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Contextual effect on mortality of neighbourhood level education explained by earlier life deprivation

Øyvind Naess, Alastair H Leyland, George Davey Smith, Bjorgulf Claussen

Various aspects of socioeconomic conditions in the neighbourhood have in recent years been found to have an influence on morbidity and mortality even after individual characteristics are taken into account. Increasing evidence suggests that to measure fully the impact of social conditions may have on mortality risk, the whole life course must be taken into account as mortality risk increases cumulatively over the life course. Few studies have combined ecological and life course factors to see if contextual effects may be explained by social conditions earlier in life at the individual level. Most studies of neighbourhood effects have had a cross sectional design or with short follow up. Effects seen could be a consequence of the fact that people in these areas may have different earlier life experiences that have not been fully taken into account. In this study we examine whether the contextual effect of educational level aggregated to the neighbour- hood level education explained by earlier life deprivation.

METHODS AND RESULTS
A cohort of all inhabitants in Oslo aged 30–69 years in 1990 was linked to the censuses in 1960 to 1990, the Educational Register in 1990, and the Death Register 1990 to 1998. There were 1985 people 30–49 years (29% excluded) and 8753 people 50–69 years (20% excluded). Education was defined as primary education (7–9 years), middle school (10–11 years), secondary school (12 years), college (12–16 years), and university (over 16 years). Altogether 473 neighbourhoods were registered at the census in 1990 to administer elections. Centile distribution (at neighbourhood level) of number of inhabitants per neighbourhood ranged from 8 (lower 5%), 248 (median) to 968 (95%). The age adjusted mortality rate (per 10000) did not vary by neighbourhood size. The proportion in each area in the age range 30–69 years with only primary education was used as the indicator of educational level in neighbourhoods. Housing conditions from the censuses in 1960, 1970, and 1980 provided information on earlier life deprivation at the individual level. Six aspects of housing conditions were included: rooms per household capita (0,1,2), type of dwelling (0,1,2), ownership (0,1), toilet (0,1), bath (0,1), and telephone in dwelling (0,1). This was summed for each individual and categorised into five roughly similar size groups. A logistic multilevel analysis was conducted to estimate neighbourhood variance in mortality adjusting for age only (model 1) and subsequently adding neighbourhood level education (model 2), individual level education (model 3), and earlier life deprivation (models 4 to 6). A full description of these variables in the same population is provided elsewhere.2

Table 1 Fixed effect (b) and SE of neighbourhood level education in 1990 (model 2) and variance (SE) on all causes of death by age and corresponding individual level education (model 3) and by all individual level life course deprivation from 1960, 1970, and 1980 (model 5) in men and women who are residents in Oslo 1 January 1990 aged 30–69

<table>
<thead>
<tr>
<th>Age 30–49</th>
<th></th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men (n = 46543)</td>
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<tr>
<td>Fixed effect education, b (SE):</td>
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<td>Individual level</td>
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</tr>
<tr>
<td>Neighbourhood</td>
<td>–</td>
<td>2.633 (0.357)**</td>
<td>0.892 (0.362)*</td>
<td>0.762 (0.36)*</td>
<td>0.774 (0.366)*</td>
<td>0.673 (0.367)***</td>
</tr>
<tr>
<td>Variance (SE)</td>
<td>0.206 (0.037)**</td>
<td>0.135 (0.031)**</td>
<td>0.109 (0.029)**</td>
<td>0.107 (0.029)**</td>
<td>0.108 (0.029)*</td>
<td>0.103 (0.028)***</td>
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<td>Women (n = 47172)</td>
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<td>Fixed effect income, b (SE):</td>
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<tr>
<td>Individual level</td>
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</tr>
<tr>
<td>Neighbourhood</td>
<td>–</td>
<td>1.279 (0.378)**</td>
<td>0.255 (0.404)</td>
<td>0.122 (0.408)</td>
<td>0.005 (0.410)</td>
<td>–0.296 (0.412)**</td>
</tr>
<tr>
<td>Variance (SE)</td>
<td>0.055 (0.034)</td>
<td>0.043 (0.032)</td>
<td>0.047 (0.033)</td>
<td>0.046 (0.033)</td>
<td>0.046 (0.033)</td>
<td>0.042 (0.032)**</td>
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<tr>
<td>Age 30–69</td>
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<td>Men (n = 31353)</td>
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<td>Fixed effect income, b (SE):</td>
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<td>Individual level</td>
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<tr>
<td>Neighbourhood</td>
<td>–</td>
<td>1.882 (0.016)**</td>
<td>0.654 (0.202)*</td>
<td>0.483 (0.192)</td>
<td>0.845 (0.192)</td>
<td>0.344 (0.192)</td>
</tr>
<tr>
<td>Variance (SE)</td>
<td>0.103 (0.015)**</td>
<td>0.073 (0.012)**</td>
<td>0.042 (0.009)**</td>
<td>0.036 (0.009)**</td>
<td>0.026 (0.008)**</td>
<td>0.022 (0.007)**</td>
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<tr>
<td>Women (n = 39039)</td>
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<td>Fixed effect education, b (SE):</td>
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<tr>
<td>Individual level</td>
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<td>–</td>
</tr>
<tr>
<td>Neighbourhood</td>
<td>–</td>
<td>1.077 (0.195)**</td>
<td>0.263 (0.195)</td>
<td>0.007 (0.191)</td>
<td>–0.995 (0.189)</td>
<td>–0.274 (0.188)</td>
</tr>
<tr>
<td>Variance (SE)</td>
<td>0.048 (0.011)**</td>
<td>0.032 (0.009)**</td>
<td>0.019 (0.008)**</td>
<td>0.011 (0.007)</td>
<td>0.007 (0.006)</td>
<td>0.004 (0.006)**</td>
</tr>
</tbody>
</table>

*p Value <0.05, **p value <0.01, ***p value <0.001. |Proportion in each neighbourhood with primary education only, lowest quartile of neighbourhoods ranging from 0 to 0.32 and highest from 0.36 to 0.44. *Primary education (7–9 years), middle school (10–11 years), secondary school (12 years), college (12–16 years), and university (over 16 years).
What this study adds

We have shown that earlier life social conditions at the individual level can be an important residual confounder when investigating the effect of neighbourhood on mortality risk. A significant effect of neighbourhood educational level became insignificant after adjustment for individual deprivation throughout the life course.

Multilevel analysis typically provides information on higher level variation (neighbourhood), some of which can be explained by the fixed effect of individual and neighbourhood level factors. Table 1 shows fixed effects of education at individual and neighbourhood level and variances in mortality risk across neighbourhoods in the two age groups. The variances were larger for men than for women and in the younger than the older age group. Adding neighbourhood level education reduced the variance substantially in both sexes and age groups. The effect of neighbourhood education was significant and stronger for men and the younger age group. Individual level education was then added. This reduced the neighbourhood level effect of education. Adding life course indicators of deprivation further attenuated the neighbourhood level effect in both sexes and age groups in a stepwise manner. Including life course deprivation seemed not to reduce the individual level effect of education substantially.

Policy implications

Policy makers tackling inequalities in health at the neighbourhood level should be cautious of evidence obtained from studies that fail to take the life course into account.

Policy makers tackling inequalities in health at the neighbourhood level should be cautious of evidence obtained from studies that fail to take the life course into account.

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CONTRIBUTORS

ON and GDS designed the study. ON analysed and wrote the first draft and GDS and AL contributed to analysing and writing later versions of the paper. BC collected the data. ON will act as guarantor for the paper.

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Ethical approval: ethical approval was not required for this study.

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