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Does contextual unemployment matter for health status across the life course? A longitudinal multilevel study exploring the link between neighbourhood unemployment and functional somatic symptoms

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ABSTRACT

This study examines whether neighbourhood unemployment is related to functional somatic symptoms, independently of the individual employment, across the life course and at four specific life course periods (age 16, 21, 30 and 42). Self-reported questioner data was used from a 26-year prospective Swedish cohort (n=1010) with complementary neighbourhood register data. A longitudinal and a set of age-specific cross-sectional hierarchal linear regressions was carried out. The results suggest that living in a neighbourhood with high unemployment has implications for residents' level of functional somatic symptoms, regardless of their own unemployment across time, particularly at age 30.

1. Introduction

Previous research suggests that experiencing unemployment might have immediate health implications but also long-lasting effects over the life course. Cross-sectional and longitudinal studies from adolescence, early adulthood and later in life have shown consequences for a range of health outcomes, such as mental health, hypertension, self-rated health and mortality (Brydsten et al., 2015; Hammarström and Janlert, 2002; Strandh et al., 2014; McKee-Ryan et al., 2005; Paul and Moser, 2009). Moreover, as illustrated by the increasing evidence on neighbourhood effects on health, individual health is not only affected by one's individual life conditions but also by the context in which individuals live, interact and develop (Riva et al., 2007; Merlo, 2011; Root and Humphrey, 2014; Pickett and Pearl, 2001; Diez Roux and Mair, 2010; Bronfenbrenner, 1977). For example, in the case of unemployment, living in a neighbourhood with high levels of unemployment might affect residents' health, at least partially independent of their own labour market status (Pickett and Pearl, 2001; Mau et al., 2012; Milner et al., 2014). However, whether such neighbourhood unemployment is related to health across the life course is relatively unknown. This issue is what the present prospective study seeks to contribute to by examining the influence of neighbourhood unemployment across the life course and at specific life course periods on functional somatic symptoms.

Research theorising the relationship between health and place investigates how contextual factors "get under the skin" among residents in a neighbourhood (Daniel et al., 2008). This process is generally viewed as a complex interplay of factors at different levels of society (Elder Jr and Giele, 2009). In this study we have conceptualized the people-place interaction of unemployment as *embodied stress:* that is, how the societal context is biologically incorporated into the body, and thereby expressed as population patterns of health and disease. Experiencing unemployment is a stressful life event which affects health through financial deprivation and emotional strain such as worries about the future, re-employment, self-esteem and feeling of belonging (Giatti et al., 2010; Jahoda, 1981). At a neighbourhood level, the composition of one's own and other residents' unemployment within the neighbourhood may also influence health, operating through mechanism such as deprivation in infrastructure, educational and labour market opportunities, availability of healthy foods at affordable prices, increased stress and lack of social support (Pickett and Pearl, 2001; Giatti et al., 2010). This could be viewed as the collective burden of neighbourhood unemployment, where deprivation in the neighbourhood could increase individual strain, independent of a person's own labour market position. Altogether, these processes may shape the pathways of embodied stress and individual health (Elder Jr and Giele, 2009).

There is a well-established body of literature on the individual health risk of living in socioeconomic disadvantaged neighbourhoods (e.g. measured by occupational structure or household income), even

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when individual socioeconomic characteristics are accounted for (Riva et al., 2007; Pickett and Pearl, 2001; Murray et al., 2012). However, few studies have investigated the role of neighbourhood unemployment as a specific aspect of neighbourhood disadvantage. Longitudinal studies from Northern Europe and the US indicate that people living in neighbourhoods with a high proportion of unemployment have poorer self-rated health as well as an increased risk of cardiovascular disease, diabetes, and mortality (Müller et al., 2015; Stafford et al., 2004; Cummins et al., 2005; van Lenthe et al., 2005). A recent retrospective British study conducted by Murray and colleagues (2016) on the National Statistics Longitudinal Study showed that employed people (age 40+) living in a neighbourhood with high unemployment in 2001 were more likely to leave the workforce ten years later, even when individual health was accounted for. The authors identified high neighbourhood unemployment as one important predictor for preventing sick-leave or early retirement in the workforce (Murray et al., 2016). Similar findings were reported in a retrospective study based on the US Health and Retirement Study by Wright and colleagues (2013), studying the relationship between urban neighbourhood unemployment history and current mental health from middle age to old age. They concluded that early exposure to neighbourhood unemployment may have mental health consequences later in life; however, not due to accumulated ill-health but instead explained by an early effect on baseline emotional health (age 51–61) (Wight et al., 2013). Little is however known, about whether such a relationship is applicable in a Swedish setting, and among those in other phases of life where a person's own labour market position is vital. The lack of prospective studies further hampers any conclusions regarding the impact of neighbourhood unemployment across the life course.

