Discrepancies in the perception of social support relationships (Stage 1 Registered Report)

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Abstract

Objective: Prior research in the area of social support suggests that it is an important influential factor of mental health. Yet, it often remains unclear how much overlap there is between provided support, the perceived availability of support resources, and the factors that account for discrepancies. Mental health disorders tend to produce and are maintained by distorted perceptions of the social environment. Depressive symptoms, in particular, are associated with increasingly negative thought processes and evaluations of social relationships and interactions. Consequently, the present study seeks to identify the discrepancies in the perceptions between givers and receivers of support. We aim to assess the extent to which the individual attributes of mental health, loneliness, and gender are related to discrepancies in support provision.

Method: In order to examine the research question, two school surveys will be utilized. First, we investigate dual-perspective networks of more than 3000 adolescents at 37 schools in North Rhine-Westphalia, Germany, using the second wave of the SOCIALBOND study. The analysis is based on sociocentric network data from adolescents in the eighth grade, distinguishing between the nominations of adolescents who provide support and those who receive emotional support at the grade level. The analyses will be replicated using two cohorts of the Net4health pilot study. The aim is to conduct the analyses in diverse national contexts and for distinct mental health outcomes.

Results: The preliminary findings based on the SOCIALBOND study indicate that there is a substantial amount of mismatch in individuals' perception of support relationships. Nevertheless, mental health and loneliness do not emerge as significant influential factors of discrepancies. In contrast, there is evidence for gender differences in misperceptions. Support provision is more likely to stay unnoticed when the provider is a young man, and young men are more likely to perceive support that was not intended.

Keywords: dual-perspective networks, social support, mental health, loneliness, perception bias, social network analysis

Introduction

Social Support, in the broadest sense, encompasses all the functions individuals within one's social environment can provide (Thoits, 2011). Thereby, social networks serve as structures that enable the generation and sharing of supportive interactions among individuals (Diewald & Sattler, 2010). Social support is a multifaceted construct, often categorized into three distinct types: emotional, instrumental, and informational support (House & Kahn, 1985). Emotional support, also referred to as esteem support, encompasses all forms of reassurance, empathy, and acceptance directed toward an individual, aiming to enhance their emotional well-being (Cohen & Wills, 1985; Thoits, 2011). Previous research suggests that perceptions of social support and the availability of network resources are potential sources of variation in mental health (for systematic reviews and meta-analyses, see e.g., Gariépy et al., 2016; Harandi et al., 2017; Rueger et al., 2016; Wang et al., 2018). Social support has been discussed both as a potential direct positive influence on mental health and as a possible buffer against the adverse effects of everyday stressors (e.g., Berkman et al., 2000; Cohen & Wills, 1985; Demirer et al., 2021; Thoits, 2011). However, these approaches face significant empirical challenges. Notably, enacted support often shows little association with psychological well-being compared to perceived social support, sometimes even exhibiting effects contrary to the predictions of the main and buffering effect models of social support (e.g., Chu et al., 2010). Moreover, enacted support demonstrates only a weak correlation with perceived social support (Haber et al., 2007).

This discrepancy between enacted and perceived support highlights the role of individual perception in social relationships. Previous research indicates that people's perceptions of their social environments, whether perceived as secure or distressful, can significantly impact mental health, potentially through inflammatory processes (Leschak & Eisenberger, 2019; Slavich, 2020). Social cognition research argues that social support has trait-like characteristics that influence cognition and that social interactions and relationships are assessed differently depending on existing cognitive patterns (Lakey & Cassady, 1990; Lakey & Drew, 1997; Mankowski & Wyer, 1997). These findings highlight that most social relationships, such as friendship or social support include individuals who make sense of these relationships subjectively. Thereby, individuals seem to make different judgments about their shared relationship, as unreciprocated friendships are common in the much-studied friendship networks (e.g. Ball & Newman, 2013; Block, 2015; Lin & Weinberg, 2014).

