No man is an island: social resources, stress and mental health at mid-life

Rukmen Sehmi PhD,
Post-doctoral researcher; Social, Genetic and Developmental Psychiatry, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom.

Barbara Maughan PhD,
Professor of Developmental Epidemiology; Social, Genetic and Developmental Psychiatry, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom.

Timothy Matthews PhD,
Post-doctoral researcher; Social, Genetic and Developmental Psychiatry, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom.

Louise Arseneault PhD,
Professor of Developmental Psychology; Social, Genetic and Developmental Psychiatry, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom.

Word count: 3840
Abstract: 255

Correspondence concerning this article should be addressed to Louise Arseneault, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London SE5 8AF, UK. Phone: (44)-(0)207-8484-0647. E-mail: louise.arseneault@kcl.ac.uk.

Abstract

Background: Positive social relationships are known to mitigate the negative effects of stress on mental health. However, the direction of association between social resources and mental health remains unclear, and it is not known whether higher than average levels of social resources confer additional benefits, in the short- and longer-term.

Aims: To investigate the concurrent and longitudinal contribution of higher levels of social resources in reducing the risk of mental health symptoms after exposure to stress at age 45, and to identify life-course precursors of mid-life social resources.

Method: The National Child Development Study (NCDS) is a prospective birth cohort of over 17,000 births in 1958. We tested concurrent and longitudinal associations between different levels of social resources at age 45 and mental health symptoms amongst individuals exposed to stress and verified whether prior mental health symptoms (age 42) explained these associations. We also tested a range of child, family and adult precursors of mid-life social resources.

Results: Higher than average levels of social resources were required to confer benefits to mental health amongst individuals exposed to high stress levels, both concurrently at age 45 and in the longer-term at age 50. In general, these associations were not attributable to prior mental health symptoms. Key predictors of mid-life social resources included evidence of early sociability.

Conclusions: Having a broad network of social ties and better personal support helps individuals withstand exposure to higher levels of stress. Given that sociable children had better mid-life social resources, early intervention may benefit individuals' social resources later in life.

Declaration of interest: None.

Keywords social support, stress, mental health, NCDS.

Introduction

Adverse life events are among the best-known risk factors for common mental health problems across the life course[1-2]. Positive social relationships may mitigate such adverse effects by providing networks of social ties and sources of emotional, informational and practical support[3]. However, some key issues remain to be clarified. First, although the majority of adults have some positive social relationships in their lives, it is unclear whether higher levels of personal support, including both qualitative and structural aspects of social relationships, confer additional benefits especially perhaps in the face of higher levels of stress. Such effects have been found for other health-promoting factors, for example, engaging in higher levels of physical activity provides additional benefits to health[4]; we hypothesized that similar processes operate in relation to a combination of quality and the extent of individuals' social relationships, which we label here *social resources*. Second, current evidence rests heavily on cross-sectional studies, where the direction of association is uncertain[5]: mental health problems may impact the social resources available to individuals, as well as the reverse. Third, although child and adolescent precursors of social resources in earlier adulthood have been identified[6-7], little is known about whether they remain important at mid-life. Long-term longitudinal studies are needed to shed light on these issues and derive pointers for interventions. In this study, we used data from a prospective national birth cohort to investigate whether higher than average levels of adult social resources confer additional benefits to mental health among individuals experiencing stressful life events. Specifically, we examined the concurrent association between variation in social resources and affective symptoms at age 45. We further investigated prospective associations between resources at age 45 and psychological distress at age 50. In both cases, we took account of variations in prior psychological distress to clarify the direction of associations. Finally, we used follow-back analyses to explore child, adolescent and early adult precursors of higher than average social resources at mid-life.

Method

Participants

Participants were from the National Child Development Study, which surveyed 18,558 babies born in one week in 1958 (98% of live births) in England, Scotland, and Wales[8]. Subsequent sweeps took place when participants were ages 7, 11 and 16 during childhood, and throughout adulthood at ages 23, 33, 42, 45, 50 and 55. At age 45, a subsample of over 9,000 participants took part in a survey designed to provide more objective measures of biomedical risk, from which several of this study's measures were derived. We drew on data from the childhood, adolescent, age 42 and age 50 sweeps (accessed adhering to the terms of the Economic and Social Data Service [ESDS] End User License [EUL] agreement), and the age 45 biomedical sweep, which had more stringent access requirements covered by a 'special licence' in order to meet the more stringent access requirements.