From a Western European perspective, Sweden is a worker-friendly welfare state, characterised by high access to different labour market measures, active trade unions, and highly developed income protection buffering against moral stigmatisation and poverty (Thornqvist, 1999; Magnusson, 2007; Calmfors et al., 2002; Esping-Andersen, 1990). Sweden is also seen as a nation with a high focus on equity in health (Raphael, 2014). However, as seen in most western countries in recent decades, macroeconomic fluctuations, globalisation, and shifting ideologies have led to a general withdrawal of governmental involvement in benefits available for citizens (Raphael, 2014). The weakening of public programmes and benefits may make people in already disadvantaged positions become more dependent on their immediate social surroundings, such as social and material resources in the neighbourhood. One of the few Swedish studies that have investigated contextual and individual influences of unemployment on health suggests that high municipal vacancy rates improved mental health among unemployed, while no contextual health effect was found for municipal unemployment rate (Strandh et al., 2011). Two other Swedish studies did however find a relationship between neighbourhood unemployment and health status, even after taking individual employment status into account (Ohlander et al., 2006; Sundquist et al., 2006). However, none of these studies applied a longitudinal perspective, and they were thus unable to investigate whether this potential relationship is present across the life course, or to identify whether the relationship varies between particular periods of the life course (Merlo, 2011).

A recent longitudinal study conducted on the same cohort as the present study did find an independent contribution of overall neighbourhood disadvantage to the overall level of ill-health across the life course and at specific life course periods, taking individual disadvantages into account (Gustafsson and San Sebastian, 2014). Drawing on the findings of this study and the potential role of neighbourhood-level unemployment for individual health, the present study therefore moves further by asking whether neighbourhood unemployment, as a single aspect of neighbourhood disadvantage, may have an independent contribution to health across the life course and if so, how it plays out at specific periods of life, irrespective of individual unemployment. The specific aims are (i) to examine whether neighbourhood unemployment is related to overall health status across the life course independently of the individual employment position from adolescence to middle age (age 16–42); and (ii) to analyse whether this relationship is demonstrable in four specific life course periods (age 16, 21, 30 and 42) from adolescence to middle age. As health outcome, we studied self-reported functional somatic symptoms (FSS), e.g. bodily complaints of unclear aetiology, such as headaches, musculoskeletal pain, abdominal pain and dizziness (Eikelboom et al., 2016; Beck, 2008; Creed et al., 2012). FSS have been shown to be closely related to increased level of stress as well as mental health, life satisfaction and general health (Raphael, 2014; Creed et al., 2012; Haug et al., 2004; Campo, 2012; van Gils et al., 2014) but also to be influenced by the neighbourhood conditions where a person resided (Swartz et al., 1989).

2. Methods

2.1. Sample and data procedures

This 26-year longitudinal study follows all school leavers in an industrial town in northern Sweden. In four waves (at age 16 in 1981, 21 (1995), 30 (1995) and 42 (2007)) participants completed a comprehensive questionnaire regarding labour market, health and health behaviours, family and leisure time. At the last follow-up the response rate was 94.3% (n=1010) of those still alive of the original cohort (n=1071). A detailed description of the cohort, the data collection procedure and available measures is published elsewhere (Hammarström and Janlert, 2012).

For each cohort participant, neighbourhood measures were collected in accordance with Statistics Sweden's small-area market statistics (SAMS). SAMS is a small-scale geographic division constructed as polygons, using demographic distinctions (such as roads, buildings etc.) to demarcate neighbourhoods. In this study the SAMS areas were composed on 31 December in 1980, 1986, 1995 and 2007, consisting of at least one cohort member and on average 1000 individuals from the neighbourhood. Neighbourhood of residence was collected in 1980 for the 1981 measure point to take into account that many of the participants moved from their parental home when leaving compulsory school. The number of neighbourhoods increased from 72 in 1980 to 374 in 2007, due to the cohort members' moving pattern. Information on socioeconomic measures were retrieved from Statistics Sweden for all residents living in each area. A more detailed description of the data procedure is published elsewhere (Gustafsson and San Sebastian, 2014). The Regional Ethical Review Board in Umeå, Sweden, approved the data collection in this study.