Research by Bernard, Killworth, and Sailer (Bernard & Killworth, 2006; Bernard et al., 1979; Killworth & Bernard, 1976, 1979) provided first evidence that self-reported social network measures do not capture actual behavioural networks. Instead, they differ, among other factors, due to a number of different perceptual biases (Butts, 2003; David & Kistner, 2000; Kumbasar et al., 1994; Lee et al., 2017; Neal, 2008). Observer accuracy, the ability to correctly perceive others' relationships, tends to be higher in smaller classroom networks, for same-sex relationships, and among female and socially prominent students (Neal et al., 2014; Neal et al., 2016). Examining local accuracy in the context of adolescent bullying, Tatum and Grund (2020) observed notable discrepancies between self-reports of victimization and reports of bullying behavior. For instance, even if adolescent A reports that B is bullying him, this does not mean that B is aware of it and reports that he is bothering A. However, empirical evidence on the extent to which individuals tend to evaluate their interactions differently is lacking for social support relationships.

Possible explanations of distorted perception of social support

Gender

Generally, research has found that young women perceive greater social support than young men (Rueger et al., 2008; Rueger et al., 2016), and provide more social support than young men (Martínez-Hernáez et al., 2016). There are several mechanisms through which gender could contribute to differing perceptions of emotional support. Previous research has identified gender differences in emotion processing at four to six years of age; with higher levels of emotion recognition, emotion regulation, and competent emotional expression among girls compared to boys (Maguire et al., 2016); and at 12 to 14 years of age, girls tended to talk more, and express more positive emotions when discussing problems with a friend (Legerski et al., 2015). Generally, the expression of feelings is de-emphasised in boys, and self-reliance is strengthened, while girls are actively encouraged to express warmth and foster intimacy (Matud et al., 2003; Olson & Shultz, 1994). If children and adolescents are socialised to express and process emotions differently from an early age, this may have consequences for the recognition of emotionally supportive interactions and introduce the potential for a mismatch in the perspective of an emotionally supportive tie.

This may also have wider consequences for the experience of support and loneliness, as loneliness is the mismatch between the preferred quantity and quality of social relationships and the objective social embeddedness. It may also have implications for effective support seeking, as those who do not recognise themselves as a source of support to others may miss opportunities to offer more effective support e.g., by providing a positive rather than dismissive response or advising their peers where they can seek further support. Consequently, women are more likely to report perceived social support, as the receipt and exchange of emotional support are socially more readily accepted and promoted for them. In addition, previous research indicates that women are better and more efficient at network recall (Brashears et al., 2016). Differences in socialisation and stereotypes that women are more likely to be helpful may also mean that social support provided by girls or women is more likely to be recognised as such (Cutrona et al., 1990).

The prevalence of gender homophily further shapes friendship and social support relationships (Lakon et al., 2017; van Rijsewijk et al., 2016; Wang et al., 2018). This tendency to interact more often with same-gender partners indicates that adolescents may develop an increased ability to read social cues within same-sex peer interactions. This may imply that social interactions with opposite-sex partners are not categorised as accurately.

Therefore, we offer two hypotheses. First, we hypothesize that girls are more likely to perceive the emotional social support provided to them ("provided, but not perceived" discrepancies) (H1). Second, we hypothesize that girls are less likely to report the perception of emotional support, where alter reports no provision of support ("perceived, but not provided" discrepancies) (H2).

Mental health

The cognitive theory of depression, developed by Beck (1967, 1976), posits that distorted thought processes play a crucial role in the onset and perpetuation of depressive symptoms. Central to this theory is the concept of the cognitive triad, which involves a negative perception of oneself, the environment, and the future. Individuals experiencing depression tend to selectively filter out experiences that challenge or contradict this negative worldview. The cognitive processes outlined in this theory contribute to a distorted perception of social interactions and relationships. Accordingly, individuals with depressive symptoms are prone to misperceiving or undervaluing the social support available to them. Lakey and Cassady

conclude that low social support can be seen as a sub-dimension of these distorted perceptions and, therefore, as an outcome of depressive symptoms: “Conceptualised as a cognitive variable, low perceived support would be considered an aspect of the negative view of the world.“ (Lakey & Cassady, 1990, p. 337). In terms of recalling social interactions, individuals with high support perceptions demonstrate better memory for supportive behaviours and poorer memory for unsupportive behaviours compared to individuals with low support perceptions (Lakey & Drew, 1997; Wyer & Srull, 1989). Experimental studies indicate that individuals experiencing depressive symptoms tend to remember standardised evaluations more negatively compared to control groups. Additionally, the processing of negative information is heightened in depressed individuals, making it challenging for them to disengage from negative thoughts or information (Gotlib, 1983; Gotlib & Joormann, 2010; Nelson & Craighead, 1977). Mixed evidence exists regarding the recall of neutral or positive feedback. Some studies indicate they are more inclined to either not recall or underestimate positive feedback (e.g., Nelson & Craighead, 1977), whereas some studies suggest that there may be no discernible differences between depressed individuals and control groups in the processing of neutral or positive feedback (e.g., Hoehn-Hyde et al., 1982). At the situational level, mood has also an influence on the perception and evaluation of social interactions (Forgas et al., 1984).