Measures

Social resources

There is considerable variation in how social resources are conceptualised and measured across studies[9]. By drawing on the Close Persons Questionnaire[10] and the Berkman-Syme Social Network Index[11,] we chose to incorporate both structural and qualitative aspects of a person's social resources. At age 45, the Close Persons Questionnaire was used to assess the quality of personal support received from the individual reported as being closest to the participant during the previous 12-month period. In most cases, this person was a spouse (79.7%), followed by a parent (3.8%), an offspring (3.6%), or a sibling (3.3%). The questionnaire captures three main constructs of social support: confiding/emotional (e.g. 'In the last 12 months, could you rely on this person when needed?'), practical (e.g. 'In the last 12 months, did this person give you help with small things when needed?'), and negative (e.g. In the last 12 months, did talking to this person make things worse?). Items assessing negative aspects of social support were reverse-coded to ensure higher scores represented more positive support. A selection of items from the Berkman-Syme Social Network Index were also included to assess the structural aspects of a person's social resources. The measure assessed the number of social ties, and the frequency of contact with family, friends and acquaintances outside the household, as well as the degree of participation in social, recreational, or political groups.

A summed score of items from both measures included confiding/emotional, practical and reverse-coded negative items assessing personal support received by the individual, along with items assessing their wider social network, to create an overall indicator of social resources (M = 49.27, SD = 8.51, range 13-70). Higher scores represent better quality support, as well as a greater number and more frequent contact with social ties. The reliability of the scale was $\alpha = 0.80$. To facilitate comparisons among individuals with differing levels of social resources, we trichotomised the index[12-13] to identify those with poor (bottom 25%, range = 13 - 44), typical (middle 50%, range = 45 - 55) and rich (top 25%, range = 55.5 - 70) resources. People with typical social resources had some contact with a wider network of social ties and received good personal support. We refer to those in the upper quarter of the distribution as having 'rich' social resources as they represent individuals who had more frequent contact with a larger network and received better quality support than those with typical resources. We refer to those in the bottom quarter of the distribution as having 'poor' social resources, as they had relatively less contact with a smaller network and received poorer quality support than those with typical resources.

Men and women were equally likely to have rich resources (OR = 1.05, 95% CI 0.90 - 1.22, p>0.05). We did not find significant interactions between gender and social resources in association with affective symptoms at age 45 ($\chi^2 = 2.29$, p>0.05) and psychological distress at age 50 ($\chi^2 = 0.79$, p>0.05). Therefore, we presented findings for men and women combined.

Stressful life events

Stressful life events experienced in the last 6 months were self-reported at age 45, including events concerning health (e.g. Have you yourself suffered serious illness, injury or assault?), employment (e.g. Were you sacked from your job?), criminality (e.g. Have you had problems with police and a court appearance?), partnerships (e.g. have you broken off a steady relationship?), and other relationships (e.g. has a close family friend or another relative died?). Nearly half of the total sample reported no exposure to adverse events in the past six months, 41.3% reported experiencing one or two, and 13.4% had experienced 3 or more.

Mental health symptoms

Affective symptoms were assessed at age 45 using the Clinical Interview Schedule-Revised (CIS-R), a validated measure designed to identify common mental disorders using structured interviews[14]. A shortened version of the CIS-R was administered in this sample, focusing on

symptoms of anxiety and depression experienced in the past week. *Psychological distress* was assessed at age 42 and at the age 50 follow-ups using a 9-item version of the Malaise Inventory[15]; this commonly used, self-reported screening tool has robust psychometric properties in this sample[16].

Precursors

A comprehensive range of child, family and adult factors were examined as potential precursors of social resources at mid-life are listed and described in supplementary Table 1.

Statistical analyses

We tested the association between different levels of social resources and mental health symptoms amongst 4,997 participants who reported exposure to either 1 or 2 stressful life events, or 3 or more. We used negative binomial regressions to account for the overdispersed distribution of the outcome measures. First, we examined concurrent associations by comparing levels of affective symptoms at age 45 between individuals with typical and rich levels of social resources with people with poor levels. We made a further comparison between individuals with typical and rich levels of resources. Second, we tested longitudinal associations between different levels of social resources and psychological distress at age 50. We further adjusted for variations in prior mental health symptoms to shed light on the direction of association between social resources and mental health symptoms at ages 45 and 50. Third, we conducted multinomial logistic regression analyses to examine a range of potential child, family and adult precursors among the full range of participants with available data on social resources at mid-life (N=8,507). We aimed to identify domains of precursors that were associated with an increased likelihood of having rich resources, compared to typical levels, whilst also reducing the risk of having poor resources. We examined each domain separately by conducting a series of bivariate analyses with each variable. In a last step, we repeated the initial analyses looking at social resources and mental health outcomes adding controls for the significant precursors of social resources. We adjusted all analyses for gender and social class at age 42 (i.e., professional, managerial and technical, skilled non-manual, skilled manual, partly-skilled and unskilled occupation) to account for differences in mental health symptoms experienced by men and women, and across varying levels of social class. STATA V.15.0 was used for all analyses[17].