2.2. Measures

Functional somatic symptoms (FSS) at age 16, 21, 30 and 42 were measured by ten items of self-reported physical symptoms in the borderline between soma and psyche (added to an index ranging 0–20) (Haug et al., 2004; Zijlema et al., 2013). Occurrence of eight of the symptoms during the last 12 months (headache/migraine, stomach ache, nausea, backache/hip pain/sciatica, fatigue, breathlessness, dizziness, overstrain) were asked for and answered as 'no', 'yes, light' or 'yes, severe'. The last two symptoms, palpitations and sleeping difficulties, were asked for and answered as 'never', 'sometimes' or 'often/always' (Cronbach's alpha was 0.699 at age 16, 0.698 at age 21, 0.737 at age 30, 0.782 at age 43) (Hammarström et al., 2016). FSS have shown to be present across the life course and increase with age (Haug et al., 2004). A recent systematic review concluded that few of the patients diagnosed with FSS had underlying somatic diseases (Eikelboom et al., 2016). FSS were used as separate measures at each age and as a time-varying measure.

The variable of neighbourhood unemployment was constructed as the proportion of non-employment in the working-age population (age 18–64) within a neighbourhood, based on register data of annual

income from different sources such as tax-based income and different types of welfare benefits. The register data was retrieved for all residents in the neighbourhood in 1981, 1986, 1995 and 2007, and classified into mutually exclusive categories (Gustafsson and San Sebastian, 2014). The conceptualisation of unemployment was lack of paid work, with the operational definition as having the main source of annual income from sources such as unemployment benefits, health-related benefits and early retirement. The variable was constructed for each wave and as a time-varying measure across all waves (Gustafsson and San Sebastian, 2014).

Individual unemployment was based on self-reported questionnaire data regarding participants' labour market position each spring and autumn at age 21, 30 and 42. For each age, a dichotomous occupational status variable was created, including people outside the labour market due to unemployment, labour market measures and sick leave (henceforth referred to as *unemployed*) and those with employment (including military service, parental leave, entrepreneur, education and other) during the last 12 months. At age 16, participants were still in compulsory school, and therefore participants' report of parents' unemployment was used as a proxy for individual unemployment. Parental unemployment was viewed as a social and material indictor of position in the social hierarchy influencing current and prospective position in the labour market (Beller and Hout, 2006). The variable was dichotomised into father and/or mother not employed (including sick leave, stay-at-home parent, early retirement or retirement and out of the labour market) and parents in employment. Individual unemployment was used as a separate measure at each age and as a time-varying measure.

Covariates included in the analysis were gender, education, socioeconomic status and social adversity, all measured by self-reported questions. *Gender* was measured at age 16 as women (reference category) and men. *Education* was measured at each age (age 21, 30 and 42) as compulsory school, upper secondary education and higher education (with higher education as reference). At the first follow-up all participants were in their 9th and final year of compulsory school. *Socioeconomic status* (SES) was measured at age 21, 30 and 42, as individual occupation and coded in accordance with Statistics Sweden's socioeconomic classification system (Statistic Sweden, 1984). The variable was dichotomised into manual workers and non-manual worker/self-employed (reference). At age 42, participants who did not have a current occupational title were asked to report their latest occupation (45 individuals classed as non-manual workers and 67 as manual workers). At age 21 and 30, the highest education was used as a proxy for SES. Three years' upper secondary education or higher education was recoded into non-manual worker (6 and 5 individuals respectively at age 21 and 30), while 2 years' upper secondary education or less was recoded into manual workers (10 and 2 individuals respectively at age 21 and 30). At age 16, parental occupational status was used, dichotomised into both parents manual workers and at least one parent in higher occupational groups (reference). *Social adversity* was constructed as an index of different age-relevant self-reported questions about the participants' social surroundings. The majority of the items had binary response options and the items with multiple response options were dichotomised (80th percentile). All items were added into indexes for each age. Social adversity at age 16 included *parental loss* (either single parents, parental separation or death), *residential instability* (number of times moving), *parental illness* (at least one parent having mental illness, physical illness and/or alcohol or drug problems). At age 21, *residential instability*, *illness* and *death* close to the participant were included. At age 30 and 42, *illness* and *death*, own *separation* (break-up from a long-term cohabitation), *social isolation*, low *decision latitude* (skill discretion and authority), *threats/violence* (verbal or physical abuse including sexual harassment and insinuations in the last 12 months) were included. A more detailed description of the items at different ages and the indexes has been published elsewhere (Gustafsson et al., 2012). All variables used, except for gender, were time-varying over the survey years. Time was constructed as a time-varying variable accounting for the time between data collections (i.e. time point 0 at age 16, 5 at age 21, 14 at age 30 and 27 at age 42) (Hox et al., 2010).