Therefore, we propose two hypotheses. First, we hypothesize that individuals with poorer mental health are less likely to perceive the emotional social support provided to them (“provided, but not perceived” discrepancies) (H3). Second, we hypothesize that individuals with better mental health are more likely to report the perception of emotional support, whereas alter reports no provision of support (“perceived, but not provided” discrepancies) (H4).

Loneliness

A conceptual distinction must be drawn between social isolation and loneliness. Social isolation is an objective measure, reflecting an individual’s actual lack of social embeddedness within social networks. In contrast, loneliness captures the subjective experience of social isolation, defined as the dissatisfaction individuals feel with the quality or quantity of their available social relationships (de Jong Gierveld, 1987; de Jong Gierveld et al., 2018). Loneliness emerges when the perceived level of social connection falls short of an individual’s desired degree of social engagement (Perlman & Peplau, 1981).

Loneliness has been identified as a significant predictor of mental health disorders, as feelings of loneliness often go hand in hand with social withdrawal, and a lack of social interaction can then lead to further deterioration in mental health (Mann et al., 2022; Cacioppo & Hawkley, 2009; Hawkley & Cacioppo, 2010). Loneliness is also associated with intensified negative emotional states (Buchholz & Catton, 1999). Prolonged exposure to such emotions is linked to an increased risk of developing depressive symptoms, creating a pathway by which loneliness can precipitate further psychological distress. Additionally, limitations in social interaction resulting from mental health challenges may contribute to a heightened sense of loneliness, establishing a bidirectional relationship between loneliness and mental illness (de Jong Gierveld et al., 2018). Empirical evidence underscores this interdependence, demonstrating that loneliness and mental health disorders frequently influence one another over time (Hsueh et al., 2019; McDowell et al., 2021; Nuyen et al., 2020).

Loneliness serves as an additional explanatory factor contributing to cognitive distortions in the perception of social relationships. The experience of loneliness not only triggers feelings of insecurity but also induces changes in cognition. Individuals grappling with loneliness often exhibit a heightened critical assessment of their social interactions, leading to a more negative

perception of these encounters. Additionally, the cognitive shifts extend to the development of expectations that others are inherently opposed to the individual (Cacioppo & Hawkley, 2009; Hawkley & Cacioppo, 2010). Importantly, this altered cognition may contribute to a diminished likelihood of perceiving available support resources as genuine. Evidence for gender effects on loneliness is mixed (Maes et al., 2019) – some studies have found that young men are more lonely than young women (Barreto et al., 2021), whereas other studies have found the opposite (Wedaloka & Turnip, 2019), and still other studies have found no gender effects on loneliness (Marquez et al., 2023).

Accordingly, we introduce two additional hypotheses. First, we hypothesize that individuals with higher loneliness are less likely to perceive the emotional social support provided to them ("provided, but not perceived" discrepancies) (H5). Second, we hypothesize that less lonely individuals are more likely to report the perception of emotional support, whereas alter reports no provision of support ("perceived, but not provided" discrepancies) (H6).

The current study

In this context, the current paper focuses on dual perspectives of emotional social support. By analysing nominations of support receipt and provision, we aim to investigate the prevalence of discrepancies within dyads of adolescents. Empirically, two different forms of discrepancies can be distinguished: Actors may report support provision that is not perceived as provided by ego ("provided, but not perceived" discrepancies). Alternatively, ego may perceive support is provided, but alter might not be aware of support provision ("perceived, but not provided" discrepancies).

Subsequently, we examine which factors, beyond memory bias (Brewer & Webster, 2000), systematically influence the occurrence of discrepancies in perceptions of emotional social support during adolescence. The importance of mental health and loneliness will be analysed, as well as possible gender differences between same-sex and opposite-sex dyads. By examining influential factors of distorted perceptions of social support ties, our research aims to contribute valuable insights to 1) the broader understanding of emotional support dynamics during a crucial developmental stage and 2) possible sources of measurement bias in the collection of self-reported network ties.