Attrition

Sample retention rates were high in childhood[7], but fell during adulthood. Data were available on 53% of participants at age 50 (9788/18,558). We used logistic regression analyses to predict availability of complete data at mid-life; data availability was unrelated to exposure to stress and social resources at mid-life, but was predicted by male gender, low parental social class and lower child reading scores. We created outcome-specific inverse probability weights[18] using the variables listed above, in order to take some account of bias associated with missingness. We used these weights in all analyses.

Results

As expected, levels of affective symptoms increased with greater exposure to stressful life events (Table 1). Higher levels of social resources were associated with lower levels of prior and subsequent psychological distress, and with lower levels of contemporaneous affective symptoms. Social resources were not associated with stressful life events.

Benefits of rich social resources on concurrent affective symptoms

Individuals with higher levels of social resources had lower levels of affective symptoms than those with poorer resources (see top panel of Figure 1). Amongst individuals exposed to 1 or 2 stressful life events, having either rich or typical levels of social resources was associated with a reduction in affective symptoms at age 45, compared to having poor resources (see supplementary table 2). Rich resources did not confer any additional benefits by contrast with typical levels. However, amongst individuals exposed to 3 or more stressors, only rich social resources conferred benefits in terms of symptom levels: individuals with typical and poor resources had similar high levels of symptoms, whereas it was only those with rich resources that had lower levels in this group.

Benefits of rich social resources on subsequent psychological distress

To assess whether the beneficial effects of rich social resources persisted over time, we examined levels of psychological distress five years after individuals were exposed to stress. The findings followed a similar pattern to those of the concurrent analyses. Amongst individuals who were previously exposed to 1 or 2 stressful life events, both rich and typical levels of social resources were associated with lower levels of psychological distress; rich resources did not confer any additional benefits (see bottom panel of Figure 1). However, amongst individuals previously exposed to 3 or more stressful life events, once again it was only those people with rich social resources who showed evidence of benefits: individuals

with typical and poor resources had similar high levels of symptoms, whereas lower levels of psychological distress were only observed amongst those with rich resources.

Effects of accounting for prior psychological distress

We further tested whether the benefits conferred by rich social resources remained after adjusting for variations in individuals' prior psychological distress assessed at age 42 (see supplementary Table 2). The benefits associated with having rich resources were reduced but remained. Overall, findings show that social resources reduced the risk of both concurrent and later symptoms, even for those who experienced prior psychological distress.

Life-course precursors of rich social resources

Our analyses identified precursors of rich mid-life social resources across development; they included greater sociability in childhood (e.g., seeing friends outside school) and in adolescence (e.g., going to discos or parties), as well as better quality social resources earlier in adult life (e.g., confiding relationships) (see Table 2). We tested the extent to which the effect of social resources on mid-life outcomes was attributable to these earlier precursors, focusing in particular on developmental indicators of sociability in childhood and adolescence (Table 3). Associations between social resources and measures of affective symptoms at mid-life became non-significant after adjusting for earlier sociability (i.e., seeing friends outside school in childhood, going to discos or parties during adolescence, and confiding relationships in adult life); while social resources are helpful at mid-life, determinants appear to be rooted in early life.

Discussion

Our findings in a large-scale, representative cohort underscore the importance of more and good quality social resources in mitigating mental health difficulties under particularly stressful circumstances. We also contribute longitudinal evidence to show that individuals can benefit from positive social resources in the longer-term, as effects on mental health persisted five years following exposure to stress. In addition, we provide evidence that social resources mitigate risk for mental health symptoms even taking account of prior mental health. By taking a life-course approach, we show that individuals who display sociability during childhood and adolescence have the most advantageous social resources by mid-life. This finding highlights that there may be advantages to intervening prior to adulthood, to ensure individuals develop social resources that help them cope with stress later in life.

Benefits conferred by rich social resources

Previous studies commonly used either dichotomous or linear approaches to characterise variations in the size of networks, frequency of contacts, and the degree of personal support individuals received[19-20]. We tested a more fine-grained approach, differentiating people with rich social resources from those with poor and more typical levels. This distinction mapped on to the distribution of social resources represented in the population we studied. It also made it possible to test whether the social resources available to the majority of adults are sufficient in mitigating risks, or whether richer resources are needed under especially stressful circumstances. Taking this approach, we corroborated previous findings that social resources have their limits[21], as typical levels did *not* mitigate risks under particularly stressful circumstances. As most prior studies did not explicitly differentiate between rich and typical levels of social resources, the association between stress and social resources proved to be more nuanced in our case. Namely, we show that rich social resources are beneficial - and indeed necessary - under particularly stressful circumstances.

