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ORIGINAL ARTICLE

Longitudinal associations between social relationships at age 30 and internalising symptoms at age 42: findings from the Northern Swedish Cohort

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Abstract
Objectives Little is known on long-term consequences of poor social relationships in adulthood. The study aimed to examine associations between social relationships at age 30 and internalising symptoms at age 42.
Methods Data was drawn from four waves of the Northern Swedish cohort ($n = 1001$, 94 % response rate). The outcome internalising symptoms was measured by a composite index of depressiveness and anxiety. A cumulative measure was constructed to reflect various aspects of social relationships. Multivariate ordinal logistic regressions were used, controlling for socioeconomic indicators and previous level of internalising symptoms.
Results An accumulation of poor social relationships indicators at age 30 is related to internalising symptoms at age 42 in women (OR 1.30; CI 1.11–1.52) and men (OR 1.17; CI 1.02–1.36). The associations remained significant after adjustment for covariates.
Conclusions Poor quality of social relationships at age 30 can predict internalising symptoms 12 years later in both men and women even when previous mental health as well as financial disadvantage is accounted for. More research is required to further examine pathways and mechanisms as well as suitable interventions.

Keywords Mental health · Prospective study · Social network · Social integration · Non-work factors

Introduction

Poor mental health in young people as well as adults is a serious public health issue (Patel et al. 2007; Steel et al. 2014). Also, longitudinal research shows that mental health problems such as depression, depressive symptoms and anxiety (also referred to as internalising symptoms) in childhood and adolescence tend to reoccur later in life (Copeland et al. 2014; Fergusson et al. 2007). From a public health perspective, it is therefore important not only to map mental health over time but also to expand the knowledge on which social circumstances influence mental health, and particularly internalising symptoms, across the life course. High-quality longitudinal research based on community samples that cover a long time span is essential to achieve this. Unfortunately, such studies are few. In addressing this knowledge gap, this paper reports from a prospective cohort study focusing on the role of social factors at age 30 in relation to internalising symptoms at age 42 in a Swedish community sample.

This study focuses on depressive, anxiety, and panic related symptoms, which we here conceptualise by the commonly used umbrella term 'internalising symptoms' (Dingle et al. 2010; Fergusson et al. 2006). According to Fergusson et al. (2006), internalising symptoms can reflect both an underlying general structure of symptoms as well as disorder-specific components. The term Internalising is being used as standard to describe mood and anxiety

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disorders due to their representation of shared psychopathological mechanisms (Markon 2010). In line with other studies (Fergusson et al. 2006; Stansfeld et al. 2011), previous longitudinal analyses of the Swedish Northern Cohort identified that internalising problems in adolescence predict similar problems in mid-life (Winefield et al. 2013).

A range of social circumstances on various levels of society influence internalising symptoms in adulthood (Aneshensel and Phelan 2006; Hill and Needham 2013). Research suggest that factors close to the individual, such as the work environment, family-related circumstances and social relationships/networks, play a central role in understanding depression, anxiety and stress in adults (Beauregard et al. 2011; Egan et al. 2008; Kawachi and Berkman 2001; Thoits 2010). In longitudinal research, less attention has been given to non-work determinants such as social relationships and networks (Beauregard et al. 2011). However, according to a longitudinal Canadian study, the contribution of neighbourhood and social relationships factors for the onset of psychological distress was greater than that of occupation and work place factors (Marchand and Blanc 2010). Beauregard et al. (2011) further concludes that there is support for a causal relationship between quality of social networks and depression and anxiety in the working population. Studies have also found that loneliness (Cacioppo et al. 2010; Teo et al. 2013), low community participation (Cruwys et al. 2013; Lancee and Ter Hoeven 2010) and qualitative as well as quantitative aspects of poor social integration (Beauregard et al. 2011; Fuhrer et al. 1999) are risk factors for poor self-rated health and depression. There is, however, a shortage of prospective studies ranging from adolescence to mid-adulthood.