Methods

Data

Socialbond: The "Social Integration and Boundary Making in Adolescence" (SOCIALBOND) project comprises a three-wave panel study of students in the German federal state of North Rhine-Westphalia. It aims to investigate the formation of social boundaries and peer affiliations among adolescents by analyzing peer dynamics across diverse school settings. In the first wave, 7th graders attending lower track, intermediate track, comprehensive, and upper track schools were sampled. The same cohorts were surveyed again one year later in grade 8. Students attending schools for special needs were not part of the target population. The selection of schools was not at random but was intentionally balanced across the four main school types to ensure variation in contextual factors that might influence social network dynamics.

For the purposes of this paper, only wave two will be the subject of analysis. Data collection for wave two was initiated at the start of the school year in autumn 2019. A total of 37 schools and 3088 adolescents took part in the second wave, yielding a participation rate of 80.48% on the student level. The adolescents were 13-14 years old at the time of data collection (Mage =

13.55), with a balanced gender ratio (46.28% girls). This data has already been analysed, and this registered report relates to a near-replication study of the data described below.

Net4Health: The Net4Health project is a panel survey of students attending secondary schools in Scotland and focuses on social networks and health data. The project aims to examine changes in adolescent health behaviors and outcomes over recent decades, as well as how determinants at the peer, school, and family levels may impact these outcomes. The data from the pilot study are used in this paper. The pilot study consists of two cohorts: one cohort of year 7 (age 12-13) and one cohort of year 9 (age 14-15) students. Data collection took place in February 2020. A total of 302 adolescents participated out of 404 in the participating year groups, resulting in a participation rate of 74.75%.

Data collection procedure

Socialbond: The survey was conducted as an in-school computer-assisted self-interview (CASI) during regular school hours. Each student was provided with a tablet, and audio support was incorporated to assist those with reading difficulties. Information material and parental consent forms were given to parents in the weeks prior to the survey and collected by teachers. Students with parental consent could then actively choose to participate or not. Monetary incentives of €5 per student were paid for each signed parental consent form, regardless of participation or refusal.

Sociocentric social networks were collected at the grade level through the use of name lists. Participants received a list with the names of all students from their school grade, ordered by classrooms, where each name was assigned an ID number. The students were not allowed to nominate individuals from outside their grade level. For more information see also: https://socialbond-project.com/schueler-schuelerinne

Net4Healht: The data collection for the Net4Health study was also carried out as a computer-assisted self-interview (CASI) within the school using the student's own phones, tablets, or laptops. Parents were given the option for opt-out consent, whereby they did not allow their child to participate. Active consent was obtained for adolescents on the day of data collection. Incentives were provided at the school-level, with participating schools receiving £500.

Sociocentric social networks were also collected at the grade level through the use of “autocomplete” options based on the roster method. The names are replaced by ID codes in the survey database. In contrast to the SOCIALBOND project, the adolescents were able to nominate individuals from outside their grade level. For more information, see also: https://osf.io/ptcfy

Variables

Socialbond

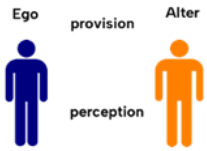
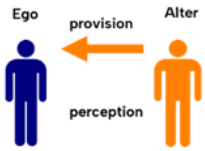
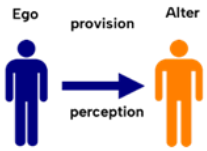
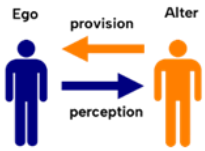
Dependent matrix: Discrepancy matrix of emotional social support

In preparation for the within-school data collection, a roster encompassing all students in the grade was generated. Each individual was then allocated a three-digit number, serving as a basis for their nomination during the selection process. To capture the social support ties among the adolescents, dual perspectives were recorded by capturing both perception ("Who will help you when you are sad or something is bothering you (e.g. an argument at home or with friends, problems in love)?") and provision ("Which classmates do you help when they are sad or something is bothering them (e.g. in an argument at home or with friends, in the case of

love)?") of emotional social support. Based on the name lists, students were asked to nominate up to five individuals out of their grade for each of the network items.