Our study contributes new evidence that people who are best able to weather exposure to multiple stressors are those who have access to better quality emotional and practical support from at least one person - typically their spouse or partner - as well as a broader network of social ties including friends, relatives and social groups. This suggests that a combination of better quality personal support and regular contact with a larger network of social ties is important. In practice, of course, these two aspects of social resources are often linked. Individuals who have regular contact with a larger network of social ties may have greater potential to access different types of support from several sources, and may consequently be better able to cope with stress[22]. This may be especially important in the case of relationship breakdowns or losses, which are not only stressors in themselves but may also entail a loss of key emotional and practical support. An individual with a larger social network may be best able to compensate for losses of this kind by drawing on the resources available to them from their wider social network.

Persisting effects of rich social resources

Our findings also show that individuals who have regular contact with a larger network of social ties and more supportive relationships reap the benefits, not only at the time of exposure to stress, but also over the longer-term. This was the case - although associations were statistically marginal - even for individuals who might be expected to be more vulnerable because of their prior mental health symptoms, and consequently may be more

likely to be exposed to stress[23] and receive less support[24]. There may be a variety of mechanisms involved in explaining how social resources yield health advantages in the longer-term. Supportive relationships may positively influence individuals' response to stress by promoting use of healthy behaviours and discouraging risky behaviours; they may also bolster individuals' beliefs that they are able to cope effectively with stress, and instill a sense of responsibility towards their social ties (e.g. needing to stay healthy to provide for a family)[25-26]. It has also been proposed that social resources may reduce the burden of allostatic load – the cumulative 'wear and tear' on physiological systems as result of exposure to stress – on health[27]. One such mechanism could be the reduction of harmful dysregulation of the hypothalamic-pituitary-adrenal (HPA) system through altering the individual's appraisal of stress.

Life-course precursors of rich social resources

Whereas the majority of existing studies tend to follow-up into earlier stages of adulthood only, we show that early precursors may continue to be important for developing good social resources up to and including mid-life. We show that more sociable children and adolescents have more and better quality social resources by mid-life, providing further evidence to the growing body of studies showing that precursors of adult social resources are rooted in early life. Our findings also corroborate and future research showing that children and adolescents who spend more time with their peers procure health benefits in later life[28].

Equipping less sociable children with the skills to initiate and maintain relationships with their peers may have far-reaching benefits across the life course. It may also be possible to strengthen social resources at older ages as our findings showed that adults with several sources of personal support prior to mid-life (typically their partner or spouse, parents or in-laws, other relatives, and friends or neighbours) were also more likely to have good social resources later in life. Interventions designed to strengthen adult social resources may be useful in ensuring individuals have the tools to elicit more or better-quality support from their existing networks when needed[29].

Limitations

Our study has some limitations. First, we were only able to examine longitudinal effects at a five-year follow-up at mid-life. Although we showed that social resources are beneficial several years later, the extent to which these effects persist over longer time periods

remains uncertain. This limitation is particularly salient given that the social resources available to individuals may become more limited with advancing age, due to health problems and the death of family. Second, our study did not include repeated measures of social resources at mid-life and so it remains unclear how the observed long-term effects operated. Cohorts with measures of social support assessed at different stages in the life-course would provide opportunities for the exploration of these issues.

Furthermore, the measure of support received focused on only one nominated person (typically the spouse or partner), thereby precluding reports of multiple sources of support. However, spouses and partners are the most probable source of support for adults and are most consistently shown to be important in protecting against depression[5]. We conducted sensitivity analyses to take account of whether individuals were in a partnership at age 45, and the findings remained unchanged (see supplementary Table 3).

Third, our study focused on two mental health outcomes given the data available in this 50-year longitudinal study. Future studies should explore the effect of social resources – in the context of stress – on other mental health outcomes. Fourth, common method variance may confound the results as we used self-reported information to identify stress exposure, levels of social resources and mental health symptoms. It may be useful for future studies to gather data from multiple informants to increase the robustness of findings. Fifth, attrition was unavoidable in our 50-year-long study. We used inverse probability weights to take some account of any associated selection bias. Sixth, our study did not assess the role of online communities and social media platforms. This is particularly important as young people today increasingly use these platforms to create and maintain social ties.

Implications

Our study has some clinical implications. We show that both the quality and quantity of social resources available to individuals may be important resilience-related factors. It may therefore be beneficial for clinicians to assess an individual's close relationships, as well as the extent to which they engage with a wider network of social ties. This is especially relevant if the individual has been exposed to several stressful life events in quick succession, as the social resources available to the majority of people may no longer be effective in mitigating risk. Under these circumstances, prompt intervention is required to prevent the onset, or worsening, of mental health problems. Effective interventions for mental health include those designed to increase opportunities for individuals to elicit support from their community[30-31], underscoring the importance of encouraging activities

that enhance social inclusion as outlined by the Care Programme Approach (CPA) framework. Examples of such interventions include, activities around social skills to facilitate 'support creation' including training in conversation skills, assertiveness and conflict resolution and group interventions that provide support through peers, including those that provide opportunity to give as well as receive support from others. Promoting social inclusion is increasingly important given recent societal changes, including technological advances, greater geographic mobility and rising economic pressures. Some individuals may consequently be at greater risk of being socially isolated (e.g. those who are unemployed) and experiencing mental health symptoms upon exposure to stress.