In line with Cohen and Janicki-Deverts (2009), we argue that the identification of psychosocial determinants of health in general and internalising symptoms in particular requires a broad approach in which several factors are studied together as integrated dimensions. In doing so, we are inspired by the system model by Bronfenbrenner (1977), that is, how settings on various ecological levels (or systems) impact on human development and health. The micro-level, that is, circumstances close to the individual as opposed to macro-level factors such as the overarching political, economic and legal conditions, is in focus in this study and particularly the dimension related to social relationships.

With respect to gender patterns, extensive research confirms that women are more likely to report internalising symptoms than men (Griffin et al. 2002; Steel et al. 2014). Feminist research has contributed substantially to understanding the underpinnings of this gender gap (Hammarström and Phillips 2012; Hill and Needham 2013). However, questions remain regarding underlying mechanisms producing gender differences in mental health, for instance in relation to social relationships. Although women tend to have more close relationships with friends and social networks than men, British research shows a positive relationship between poor social support and psychological distress (GHQ-caseness) in men but not in women (Stansfeld et al. 1998b). On the other hand, other studies have found that when several types of social support, social relationships and network were analysed in relation to psychological distress, no gender differences were found (Fuhrer et al. 1999). Apart from these inconsistent findings, few studies have analysed social relationship factors and gendered patterns in the same study.

The aim of the present study was to examine associations between social relationships at age 30 and internalising symptoms at age 42 in a 26-year prospective Swedish cohort study.

Methods

Population and setting

The study is based on the Northern Swedish Cohort which includes all individuals who, in 1981, were in the last year of compulsory school (age 16) in all nine schools in a middle-sized municipality in Northern Sweden. Schools for children with special needs such as visual or hearing impairment or intellectual disabilities were not included. At baseline, the sample consisted of 1083 individuals. This cohort has proven to be representative for the country as a whole with regard to socio-demographics and self-reported health status for example (Hammarström and Janlert 2012). The current study uses data from the waves at ages 16, 21, 30 and 42.

At the 26-year follow-up when participants were 42 years old the response rate was 94 % (out of those still alive, $n = 1001$, 519 men, 482 women). The effective sample size in the full regression models in this study is 887 (women 428; men 459). The Northern Swedish Cohort Study is further described elsewhere (Hammarström and Janlert 2012).

Measures

At each wave, participants completed a questionnaire on social, working and financial conditions, health, medication, and leisure activities. This study uses data on parental SES from baseline wave at age 16; internalising symptoms at waves age 21 and age 42; social relationships dimension and low cash margin at wave age 30.

Dependent variable at age 42 in 2007.

Internalising symptoms

The composite measure of internalising symptoms was based on three items on anxiety and depressiveness derived from the following questions:

'Have you experienced any nervous problems within the previous 12 months?' The possible responses were 'No' and 'Yes'. Those ticking yes were asked to specify types of nervous symptoms from a list of six alternatives. Two of these symptoms were worry/anxiousness and anxiety/panic. These two items represent the first two in the internalising symptoms index and were both binary variables coded as 'No' = 0 and 'Yes' = 1.

'How often in the past 12 months have you felt sad or low?' The 4-point Likert scale was 'Never' = 0, 'Sometimes' = 1, 'Often' = 2, and 'Always' = 3. To keep the variation in this item, the full 4-point scale was kept.

Based on these three variables (worry/anxiousness, anxiety/panic and sad/low), a composite index was computed which ranged from 0 = not experiencing any symptoms to 8 = having worry/anxiousness, anxiety/panic and often or always feeling sad and low. The order of the values in the scale is based on clinical judgments of the seriousness of these mental health symptoms as well as the frequency of symptoms. For example, experiencing anxiety/panic was graded as more serious in comparison with being worried/anxious or sometimes feeling sad and low. This index has the properties of an ordinal scale. Please see Appendix and previous work for more details (Gustafsson et al. 2013; Hammarström and Janlert 2012; Winefield et al. 2013).

The internalising symptoms index is a theoretically constructed scale which means that empirically derived psychometric properties such as internal consistency are not as relevant as was it a straightforward sum score index. However, for descriptive purposes we report the Cronbach's alpha: age 21: 0.537, age 42: 0.712, as well as factor analyses results (principal component analysis with varimax rotation): age 21: the variables loaded on one component which explained 54.6 % of the variance, factor loadings ranged from 0.72 to 0.78 and a KMO was 0.62. For age 42, the corresponding results were: one component explaining 67.7 % of the variance, factor loadings ranged from 0.79 to 0.84 and a KMO was 0.69.