In order to obtain an adjacency matrix that provides information about possible discrepancies in emotional social support between adolescents, the first step is to transpose the adjacency matrix containing the reports of support provided. The transposed provision of support matrix denoted as support^{T} matrix now provides the same substantive information as the perceived social support matrix, the only difference being the perspective from which the relationship is reported. The provision of support^{T} matrix indicates in the rows whether the respective ego is receiving emotional support from the respective alter, based on the reports of the providing alter. The perceived support matrix also indicates in the rows whether the respective ego receives emotional support from the respective alter, but from the perspective of the recipient of the support. The next step is to subtract the two matrices from each other. However, before doing so, the perceived social support matrix must be multiplied by two to ensure that, after subtraction, the four cross-categories remain distinguishable and do not cancel each other out to zero. Once this adjustment is made, the provision of support^{T} matrix is subtracted from the perceived social support matrix. Four different combinations of perspectives can then be distinguished: 1) ego and alter agree that ego does not receive support from alter, 2) ego and alter agree that ego receives support from alter, 3) Alter reports support provision, but no report of receiving support from the ego ("provided, but not perceived" discrepancies) and 4) ego perceives receiving support, but no report of support provision from alter ("perceived, but not provided" discrepancies) (see also Table 1).

Table 1 - Possible combinations between reports of emotional support receipt and provision

	Alter does not report provision of support	Alter does report provision of support
Ego does not report perception of support		
Ego does report perception of support		

Explanatory matrices:

Mental health: The Mental Health Inventory - 5 (MHI-5), which is a component of the 36-Item Short Form Survey Instrument (SF-36), is used to assess students' mental health. Specifically, the RAND 36-Item Health Survey 1.0 version, as described by Hays et al. (1993), is used. The MHI-5 has been validated to capture symptoms related to depression and anxiety in children and adolescents (Rivera-Riquelme et al., 2019) and focuses on mental health status over the past four weeks. The MHI-5 includes three items addressing negative emotions and two items addressing positive emotions. Following Hays et al. (1993), each item was recoded to a 0–100

scale, with higher scores indicating better mental health. The overall mental health score was then calculated as the mean of the five items The scale was translated into German for this study.

Loneliness: A single-item questionnaire was used to measure adolescents' loneliness.: „How many times have you felt lonely in the past four weeks?“. Higher values indicate less loneliness.

Gender: Self-reported gender of the adolescents (dichotomous item boy, girl).

Age: Age of the adolescents at the time of the survey.

Socio-economic background: Due to the absence of parental data, the study relies on adolescents' perceptions of financial limitations as a proxy for socio-economic status, as adolescents lack accurate knowledge of household income. Two items are used to assess the extent to which the adolescent's financial resources limit their daily lives: “how often do you lack the money to take part in activities (for example, school trips, cinema visits or things your friends do)?” and “how often do you lack money for something you would like to have (for example, for clothes or games consoles)?”. This measure has been found to correlate with the broader socio-economic family background (Currie et al., 2008).

Indegree support provision: Number of incoming nominations of the support provision network item. Corresponds to the number of adolescents who indicated they help ego.

Indegree support perception: Number of incoming nominations of the support perception network item. Corresponds to the number of adolescents who stated that ego helps them.

To examine the determinants of discrepancies in emotional social support networks, four types of matrices can be distinguished on the basis of individual-level attributes. The *Ego Effect* matrix records, for each ego, the value of his or her individual-level attribute in each cell of ego's row. This allows for the examination of how ego's levels on a given attribute may influence the occurrence of discrepancies in the emotional social support network. Alter Effects are represented in a matrix where, for each ego row, the value in the corresponding cell reflects the individual-level attribute of the nominated alter in that column. This enables analysis of how the attributes of alters may impact egos discrepancies in emotional social support perceptions. Additionally, the Same Effect matrix contains information indicating whether ego and alter share the same level on a particular individual attribute in each cell. This permits an examination of how alignment in an individual attribute between ego and alter may affect discrepancies in the emotional social support network. Finally, the Difference Effect matrix records the magnitude of the difference in the individual attribute between ego and alter in each dyadic cell, allowing us to investigate the extent to which the degree of difference on this attribute influences discrepancies in the emotional social support network.