Our findings also emphasise the need for further longitudinal research to better understand the complex interplay between social resources, stress and mental health. Longitudinal studies offer unique opportunities to assess changes in the nature of a person's social resources across age, which may inform a more targeted approach to addressing deficits in support at different life stages. It may also be possible to examine the extent to which interventions designed to improve access to support (e.g. peer support programs) engender resilience when people are exposed to stress.

Although bolstering adult social resources at the time of exposure to stress is worthwhile, our findings suggest that early interventions may provide the best opportunity to benefit future mental health. Schools and educational professionals should be aware that children with poorer social skills may be less well-equipped to cope with stress later in life. Engaging children in structured activities such as volunteering and active citizenship is one such intervention which bring the opportunity for children to lead or participate in a social action projects in the community (e.g. National Citizen Service/ Supporting Inclusion Programme). Another example is peer-mentoring by older children matched with younger mentees based on gender, hobbies, personalities, academic subjects. Children may benefit from school-based (e.g. aggression or bullying prevention) or out-of-school (e.g. mentoring or arts/ sports-based activities) social and emotional learning interventions[32]. Such interventions may provide children with the skills to forge more and better-quality social ties with others well into adulthood.

Table 1: Correlations between social resources, stressful life events, and mental health symptoms

	1	2	3	4	5
1. Stressful life events age 45	**1**				
N	*4347*				
2. Social resources age 45	-0.03	**1**			
N	*3992*	*3992*			
3. Psychological distress age 42	**0.11**	**-0.09**	**1**		
N	*4183*	*3854*	*4183*		
4. Affective symptoms age 45	**0.17**	**-0.10**	**0.45**	**1**	
N	*4333*	*3979*	*4171*	*4333*	
5. Psychological distress age 50	**0.11**	**-0.06**	**0.57**	**0.47**	**1**
N	*3790*	*3519*	*3675*	*3782*	*3790*

Significant findings are in bold, p<0.001.