Independent variables

Social relationships dimension at age 30.

The measure of the social relationships dimension was computed as cumulative adversity score (range 0–5) based on five dichotomous variables (described below) where a higher score indicates worse quality of the social relationship dimension of an individual's life. The measure is based on a theoretical assumption of hypothesised dose–response effect on internalising symptoms of several aspects of the social relationship dimension, aspects that are not necessarily empirically correlated with a latent construct (Streiner 2003). Similar approaches have been applied in previous research (Gustafsson et al. 2014). For descriptive purposes, we also assessed the statistical cohesiveness in a factor analysis (principal component analysis with varimax rotation) which showed that all five items loaded on the same component (explaining 30 % of variance; factor loadings: 0.45–0.65; KMO: 0.61).

The first two aspects, reflecting quantitative as well as qualitative aspects of social networks, were assessed by items from two of the subscales of the interview schedule for social interaction (ISSI): availability of social integration (AVSI) and availability of attachment (AVAT) (Henderson et al. 1980). The ISSI instrument has been translated into Swedish and has previously shown satisfactory psychometric properties (Unden and Orth-Gomer 1989).

The quantitative aspects of social networks (AVSI) included the following items: how many people who share your interests do you know and have contact with? How many people do you know, that you meet or talk to during a week? How many friends do you have who can visit you in your home and feel 'at home'? How many people can you speak openly with? Response alternatives were (numerical value in parentheses): 'None'(1); '1–2' (2); '3–5' (3); '6–10'(4);'11–15' (5); 'More than 15' (6). The sum score (range 4–24) was dichotomised by median split (>14).

The qualitative aspects of social networks were assessed by the following statements derived from the AVAT scale: there is someone special who I really feel supports me; there is someone special who is close to me; others appreciate what I do for them; there are people around me whom I easily can ask for favours; there are other persons outside my family that are close to me and that I can turn to in times of hardship. Response alternatives were: agree completely (1), agree (2), disagree (3), disagree completely (4). The sum score (range 5–20) was dichotomised by median split (>7).

Always or almost always spending leisure time alone constituted the third variable. The fourth variable was poor contact with relatives outside the immediate family. The fifth and final variable in the social relationships dimension variable was low level of participation (seldom or never) in organised activities such as associations or clubs.

As this measure indicates cumulative disadvantage regarding social relationships, we labelled it poor social relationships.

Control variables

Parental socioeconomic status (SES) at age 16 was coded according to the Swedish socioeconomic classification system (Johansson 1970). Manual occupation was coded as low socioeconomic status and non-manual occupations as well as self-employment was categorised as mid/high SES. Both parents being manual workers was categorised as low SES while one or both parents belonging to the higher category was coded as mid/high SES.

Low cash margin is one aspect of financial strain. At age 30 in 1995 participants were asked whether they would be able to obtain SEK 13,000 in a week (equivalent to approximately 2000 US dollars). The answer "no" was coded as low cash margin.

The present study includes data on internalising symptoms in at age 21 (coded the same as the outcome). Apart from being directly associated with internalising symptoms in mid-adulthood, it is possible that the level of internalising symptoms in young adulthood influences, for example, later quality of social relationships as well as labour market position (and thus level of income) (Hammarström and Janlert 2005; Stansfeld et al. 1998a, 2008). We conceptualise this as health selection and argue that controlling for internalising symptoms at age 21 is one way of accounting for health selection.

Statistical analyses

Because of the skewed distribution of the measures internalising symptoms and social relationships, Mann–Whitney *U* tests were used to assess between-group differences. Associations were assessed by ordinal regression, as the dependent variable had an ordinal scale. Correlations between variables included in the regression models were <0.23 and multicollinearity was tested for and found non-significant (VIF < 1.07). Level of significance was set at 0.05 and all regressions were performed separately for men and women. The estimates (log odds) were transformed into odds ratios. All analyses were performed in IBM SPSS version 22.

Results

As displayed in Table 1, women reported worse mental health (as in level of internalising symptoms) than men at both age 21 and 42. There was no gender difference in poor social relationships.