Net4Health

Dependent matrix: Discrepancy matrix of emotional social support:

Similar to the SOCIALBOND project, the adolescents in the Net4Health study were also able to report dual perspectives of their social support ties. On the one hand, the adolescents were asked to nominate alters to whom they provide emotional social support ("Who has talked to you or has asked for your advice about their mood, emotions, or stressful situations?"), and on the other hand to nominate those alters from whom they perceive emotional social support ("Who would you talk to, or ask for advice about your mood, emotions, or stressful situations?"). In contrast to SOCIALBOND, adolescents could nominate friends from school or outside school, as well as adults like teachers or family members. In the context of this paper, only the nominations within the grade level will be considered. The adolescents were able to nominate three alters for each network item.

The discrepancy matrix is determined using the same procedure as for the SOCIALBOND data, and accordingly, the same four different combinations of ego and alter perspectives can be distinguished.

Explanatory matrices:

Mental health: The General Health Questionnaire (GHQ-12) (Goldberg et al., 1997) is used to assess the adolescents' mental health and detect potential mental disorders. Comprising 12 questions, it focuses on the respondent's recent psychological well-being, exploring aspects such as depression, anxiety, social dysfunction, and overall distress.

Loneliness: A modified version of the 3-item short version of the UCLA Loneliness Scale is used in combination with a one-item direct measure that asks the respondents directly about their experience of loneliness (Office for National Statistics 2018).

Gender: Self-reported gender of the adolescents (young man, young woman, non-binary, other).

Age: Year group of the adolescents at the time of the survey, either Secondary 2 (age 12-13) or Secondary 4 (age 14-15).

Socio-economic background: Socio-economic status is measured using adolescents' relative economic self-assessment. Students were asked to evaluate their family's financial standing on a scale from 1 to 10, with 1 representing "the best off people in Scotland (families with the most money)" and 10 representing "the worst off people in Scotland (families with the least money). Previous research indicates that the subjective social status is a valid proxy for objective socio-economic indicators (Goodman et al., 2001).

Indegree support provision: Number of incoming nominations of the support provision network item. Corresponds to the number of adolescents who indicated they help ego.

Indegree support perception: Number of incoming nominations of the support perception network item. Corresponds to the number of adolescents who stated that ego helps them.

For the Net4Health study, the construction of ego, alter, same, and difference matrices follows the identical procedure applied in the socialbond dataset.

Missing data

In Socialbond, missing values on relevant variables were managed through a complete case analysis approach. As a result, only dyads with complete information for both adolescents on the network items and individual-level variables are included in the analysis.

In Net4health, multiple imputation with chained equations is used to account for item or participant missingness on node attributes. Network data will not be imputed. We will compare model results from multiply imputed and complete case datasets.

Statistical models

In social networks, the dyads within a network boundary are not independent, as indiviudals in network data can influence each other. This dependency violates a core assumption of traditional regression models, which require independent observations to produce unbiased estimates. Multiple Regression Quadratic Assignment Procedure (MRQAP) models (Krackardt, 1987; Krackhardt, 1988) can be used to analyse the relationships between variables in the context of network data. MRQAP models build on the Mantel test (Mantel, 1967), which is widely used to assess correlations between two similarity matrices. MRQAP extends this by allowing for multiple predictor matrices, to be included simultaneously, enabling the analysis of how multiple covariates impact a dependent adjacency matrix in the context of network data.

MRQAP models can predict the impact of one or more matrices (e.g., containing individual level information or any other adjacency matrix) on the dependent network adjacency matrix, thereby controlling for the other matrices. More specifically, we can examine the extent to which individual-level attributes of the ego (ego effects), individual-level attributes of the alter (alter effects), or the sameness (dyadic same effects) or similarity (dyadic difference effects) of individual-level attributes between ego and alter affect the existence or strength of a tie at the dyadic level. To address the non-independence of observations due to the network structure of the data, MRQAP employs permutation testing. This involves randomly permuting the observed network matrices while keeping the structural features of the network constant. By reshuffling the nodes and their attributes, a distribution of expected values under the null hypothesis of no relationship between the predictor matrices and the network structure is created.