2.3. Analysis

Hierarchical linear regression was applied, taking into account the correlation between different levels, with time nested within individuals, nested within neighbourhoods. By adding a random part in the analysis the technique accounts for the dependence between different levels, allowing the intercept coefficients to vary between different neighbourhoods. Variance partition coefficient (VPC) was used to estimate the proportion of total variance in FSS attributed to the neighbourhood, and deviance information criterion (Bayesian DIC) for the model fitting (lowest numbers preferred) were calculated.

The analysis was carried out in two steps. First, a longitudinal analysis of the general impact across the life course and then narrowing it down to a series of cross-sectional analyses for each period (16, 21, 30 and 42). The longitudinal analysis was performed (corresponding to the first aim) with time (at level 1), individuals (at level 2) and neighbourhood (at level 3). Five models were run, where the cumulative measure of FSS was regressed on neighbourhoods in the empty model (Model 0), adjusted for time (Model 1), time and neighbourhood unemployment (Model 2), time and individual unemployment (Model 3) and, finally, a full model including all individual and neighbourhood variables (Model 4). The four cross-sectional analyses were run (corresponding to the second aim) with individuals (at level 1) and neighbourhoods (at level 2), separately at age 16, 21, 30 and 42. Four models were run at each age: an empty model with FSS regressed on neighbourhoods (Model 0), adjusted for neighbourhood unemployment (Model 1), individual unemployment (Model 2) and with all individual covariates included (Model 3). Stratification by gender (data not in table) showed similar patterns to those in the total sample, and therefore only the gender-collapsed findings are reported in the results section. The approach of combining longitudinal and cross-sectional analysis allowed us to study the overall relationship between the collective neighbourhood unemployment and individual FSS across the life course, and to narrow it down to specific life course periods to further identify whether the potential relationship of current neighbourhood unemployment and individual FSS at specific periods of life. Due to missing data on particular variables the effective sample size varied. In the longitudinal analysis the sample was n=987, in the cross-sectional analyses n=992 at age 16, n=996 at age 21, n=902 at age 30 and n=986 at age 42. No systematic pattern was found in the missing values.

All analyses were performed in SPSS 22 and STATA 13. Bayesian modelling was applied using Markov Chain Monte Carlo (MCMC) with support of MLwiN software to generate interval estimates for the regression coefficients (Browne, 2009). A strength of the MCMC method is the reliable estimates for small samples (Mau et al., 2012). Coefficients together with their 95% credible intervals (CrI) are reported. Interaction term between neighbourhood and individual unemployment was tested but without fruitful modifications to the results (data not shown).

3. Results

Descriptive statistics across all ages are presented in Table 1 with bivariate correlation of individual-level variables and concurrent FSS for each age (at age 16, 21, 30 and 42). On all four occasions, participants reported relatively low levels of FSS, gradually increasing from young adulthood to mid-life. High education, high socioeconomic status and low social adversity were related to lower levels of FSS. The highest level of neighbourhood unemployment was found at age 30 (average 12.87% of the working age population) compared to age 16

Table 1
Descriptive statistics and bivariate correlation (Pearson's r) with individual level variables and concurrent functional somatic symptoms at age 16, 21, 30 and 42.