In bivariate analyses (Table 2, model 1), poor social relationships at age 30 were associated with higher level of internalising symptoms at age 42 for both women and men. Among control variables, low cash margin and internalising symptoms at age 21 showed bivarate associations with the outcome while parental SES did not. The association between poor social relationships and internalising symptoms remained significant for both women and men when controlling for parental SES and low cash margin (Model 2) and in the full model including internalising symptoms at age 21 (Model 3). In contrast to men, low cash margin was rendered non-significant when included in the same model as social relationships among women. Thus, poor social relationships at age 30 were independently related to internalising symptoms at 42 for both women and men.

Table 2 further shows that internalising symptoms at age 21 were related to level of internalising symptoms at age 42 for both men and women.

Discussion

The main finding is that poor social relationships at age 30 can influence internalising symptoms in 42-year-old men and women even when adjusted for indicators of socioeconomic status and previous level of internalising symptoms. Another central contribution of the study is that, in contrast to research assessing the effect of single specific indicators, it examined the cumulative effect of several aspects of an important dimension of people's lives relating to social relationships.

The findings suggest that an accumulation of various aspects of poor social relationships (including social integration and support) at age 30 is independently associated with internalising symptoms later in life in both men and

Table 1 Descriptive statistics and gender comparisons of internalising symptoms at age 21 in 1986 and age 42 in 2007 and the social relationship dimension at age 30

	Women		Men		*p* value Mann–Whitney *U* test
	n	*m* (sd)	*n*	*m* (sd)	
Internalising symptoms age 21 (range 0–8)	477	1.47 (1.82)	517	1.00 (1.52)	<0.001
Internalising symptoms age 42 (range 0–8)	481	1.90 (2.51)	512	1.15 (2.00)	<0.001
Social relationship dimension (range 0–5)	435	1.76 (1.16)	468	1.84 (1.26)	0.51

The Northern Swedish cohort

Table 2 Associations between social relationship dimension at age 30 in 1995 and internalised symptoms at age 42 in 2007

	Model 1 (bivariate)		Model 2		Model 3	
	OR	CI	OR	CI	OR	CI
Women						
Social relationship dimension age 30 (range 0–5)	**1.41**	1.22–1.64	**1.42**	1.22–1.66	**1.30**	1.11–1.52
Low parental SES age 16	1.16	0.83–1.63	1.04	0.71–1.51	1.13	0.77–1.65
Low cash margin age 30	**1.53**	1.07–2.18	1.47	0.99–2.20	1.22	0.82–1.84
Internalising symptoms age 21 (range 0–8)	**1.43**	1.30–1.57			**1.36**	1.23–1.51
Pseudo R		0.06		0.14		
Men						
Social relationships age 30 (range 0–5)	**1.28**	1.11–1.47	**1.21**	1.04–1.39	**1.17**	1.02–1.36
Low parental SES age 16	1.28	0.91–1.79	1.29	0.90–1.86	1.40	0.97–2.02
Low cash margin age 30	**1.99**	1.26–3.15	**2.00**	1.20–3.34	**1.80**	1.07–3.03
Internalising symptoms age 21 (range 0–8)	**1.37**	1.23–1.52			**1.32**	1.18–1.48
Pseudo R		0.05		0.09		

Ordinal regressions adjusted for low parental SES at age 16 in 1981 and internalised symptoms at age 21 in 1986 as well as low cash margin at age 30 in 1995. Significant odds ratios are indicated in bold. N in model 3, women 428; men 459. The Northern Swedish cohort

Model 1 bivariate (crude) associations, *Model 2* multivariate regression. Odds ratios for social relationships adjusted for parental SES and low cash margin, *Model 3* Model 2 + adjustment for internalising symptoms at age 21

women. Along with existing research (Barger et al. 2014; Fuhrer et al. 1999; Lancee and Ter Hoeven 2010; Teo et al. 2013; Thoits 2010; Umberson and Montez 2010), this finding confirms the importance of supportive social relationships for mental health in adults.