In the context of the current paper, MRQAP logistic regressions are estimated as the dependent adjacency matrix contains dichotomous information. To identify influential factors of provided, but not perceived support discrepancies, only dyads in which ego and alter agree on the perception and provision of emotional social support (coded = 0) and those in which alter reports support provision but ego does not report receipt (coded = 1) are included in the analysis. Accordingly, only dyads in which the ego and alter agree on the perception and provision of emotional social support (coded = 0) and those in which ego perceives support from alter, but alter does not report the provision of support (coded = 1) are analysed for the calculation of explanatory factors for the discrepancy "perceived, but not provided." The dyads are restricted in this way because the "provided, but not perceived" and "perceived, but not provided" discrepancies may be caused by different factors and, therefore, require separate models. In addition, only agreement dyads are used as the reference category because the absence of any discrepancy could have been caused by either agreement on support or agreement on the non-existence of social support, but both categories together create a reference category that is too heterogeneous. Age, socio-economic status, degree support provision and degree support perception are included as confounders in the multivariate models.

Given the structure of the datasets, we first compute an MRQAP model for each school separately. Then, a meta-regression is calculated 1) over all SOCIALBOND schools and 2) a meta-regression over the Net4Health pilot schools. Both fixed effects and random effects meta-regressions are calculated. Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) are used to decide between the fixed-effects and random-effects meta-regressions by selecting the one that has a smaller information criterion and therefore fits the data better (An, 2015).

Results

Descreptive results

Table 2 - Descriptive statistics, SOCIALBOND

Variable	N	Mean	SD	Median	Inter-quartile range	Min	Max
Mental health	2,983	65.815	18.346	68	24	0	100
Loneliness	2,887	4.965	1.366	6	2	1	6
Age	3,044	13.555	0.756	13	1	9	19

Gender (girls)	3,062	1.463	0.499	1	1	1	2
Socio-economic status	3,051	3.495	0.575	3.5	1	1	4
Outdegree perceived support	3,072	2.184	1.640	2	2	0	5
Outdegree provided support	3,072	2.616	1.665	3	3	0	5
Outdegree provided support^{T}	3,072	2.616	1.912	2	3	0	12
Indegree perceived support	3,072	2.184	1.783	2	2	0	10
Indegree provided support	3,072	2.616	1.912	3	3	0	12

The average age of the adolescents in the SOCIALBOND dataset is 13.56 years, with a balanced gender ratio of 46.3% boys. Both the mental health index and the loneliness item are left-skewed, with a mean value of 65.82 for mental health and 4.97 for loneliness. With regard to the emotional social support networks, the mean value of the outdegree of perceived support is 2.18, and that of the outdegree of provided support is 2.62. The mean of the indegree of perceived support is 2.18. On average, an adolescent was nominated as a support provider by a corresponding number of others. Whereas the mean value of the indegree of provided support is 2.62, corresponding to the average number of other adolescents who have nominated providing support to an individual (see Table 2).

Table 3 - Descriptive overview of empirical combinations between reports of emotional support receipt and provision, SOCIALBOND

	Alter does not report provision of support	Alter does report provision of support	Sum
Ego does not report perception of support	285 079	4 226	289 305
Ego does report perception of support	2 900	3 837	6 737
Sum	287 979	8 063	296 042

Table 3 depicts the observed frequencies of the different combinations between reports of emotional support receipt and provision. Given that support networks tend to be sparse, for a majority of 285 079 dyads, neither reception of support by ego nor provision of support by alter is reported. For 8 063 dyads, support provision is reported by alter, whereby in 52% of these dyads, ego does not confirm the receipt of support from alter (“provided, but not perceived” discrepancies). Overall, ego reports receiving support from alter in 6737 dyads, but no support provision is reported by alter in 43% of these dyads (“perceived, but not provided” discrepancies).