	Age 16 (n=992)		**Age 21** (n=966)		**Age 30** (n=902)		**Age 42** (n=986)	
	Descriptive	r[a]	Descriptive	r[a]	Descriptive	r[a]	Descriptive	r[a]
Health outcome								
Functional somatic symptoms, mean (SD)	3.35 (2.54)	–	2.82 (2.51)	–	3.73 (2.93)	–	4.24 (3.31)	–
Neighbourhood variable								
Unemployment in the neighbourhood (%), mean (SD)	7.01 (3.16)	–	6.69 (2.75)	–	12.87(4.89)	–	7.47 (3.88)	–
Individual variables								
Occupational status, n (%) unemployed	305[b] (30.6)	0.02	378 (38.0)	0.12[c]	175 (17.5)	0.12[c]	129 (12.9)	0.19[c]
Gender, n (%) men	519 (51.9)	−0.13[c]	519 (51.9)	−0.14[c]	519 (51.9)	−0.12[c]	519 (51.9)	−0.15[c]
Education, n (%)								
Compulsory school (reference)	–	–	160 (16.1)	0.18[c]	97 (10.0)	0.09[c]	85 (8.6)	0.10[c]
Upper secondary education	–	–	524 (52.6)	−0.06[c]	522 (53.8)	0.05	454 (46.0)	0.03
Higher education	–	–	312 (31.3)	−0.08[c]	351 (36.2)	−0.11[c]	448 (45.4)	−0.08[c]
Socioeconomic status, n (%) manual worker	377 (38.0)	0.17[c]	623 (63.1)	0.18[c]	425 (43.4)	0.22[c]	349 (34.9)	0.33[c]
Social adversity, mean (SD)	0.73 (0.81)	0.04	0.76 (0.85)	0.10[c]	0.97 (0.99)	0.13[c]	1.64 (1.26)	0.13[c]

Numbers of neighbourhoods n=72 (age 16), n=215 (age 21), n=333 (age 30) and n=374 (age 42)
[a] Chi-square,
[b] At age 16, parents occupational status has been used as a proxy for individual occupational status
[c] $p < 0.05$,

(7.01%), 21 (6.69%) and 42 (7.47%). The distribution of neighbourhood unemployment at age 30 also distinguished itself from other periods by displaying generally higher unemployment among all neighbourhoods (range 2.96–26.80% at age 30 compared to 2.07–15.07% at age 16, 0–13.82% at age 21 and 0–20.22% at age 42). Individual unemployment decreased successively from young adulthood (at age 21, 64%) to mid-life (at age 42, 10.5%).

Results corresponding to the first aim, which concerns the neighbourhood unemployment and FSS across the life course, are shown in Table 2. Random effects in the initial empty model showed that approximately 43% of the average variation in FSS is attributed to the clustering by individuals over time, while 1% is attributed to the clustering by neighbourhoods over the life course. In the fixed effects part of the table (Models 1–4), time estimate and neighbourhood unemployment showed a significant association with FSS, i.e. individuals who lived in neighbourhood environments with high unemployment reported on average worse health than did people in lower-unemployment neighbourhoods. This pattern remained when adjusting for individual unemployment and other individual-level covariates. In the full model, neighbourhood unemployment (β=0.04; 95% CrI 0.02–0.06) and individual unemployment (β=0.26; 95% CrI 0.05–0.45) were significantly related to FSS. In sum, the longitudinal analysis showed that the composition of residents' labour market position was related to health across the life course, above and beyond individuals´ own unemployment.

The second aim, addressing the age-specific cross-sectional analysis of the relationship between neighbourhood unemployment and FSS, is shown in Tables 3–6. The explained variance by neighbourhood clustering was 1% at age 16, 0% at age 21, 0% at age 30 and 5% at age 42. In the fixed effects of the tables, neighbourhood unemployment in adolescence (age 16) was not related to FSS in the crude or adjusted model (Models 1–2), but negatively related to FSS after adjustment for individual-level predictors (Model 3). A different pattern was found in young adulthood (age 21) and middle age (age 42), where a positive relationship between neighbourhood unemployment and FSS was observed in both crude and adjusted analysis for individual unemployment (Models 1–2), although the significance disappeared when all individual-level predictors were considered (Model 3). In contrast, in adulthood (age 30), neighbourhood unemployment was related to FSS across all models (Models 1–3) (β=0.05; 95% CrI 0.01–0.09). Individual unemployment (Models 2–3, Tables 3–6) showed a positive association of FSS at age 21, 30 and 42 but was insignificant at age 16. In sum, with the cross-sectional analysis the relative importance of different contexts was identified across four specific periods of life, suggesting that adulthood (age 30) may be one of the predominant periods across the life course in the association of neighbourhood unemployment and FSS.

Table 2:
Three-level hierarchical linear regression on functional somatic symptoms with time nested within individuals nested within neighbourhoods (95% Crl).