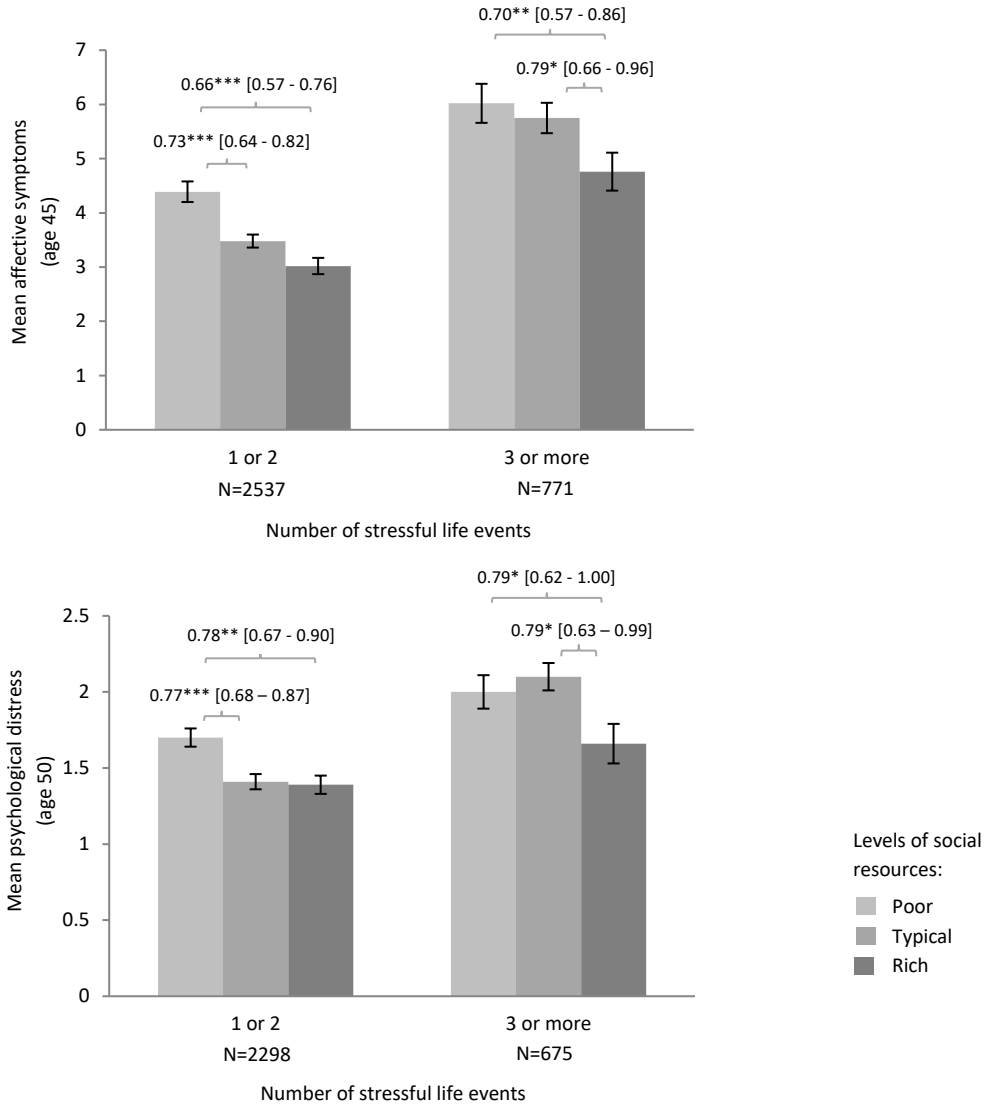

Figure 1: Mean scores for levels of social resources by stressful life events in affective symptoms (top panel) and psychological distress (bottom panel). * p<0.05, ** p<0.01, *** p<0.001.

Table 2: Life-course precursors of social resources at age 45[a]

	Poor social resources vs typical levels	Rich social resources vs typical levels	*N*
Child factors	**RRR (95% CI)**	**RRR (95% CI)**	
Female	**0.80*** [0.71-0.89]**	1.03 [0.92-1.16]	*7414*
Higher reading scores in childhood	**0.99** [0.98-1.00]**	1.00 [0.99-1.00]	*7414*
Higher cognitive scores in childhood	**0.99*** [0.99-1.00]**	1.00 [0.99-1.00]	6670
Higher internalising scores	**1.05* [1.01-1.10]**	**0.95* [0.91-0.99]**	*7051*
Higher externalising scores	1.02 [1.00-1.05]	0.97 [0.95-1.00]	*7181*
Personality			
Impulsive	**0.92* [0.86-0.99]**	1.06 [0.99-1.14]	*5845*
Moody	1.03 [0.98-1.09]	1.01 [0.95-1.06]	*5865*
Aggressive	**0.91* [0.84-1.00]**	1.04 [0.96-1.14]	*5851*
Rigid	**1.10* [1.02-1.20]**	1.02 [0.94-1.11]	*5837*
Withdrawn	**1.13*** [1.07-1.20]**	0.96 [0.90-1.02]	*5870*
Lazy	1.00 [0.95-1.06]	0.99 [0.94-1.05]	*5857*
Disability	**1.46** [1.12-1.91]**	1.01 [0.74-1.36]	*5362*
Social resources in childhood/adolescence			
Child sees friends outside school	**0.75*** [0.66-0.84]**	**1.18* [1.03-1.34]**	*6459*
Child does not get on with both parents	**1.23* [1.01-1.50]**	**0.76* [0.60-0.95]**	*5360*
Arguments with parents	0.95 [0.76-1.17]	1.02 [0.82-1.26]	*5722*
Often goes to discos/parties	**0.79*** [0.69-0.90]**	**1.25** [1.09-1.42]**	*5588*
Family environment			
Child not living with both parents	1.18 [0.97-1.43]	0.94 [0.76-1.16]	*5136*
Child is/has been in care	**1.59* [1.06-2.39]**	0.89 [0.55-1.45]	*5594*
Higher parental social class	0.88 [0.77-1.00]	0.92 [0.80-1.05]	*7402*
Family difficulties	**1.23* [1.00-1.52]**	0.93 [0.74-1.17]	*6972*
Psychopathology in adulthood			
More psychological distress	**1.09*** [1.05-1.13]**	**0.95* [0.91-1.00]**	*6641*
Socioeconomic status			
Higher education level	0.90 [0.79-1.03]	**0.83** [0.73-0.95]**	*6535*
Higher social class	1.03 [0.98-1.08]	1.02 [0.97-1.07]	*6241*
Property ownership	0.88 [0.75-1.03]	0.99 [0.84-1.17]	*6159*
Ever unemployed	1.04 [0.90-1.19]	0.90 [0.78-1.04]	*6361*
Social resources in adulthood			
Often volunteers	**0.81** [0.71-0.94]**	1.10 [0.96-1.26]	*6477*
Earlier social support			
Domestic	**0.76*** [0.67-0.86]**	**1.24** [1.10-1.40]**	*6316*
Financial	**0.74*** [0.63-0.86]**	1.12 [0.97-1.29]	*6237*
Household	**0.81** [0.71-0.93]**	**1.34*** [1.18-1.53]**	*6309*
Personal	**0.75*** [0.67-0.85]**	**1.15* [1.02-1.30]**	*6313*
Confiding	**0.77*** [0.67-0.89]**	**1.17* [1.02-1.34]**	*5909*
Emotional	**0.76*** [0.67-0.87]**	**1.29*** [1.14-1.46]**	*6220*
Social difficulties			
Drawn into arguments	1.03 [0.87-1.22]	0.96 [0.81-1.14]	*6440*
Can't trust other people	**1.35*** [1.19-1.54]**	**0.84* [0.73-0.97]**	*6250*
Doesn't get on with other people	**1.60*** [1.41-1.80]**	**0.64*** [0.56-0.72]**	*6287*
Often attends religious meetings	0.84 [0.70-1.02]	**1.31** [1.10-1.56]**	*3460*
Not married	**1.52*** [1.34-1.73]**	**0.73*** [0.63-0.84]**	*6513*

