees, particularly women, may experience discrimination and fewer opportunities for integration in low-deprivation neighborhoods. For non-refugee immigrants, low-deprivation neighborhoods may reflect financial stability, while high-deprivation neighborhoods may offer fewer economic opportunities, particularly for men.<sup>11</sup> Alternately, neighborhood factors may be less important for refugees than past trauma or the support provided by the Swedish government.<sup>12,13</sup>

By demonstrating differences using two analytic approaches, we provide insight into self-selection bias in the prior neighborhood-health literature, and we shed light on the possible differential effect of neighborhood deprivation on depression/anxiety by immigration status.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments:

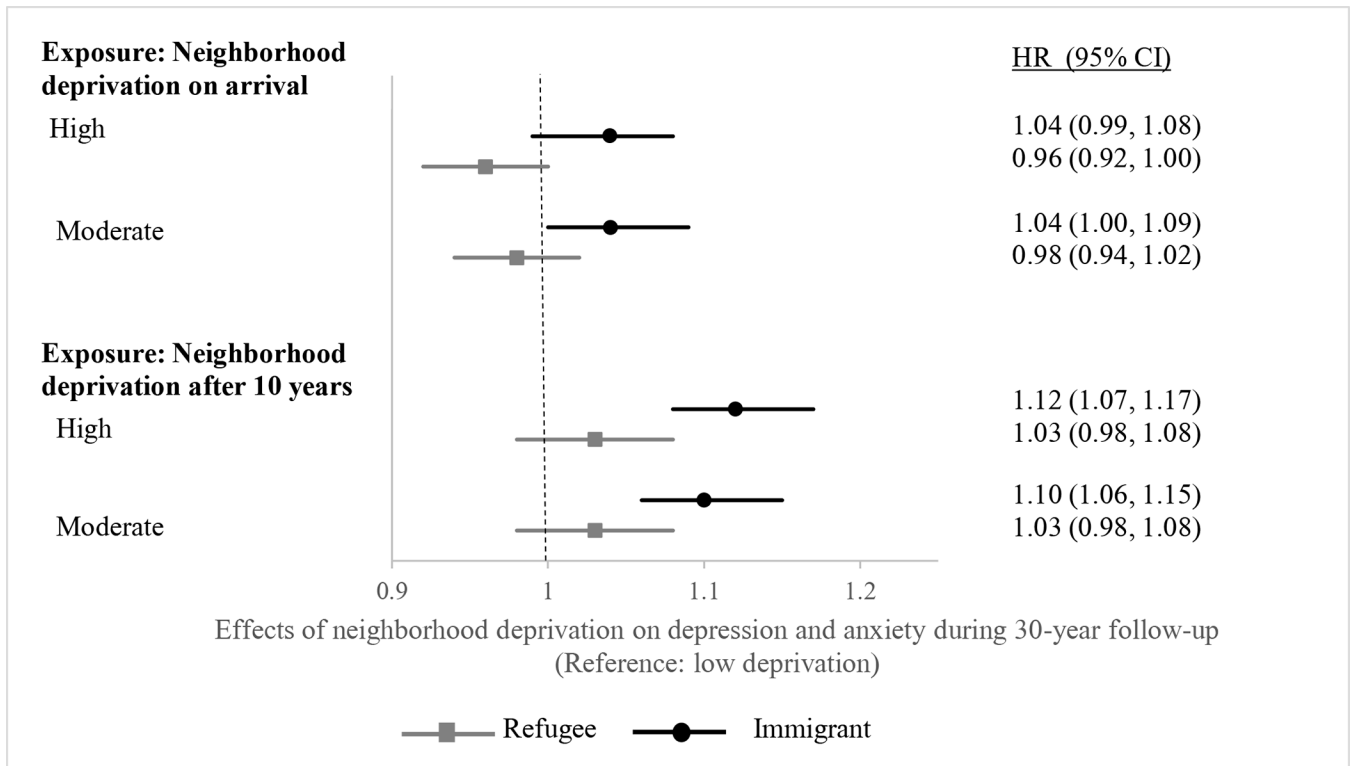
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**Figure. Association of neighborhood deprivation with poor mental health during 30-year follow-up**

Refugees on arrival: n=48,056; after 10 years: n=31,749

Non-refugee immigrants on arrival: n=97,254; after 10 years: n=51,593

Note: Analyses involved Cox proportional hazards models, adjusting for characteristics listed in eTable 1, year of arrival to account for secular trends, and fixed effects for initial municipality. Models incorporated shared frailty at the municipality level to account for correlated observations within families and municipalities.