Estimates	**Model 0**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
β coefficient	3.57 (3.47–3.68)	3.10 (2.95–3.24)	2.78 (2.57–2.99)	2.61 (2.39–2.85)	2.99 (2.73–3.24)
Time		0.04 (0.03–0.05)	0.04 (0.03–0.05)	0.04 (0.03–0.05)	0.05 (0.03–0.06)
Area level					
Neighbourhood unemployment			0.04 (0.02–0.06)	0.04 (0.02–0.06)	0.04 (0.02–0.06)
Individual level fixed effects[a]					
Unemployment				0.47(0.25–0.67)	0.26 (0.05–0.46)
Gender					−0.78 (−0.97 – −0.60)
Education					−0.34 (−0.43 – −0.25)
Social adversity					0.53 (0.45–0.62)
Socioeconomic status					0.20 (0.01–0.39)
Random effects					
Area level variance	0.04	0.04	0.01	0.01	0.02
Individual level variance	3.62	3.51	3.46	3.36	2.84
Time level variance	4.71	4.63	4.62	4.67	4.52
VPC area	1%	1%	0%	0%	0%
VPC individual	43%	43%	43%	42%	39%
VPC time	56%	57%	57%	58%	61%
Bayesian DIC	18283.59	18209.60	18119.46	18128.88	17675.40

[a] reference categories: employed, women, compulsory education, non-manual workers

Table 3:
Two-level hierarchical linear regression in adolescence (age 16) on functional somatic symptoms with individuals nested within neighbourhoods (95% Crl).

	Model 0	Model 1	Model 2	Model 3
Estimates				
β coefficient	3.35 (3.17–3.53)	3.57 (3.12–4.02)	3.55 (3.09–4.00)	4.38 (3.73–5.06)
Area level				
Neighbourhood unemployment		−0.03 (−0.09–0.03)	−0.03 (−0.09–0.02)	−0.06 (−0.12 – −0.00)
Individual level fixed effects[a]				
Unemployment			0.16 (−0.18–0.50)	−0.01 (−0.36–0.34)
Gender				−0.71 (−1.02 – −0.39)
Social adversity				0.54 (0.35–0.74)
Socioeconomic status				0.24 (−0.11–0.60)
Random effects				
Area level variance	0.08	0.10	0.09	0.07
Individual level variance	6.39	6.38	6.38	6.12
VPC	0.01	0.02	0.01	0.01
Bayesian DIC	4665.08	4665.96	4667.15	4603.05

Model 0: FSS regressed on neighbourhoods; Model 1: model 0+ neighbourhood unemployment; Model 2: model 1+ individual unemployment; Model 3: model 2+ individual covariates
[a] reference categories: employed, women, compulsory education, non-manual workers

4. Discussion

This prospective study sought to contribute to the field of unemployment and health, by analysing the contextual influence of neighbourhood unemployment on individual functional somatic symptoms (FSS) across three decades as well as in four specific life course periods, taking individual unemployment into account. Our findings suggest that the proportion of residents with unemployment in the neighbourhood has a general impact on individuals FSS across the life course, regardless of a person's own unemployment experience. When narrowed down to specific life course periods, the relative importance of neighbourhood unemployment was shown to be predominant in adulthood (age 30). These findings stress the contextual importance of neighbourhood unemployment for current health status as well as development of health status across the life course.

To the best of our knowledge this is the first prospective study of its kind examining the influence of neighbourhood and individual unemployment on health status in a life course perspective. Our longitudinal findings suggest that high neighbourhood unemployment predicts higher levels of overall individual FSS, independently of factors such as one's own labour market position, socioeconomic status and level of education. The findings may be seen as embodied stress across time, expressed in health differentials, indirectly through residents' unemployment (Daniel et al., 2008), or viewed the as individual strain of the collective burden of the neighbourhood. In accordance with the relatively small effects generally found within the field of neighbourhoods and health (Pickett and Pearl, 2001; Cummins et al., 2007), our findings showed a modest but significant association. However, even small statistical effects may have a large population impact, such as in planning and evaluating public health interventions and policies (Merlo, 2011). Significant associations between neighbourhood unemployment and health status were also found by Murray (2016), Wright (2013) and Müller (2015) and colleagues' retrospective studies among middle-aged up to old-aged individuals. This indicates that neighbourhood unemployment may be one among other potential factors predicting individual FSS.

Contrary to our findings, the cross-sectional study by Strandh and colleges (2011) of municipal unemployment rates and mental health among the unemployed in a Swedish setting discovered that high municipal unemployment rates were related to better health, regardless of individual labour market position. It is possible that municipal unemployment rate does not capture the same phenomenon of individuals' everyday environment as neighbourhoods. In fact, previous research has shown a paradox, where high national and municipal rates have shown to be health-protective factors (Stuckler et al., 2015; Janlert, 2009) while individual unemployment and local neighbourhood unemployment may be related to ill-health (Brydsten et al., 2015; Tapia Granados et al., 2014). This is also referred to as the theory of social norm of unemployment, where individual deviation from the social norm of employment becomes smaller in high national

Table 4:
Two-level hierarchical linear regression in young adulthood (age 21) on functional somatic symptoms with individuals nested within neighbourhoods (95% Crl).