[a] Weighted relative risk ratios are reported, CI = confidence interval. Significant findings are in bold. * p<0.05, ** p<0.01, *** p<0.001.

Table 3: Group comparisons across levels of social resources for participants exposed to a) 1 or 2, or b) 3 or more stressful life events, adjusted for earlier sociability[a]

Number of stressful life events age 45	Mid-life outcomes	Group comparisons			
		Typical vs Poor resources	Rich vs Poor resources	Rich vs Typical resources	*N*
			IRR (95% CI)		
	Affective symptoms (age 45)				
1-2		0.96 [0.85-1.09]	0.88 [0.75-1.04]	0.92 [0.78-1.07]	*1967*
3 or more		0.99 [0.83-1.18]	0.90 [0.73-1.11]	0.91 [0.74-1.12]	*616*
	Psychological distress (age 50)				
1-2		0.94 [0.83-1.07]	0.96 [0.82-1.12]	1.02 [0.88-1.18]	*1803*
3 or more		1.09 [0.90-1.31]	0.94 [0.74-1.19]	0.86 [0.68-1.09]	*534*

[a] Analyses are adjusted for gender, social class and prior mental health symptoms. Weighted incidence rate ratios are reported, CI = confidence interval. Significant findings are in bold, * p<0.05, ** p<0.01, *** p<0.001, # = p<0.10.

Note: Earlier sociability included the following variables: seeing friends outside school in childhood, going to discos or parties during adolescence, and confiding relationships in adult life.

References

1. Kendler KS, Karkowski LM, Prescott CA. Causal relationship between stressful life events and the onset of major depression. *Am J Psychiatry* 1999; **156**: 837-41.

2. Miloyan B, Bienvenu OJ, Brilot B, Eaton WW. Adverse life events and the onset of anxiety disorders. *Psychiatry Res* 2018; **259**: 488-92.

3. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. *Psychol Bull* 1985; **98**: 310-57.

4. World Health Organization. *Global recommendations on physical activity for health*. World Health Organization, 2010.

5. Gariépy G, Honkaniemi H, Quesnel-Vallée A. Social support and protection from depression: systematic review of current findings in Western countries. *Br J Psychiatry* 2016; **209**: 284-93.

6. Pulkkinen L, Nygren H, Kokko K. Successful development: Childhood antecedents of adaptive psychosocial functioning in adulthood. *J Adult Dev* 2002; **9**: 251-65.

7. Englund MM, Kuo SI, Puig J, Collins WA. Early roots of adult competence: The significance of close relationships from infancy to early adulthood. *Int J Behav Dev* 2011; **35**: 490-6.

8. Power C, Elliott J. Cohort profile: British birth cohort (National Child Development Study). *Int J Epidemiol* 2006; **35**: 34-41.

9. Valtorta NK, Kanaan M, Gilbody S, Hanratty B. Loneliness, social isolation and social relationships: what are we measuring? A novel framework for classifying and comparing tools. *BMJ Open* 2016; **6**: e010799.

10. Stansfeld S, Marmot M. Deriving a survey measure of social support: the reliability of validity of the Close Persons Questionnaire. *Soc Sci Med* 1992; **35**: 1027-35.

11. Berkman LF, Syme SL. Social networks, host resistance, and mortality: a nine-year follow-up study of Alameda County residents. *Am J Epidemiol* 1979; **109**: 186-204.

12. Stouthamer-Loeber M, Loeber R, Farrington DP, Zhang Q, van Kammen W, Maguin E. The double edge of protective and risk factors for delinquency: Interrelations and developmental patterns. *Dev Psychopathol* 1993; **5**: 683-701.