In terms of gender patterns, findings show that women reported higher levels of internalising symptoms, at both age 21 and 42. This finding confirms existing evidence (Griffin et al. 2002; Steel et al. 2014). The similarities between men and women regarding level of social relationships and their association with internalising symptoms suggest that we cannot attribute the gender pattern in internalising symptoms to gender differences in how social relationship related factors at age 30 are associated with internalising symptoms at 42. In line with findings from the Whitehall II study (Griffin et al. 2002), it is possible that adult socioeconomic status/position is more closely linked to level of internalising symptoms and poor social relationships than gender is. However, social position (including distribution of resources and power) is interlinked with gender and contribute to gender inequalities in mental health (Brännlund and Hammarström 2014; Hammarström and Phillips 2012; Hill and Needham 2013).

It is noteworthy that, in contrast to men, the association between the covariate low cash margin and internalising symptoms was rendered non-significant when adjusted for social relationships among women. Even if this reduction in odds ratio might be due to less power in the analysis, and comparisons between models should be made with caution, it is also possible that financial strain has a stronger long-term effect on mental health for men than for women.

This study is among few that have studied mental health associations of social relationships over a long time period, and with the unique possibility to control for socioeconomic adversity indicators and internalising symptoms earlier in life. The results indicate that the associations between poor social relationships at age 30 and internalising symptoms at age 42 are not explained by health selection or socioeconomic disadvantage. This is an important finding also because social withdrawal is a symptom of, for example, anxiety disorders (Heimberg et al. 2014). On the other hand, we cannot with certainty discern the direction of causality. Most existing research points to a causal relationship from poor social relationships to poor mental health (Beauregard et al. 2011; Cruwys et al. 2013). Nevertheless, further research is needed to examine possible mechanisms in detail, for example by assessing directions of associations between poor social network and mental health problems as well as the interrelation of social and socioeconomic factors across time. This was not the aim of the present paper but is currently being explored in another study within the project which is looking into whether poor social relationships cause poor mental health, or vice versa, or if the relationships are reciprocal. Future research also needs to focus on development and effectiveness of interventions targeting improvement of social integration in adults. It has, for example, been suggested that increased social engagement has a protective effect on depression in older adults (Cruwys et al. 2013). The mental health importance of social relationships should be acknowledged by a broad range of professionals and institutions

such as employers, health care practitioners, social workers and universities.

Strengths and limitations

The current study is based on one of few prospective studies with a high response rate that has followed a cohort of school leavers to their forties. The low attrition rate means that there is a very low risk of bias due to drop out of those most disadvantaged regarding both exposure and outcome. Another strength is the prospective design, extensive coverage of the life span and consistency in measures used across waves.

All measures were self-reported, which might introduce some common method bias. However, the fact that exposures and outcome were measured 12 years apart should mitigate this problem.

With regard to measures, internalising symptoms did not show perfect psychometric properties. However, we find that there is a value of using a clinically theoretically computed measure, which was the same across waves. We also argue that conventional approaches to computing measures can be challenged without losing validity of the findings (Streiner 2003). However, for reasons of comparability, well-established validated scales of depressive and anxiety symptoms would have been preferred.

The measure of social relationships variables covers a reasonable range of indicators, taking into account both quality and quantity of social networks as well as social integration in the extended family and the community. Because we employed this broad approach of various aspects of social relationships, we neither aimed nor were able to determine which specific components contribute to the presence or absence of association. Items included in the composite measure of social relationships were dichotomised which on the one hand may facilitate interpretation but on the other hand does not fully account for the variation and distribution of the variables. It is also possible that the equal weight given to each included indicator may have overestimated the level of poor social relationships (attending organised community or club activities regularly was, for example, relatively uncommon). At the same time, random error in the exposure measure may lead to an underestimation of the association. Despite these limitations, we argue that this approach contributes to the understanding of the role of social relationships, as an integrated dimension, on development of internalising symptoms over time.

In conclusion, this study contributes to the field by suggesting that poor quality of social relationships at age 30 can predict internalising symptoms 12 years later in both men and women even when previous mental health as well as financial disadvantage is accounted for. These findings also support the Bronfenbrenner theoretical proposition of the mental health importance of circumstances close to the individual (micro-level). Future research is required to further examine pathways and mechanisms involved.

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