	Model 0	**Model 1**	**Model 2**	**Model 3**
Estimates				
β coefficient	2.81 (2.66–2.98)	2.38 (1.95–2.81)	2.21 (1.77–2.65)	3.52 (2.65–4.38)
Area level				
Neighbourhood unemployment		0.07 (0.01–0.13)	0.06 (0.00–0.12)	0.04 (−0.02–0.10)
Individual level fixed effects[a]				
Unemployment			0.60 (0.27–0.93)	0.28 (0.05–0.62)
Gender				−0.57 (−0.86 – −0.26)
Education				
Upper secondary education				−0.88(−1.35 – −0.41)
Higher education				−0.80(−1.34 – −0.24)
Social adversity				0.41 (0.22–0.59)
Socioeconomic status				0.36 (−0.02–0.74)
Random effects				
Area level variance	0.01	0.02	0.02	0.03
Individual level variance	6.29	6.24	6.16	5.84
VPC	0.00	0.00	0.00	0.01
Bayesian DIC	4521.48	4477.49	4466.60	4385.62

Model 0: FSS regressed on neighbourhoods; Model 1: model 0+ neighbourhood unemployment; Model 2: model 1+ individual unemployment; Model 3: model 2+ individual covariates
[a] reference categories: employed, women, compulsory education, non-manual workers

Table 5:
Two-level hierarchical linear regression in adulthood (age 30) on functional somatic symptoms with individuals nested within neighbourhoods (95% Crl).

	Model 0	Model 1	Model 2	Model 3
Estimates				
β coefficient	3.73 (3.53–3.92)	2.75 (2.21–3.31)	2.69 (2.14–3.24)	3.73 (2.67–4.81)
Area level				
Neighbourhood unemployment		0.07 (0.03–0.11)	0.07 (0.03–0.11)	0.05 (0.01–0.10)
Individual level fixed effects[a]				
Unemployment			0.81 (0.30–1.33)	0.64 (0.11–1.14)
Gender				−0.74 (−1.11 – −0.35)
Education				
Upper secondary education				−0.19 (−0.85–0.48)
Higher education				−0.48 (−1.24–0.29)
Social adversity				0.49 (0.28–0.68)
Socioeconomic status				0.27 (−0.17–0.69)
Random effects				
Area level variance	0.03	0.05	0.04	0.03
Individual level variance	8.57	8.40	8.33	7.89
VPC	0.00	0.01	0.00	0.00
Bayesian DIC	4501.08	4466.82	4459.23	4287.45

Model 0: FSS regressed on neighbourhoods; Model 1: model 0+ neighbourhood unemployment; Model 2: model 1+ individual unemployment; Model 3: model 2+ individual covariates
[a] reference categories: employed, women, compulsory education, non-manual workers

or regional unemployment, while local unemployment may affect a person's perception of their own job insecurity (Clark et al., 2010).

In this study we also investigate the current exposure of neighbourhood unemployment and FSS cross-sectionally at four specific life course periods, to further see whether the association was restricted to specific periods across the life course. The patterns indicated that neighbourhood unemployment and individual unemployment at adulthood (age 30) have an independent contribution to FSS regardless of individual characteristics, but not in the other life course periods (age 16, 21 and 42). Our results could reflect an age-specific phase, characterised by relatively stable labour market attachment and family formation (Green, 2014). However, it may also reflect the macroeconomic shift in the Swedish labour market, from a nation of low unemployment in the 1980s to a nation of relatively high unemployment in the 1990s (Statistic Sweden, 1997; Bengtsson, 2012). When participants in this study were in their thirties (during the 1990s recession) national unemployment levels rose dramatically (the national unemployment rate was 7.7% in the 1980s, increasing to 13.8% in the 1990s) (Statistic Sweden, 2005). In our findings this pattern may be viewed in the high neighbourhood-level and low individual-level health implications during high national unemployment rate (at age 30), compared to the opposite pattern during the time of lower national unemployment rate (at age 21 and 42). Similar findings have been found in a Finnish study of national unemployment rate and mortality (Martikainen and Valkonen, 1996). At an individual level, this variation may be explained by less stigmatisation, isolation and stress related to the individual unemployment when the experience is shared with others (Daniel et al., 2008). The absence of neighbourhood-level association at age 16, 21 and 42 may also be related to lack of statistical power due to overall low levels of unemployment and small variation at the neighbourhood level. Therefore, the general pattern of the age-specific findings should be interpreted with caution.