13. Brumley LD, Jaffee SR. Defining and distinguishing promotive and protective effects for childhood externalizing psychopathology: a systematic review. *Soc Psychiatry Psychiatr Epidemiol* 2016; **51**: 803-15.

14. Lewis G, Pelosi AJ, Araya R, Dunn G. Measuring psychiatric disorder in the community: a standardized assessment for use by lay interviewers. *Psychol Med* 1992; **22**: 465-86.

15. Rutter M, Tizard J, Whitmore K. *Education, health and behaviour.* Longman, 1970.

16. Rodgers B, Pickles A, Power C, Collishaw S, Maughan B. Validity of the Malaise Inventory in general population samples. *Soc Psychiatry Psychiatr Epidemiol* 1999; **34**: 333-41.

17. StataCorp. 2017. *Stata Statistical Software: Release 15*. College Station, TX: StataCorp LLC.

18. Seaman SR, White IR. Review of inverse probability weighting for dealing with missing data. *Stat Methods Med Res* 2013; **22**: 278-95.

19. Bélanger E, Ahmed T, Vafaei A, Curcio CL, Phillips SP, Zunzunegui MV. Sources of social support associated with health and quality of life: a cross- sectional study among Canadian and Latin American older adults. *BMJ Open* 2016; **6**: e011503.

20. Pettit JW, Roberts RE, Lewinsohn PM, Seeley JR, Yaroslavsky I. Developmental relations between perceived social support and depressive symptoms through emerging adulthood: blood is thicker than water. *J Fam Psychol* 2011; **25**: 127-36.

21. Burton EM, Stice E, Seeley JR. A prospective test of the stress-buffering model of depression in adolescent girls: no support once again. *J Consult Clin Psychol* 2004; **72**: 689-97.

22. Ostberg V, Lennartsson C. Getting by with a little help: the importance of various types of social support for health problems. *Scand J Public Health* 2007; **35**: 197-204.

23. Hammen C. Stress generation in depression: reflections on origins, research and future directions. *J Clin Psychol* 2006; **62**: 1065-82.

24. Hakulinen C, Pulkki-Råback L, Jokela M, Ferrie JE, Aalto AM, Virtanen M, et al. Structural and functional aspects of social support as predictors of mental and physical health trajectories: Whitehall II cohort study. *J Epidemiol Community Health* 2016; **70**: 710-5.

25. Thoits PA. Mechanisms linking social ties and support to physical and mental health. *J Health Soc Behav* 2011; **52**: 145-61.

26. Umberson D, Crosnoe R, Reczek C. Social relationships and health behavior across life course. *Annu Rev Sociol* 2010; **36**: 139-57.

27. Wiley JF, Bei B, Bower JE, Stanton AL. Relationship of psychosocial resources with allostatic load: a systematic review. *Psychosom Med* 2017;ß **79**: 283-92.

28. Cundiff JM, Matthews KA. Friends with health benefits: The long-term benefits of early peer social integration for blood pressure and obesity in midlife. *Psychol Sci* 2018*;* **29**: 814-23.

29. Brand EF, Lakey B, Berman S. A preventive, psychoeducational approach to increasing perceived social support. *Am J Community Psychol* 1995; **23**: 117-35.

30. Dawson KS, Bryant RA, Harper M, Kuowei TA, Rahman A, Schafer A, et al. Problem Management Plus (PM+): a WHO transdiagnostic psychological intervention for common mental health problems. *World Psychiatry* 2015; **14**: 354-7.

31. Hogan B, Linden W, Najarian B. Social support interventions: do they work? *Clin Psychol Rev* 2002; **22**: 381-440.

32. Clarke AM, Morreale S, Field CA, Hussein Y, Barry MM. *What Works in Enhancing Social and Emotional Skills Development during Childhood and Adolescence? A review of the evidence on the effectiveness of school-based and out- of-school programmes in the UK*. WHO Collaborating Centre for Health Promotion Research, National University of Ireland, Galway, 2015.

Acknowledgements

The work was supported by the Economic and Social Research Council [grant number ES/P010113/1]. The biomedical examination in the National Child Development Study was funded by the Medical Research Council (MRC) grant G0000934. The funders did not have any role in the analysis, interpretation of the results or preparation of the manuscript.

We thank all the participants in the National Child Development Study; the Centre for Longitudinal Studies (CLS), UCL Institute of Education for use of the data; and the Economic and Social Data Service (ESDS) for facilitating access to the data. Louise Arseneault is the Economic and Social Research Council Mental Health Leadership Fellow.

Declaration of Interests

The authors have no conflicts of interest to declare.

Authors contribution

Study concept and design: Sehmi, Arseneault, Maughan.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Sehmi, Arseneault, Maughan.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Sehmi.
Obtained funding: Arseneault.
Administrative, technical, or material support: Sehmi, Arseneault
Study supervision: Arseneault, Maughan.