The main strength of the study is the rich data; a 26-year long cohort study with comprehensive questionnaire data across five waves, high response rate and complementary area-level register data from Statistics Sweden. This dataset enables access to individuals who typically do not participate in self-reported studies, e.g. individuals without a job, in social isolation or poverty, or those suffering from mental illness. Therefore, we assume a lower risk of selection bias in our sample compared to other cohorts. The cohort is comparable to the Swedish population with regard to demographics, socioeconomics and illness, but shows higher youth unemployment during that time (Hammarström, 1986; Hammarström and Janlert, 2012). We also note limitations in this study. By using single measurement points for

Table 6:
Two-level hierarchical linear regression in middle age (age 42) on functional somatic symptoms with individuals nested within neighbourhoods (95% Crl).

	Model 0	Model 1	Model 2	Model 3
Estimates				
β coefficient	4.26 (4.02–4.50)	3.65 (3.14–4.14)	3.59 (3.13–4.05)	4.63 (3.51–5.72)
Area level				
Neighbourhood unemployment		0.08 (0.02–0.14)	0.06 (0.00–0.11)	0.02 (−0.04–0.07)
Individual level fixed effects[a]				
Unemployment			1.77(1.17–2.36)	1.00 (0.40–1.58)
Gender				−1.00 (−1.39 – −0.61)
Education				
Upper secondary education				−0.28 (−0.98–0.44)
Higher education				−0.55 (−1.31–0.22)
Social adversity				0.71 (0.55–0.87)
Socioeconomic status				−0.22 (−0.26–0.69)
Random effects				
Area level variance	0.55	0.32	0.10	0.16
Individual level variance	10.45	10.47	10.35	9.19
VPC	0.05	0.03	0.01	0.02
Bayesian DIC	5150.58	5118.63	5092.57	4921.42

Model 0: FSS regressed on neighbourhoods; Model 1: model 0+ neighbourhood unemployment; Model 2: model 1+ individual unemployment; Model 3: model 2+ individual covariates
[a] reference categories: employed, women, compulsory education, non-manual workers

each neighbourhood wave (Cummins et al., 2007), we were not able to account for variation within the neighbourhoods. This might explain some part of the generally low variation attribution to neighbourhoods. Social selection related to neighbourhoods might also be a limitation where the moving pattern relates to the unemployment climate in the neighbourhood, predisposing individuals to ill-health gains or deficits. However, a previous US study on self-selection bias in studies on neighbourhood and health concluded that residential self-selection plays only a small and inconsistent role in biasing neighbourhood and health (James et al., 2015). Similar findings were found in a study of residential selection across time based on the same cohort as the present study, concluding that neighbourhood context in mid-life is partially rooted in early life selection factors (Gustafsson et al., 2013). Additionally, Sweden has a generally low level of segregation, particularly during the 1980s and 1990s in Northern Sweden. There may, however, be limits in the comparability between waves due to the different age-specific circumstances, such as the items included in the social adversity index, available education and different response options for individual unemployment. Furthermore, the operationalisation of neighbourhood and individual unemployment used in this study may contain a heterogeneous group, ranging from those actively looking for a job to those with early retirement or long-term sick leave. This may have implications for comparability to other studies with narrower definitions of unemployment. However, due to the frequent change in unemployment and non-employment classification across time and between countries, comparability is constantly a difficult issue (Erlinghagen and Knuth, 2010). Functional somatic symptoms were measured and operationalised identically in each wave and have shown to be stable over time (Hammarström et al., 2016).

5. Conclusion

This prospective study analysed the relative influence of contextual unemployment in the neighbourhood on individual functional somatic symptoms, first by longitudinally examining the general impact across the life course and then narrowing it down to specific contextual exposures in four different periods of life. A small clustering by neighbourhood unemployment was found, implying that interventions at a neighbourhood level may be one factor, of potentially several other factors, important for reducing FSS. Even though individual unemployment may still be the most prominent factor for individual health status, our findings emphasise the independent relationship of neighbourhood unemployment and FSS across the life course, stressing the importance of further investigating the potential health implications of neighbourhood unemployment parallel to individual unemployment.

Conflicts of interest

The authors declare that there is no conflict of interest.

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