Quadratic Assignment Procedure

Table 4 - Dyad-level QAP regressions, fixed-effects meta regression, SOCIALBOND

	Model 1 Provided, but not perceived		Model 2 Provided, but not perceived		Model 3 Perceived, but not provided		Model 4 Perceived, but not provided	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Constant	1.646*	0.452	1.091*	0.465	-0.481	0.486	-1.246*	0.502
Dyadic:								
Diff. mental Health	0.006	0.019			0.003	0.021		
Diff. loneliness			0.045	0.073			0.072	0.080
Diff. age	-0.020	0.093	-0.022	0.097	-0.085	0.100	-0.025	0.104
Same sex	-0.759*	0.134	-0.790*	0.136	-1.135*	0.141	-1.171*	0.144
Ego:								
Mental health	-0.006	0.018			0.005	0.019		
Loneliness			-0.115	0.070			0.094	0.077
Age	0.025	0.092	0.036	0.095	0.050	0.099	0.030	0.102
Sex (ref. girls)	-0.121	0.136	-0.121	0.138	-0.400*	0.143	-0.429*	0.145
Indegree support provision	0.212*	0.054	0.216*	0.055				
Indegree support perception					-0.467*	0.062	-0.490*	0.063
SES	-0.096	0.098	-0.103	0.101	0.106	0.108	0.158	0.110
Alter:								
Mental health	0.001	0.018			-0.004	0.019		
Loneliness			0.026	0.070			-0.028	0.076
Age	0.029	0.091	0.052	0.095	0.027	0.099	0.028	0.102
Sex (ref. girls)	-0.516*	0.136	-0.459*	0.137	-0.262	0.143	-0.175	0.145
Indegree support provision	-0.426*	0.056	-0.443*	0.057				
Indegree support perception					0.295*	0.060	0.300*	0.061
SES	0.063	0.100	0.094	0.102	0.004	0.106	0.012	0.109
N Observations (Dyads)	7559		7254		6320		6067	

Notes: * $p < .05$

Table 4 presents results from fixed-effects meta regressions based on the school-level quadratic-assignment-procedure logistic regression models of the SOCIALBOND data. Separate models for mental health and loneliness were estimated for each discrepancy.

With regard to the effect of mental health, the results in Model 1 suggest that neither the mental health of ego or alter, nor the similarity of ego and alter in terms of mental health

influences whether ego fails to recognise the support offered by alter as such ("provided, but not perceived" discrepancies). The results in model 2 also suggest that the level of loneliness of ego or alter, or the similarity of both in terms of loneliness, does not influence the occurrence of "provided, but not perceived" discrepancies. However, we do find significant gender effects. Support is more likely to remain unperceived by the ego when the provider is a young man. Mismatches are more likely in opposite-sex dyads than in same-sex dyads. Support provision is also significantly more likely to stay unperceived by ego, when ego is supported by many according to the indegree of provided social support.

Models 3 and 4 show the results for the occurrence of "perceived, but not provided" discrepancies, that is, dyads in which ego reports receiving support but alter does not report providing support. Similarly, the mental health or loneliness of ego or alter, or their similarity in these attributes, is not a significant factor for the occurrence of this discrepancy. Again, the results show significant gender differences. Here, young men egos are more likely to perceive support, which was not intended by alter. Mismatches are also significantly less likely between same-sex dyads than between opposite-sex dyads. Adolescents are less likely to report unintentional support when alter is nominated by many as a support provider, as indicated by the indegree of perceived support.

Effect size

Table 5: Estimates and standard errors based on dyad-level QAP regressions, fixed-effects meta regression SOCIALBOND

	Provided, but not perceived		Perceived, but not provided	
	Estimate	SE	Estimate	SE
Diff. mental Health	0.006	0.019	0.003	0.021
Diff. loneliness	0.045	0.073	0.072	0.080
Ego Mental health	-0.006	0.018	0.005	0.019
Ego Loneliness	-0.115	0.070	0.094	0.077
Alter Mental health	0.001	0.018	-0.004	0.019
Alter Loneliness	0.026	0.070	-0.028	0.076

Our analysis will perform a near-replication of the SOCIALBOND models above, using the comparable data held in Net4health.

Statistical power

Based on the sample size of 302 nodes in two networks, with choose (154,2) + choose(148,2) = 22,659 dyads. Assuming the SOCIALBOND proportion of discrepant ties of 0.02407 and R2 from other variables in a logistic regression of 0.05, we would have an alpha of 0.08.

The Net4health sample comprises 302 nodes with a total number of observed dyads 22,659 (154 choose 2 possible dyads in network one + 148 choose 2 dyads in network two). We employ a z-test power calculation that specifies a logistic regression considering the number of dyads as the outcome variable (as an MRQAP does), and we assume a proportion of discrepant ties of 0.02407. We consider a two-tailed effect since our hypotheses do not make assumptions about the direction of the effect. Considering this specification, we foresee a critical z of 1.405 and a probability error (alpha) of 0.16. Figure 1 shows how the probability of the error decreases while the sample size increases.

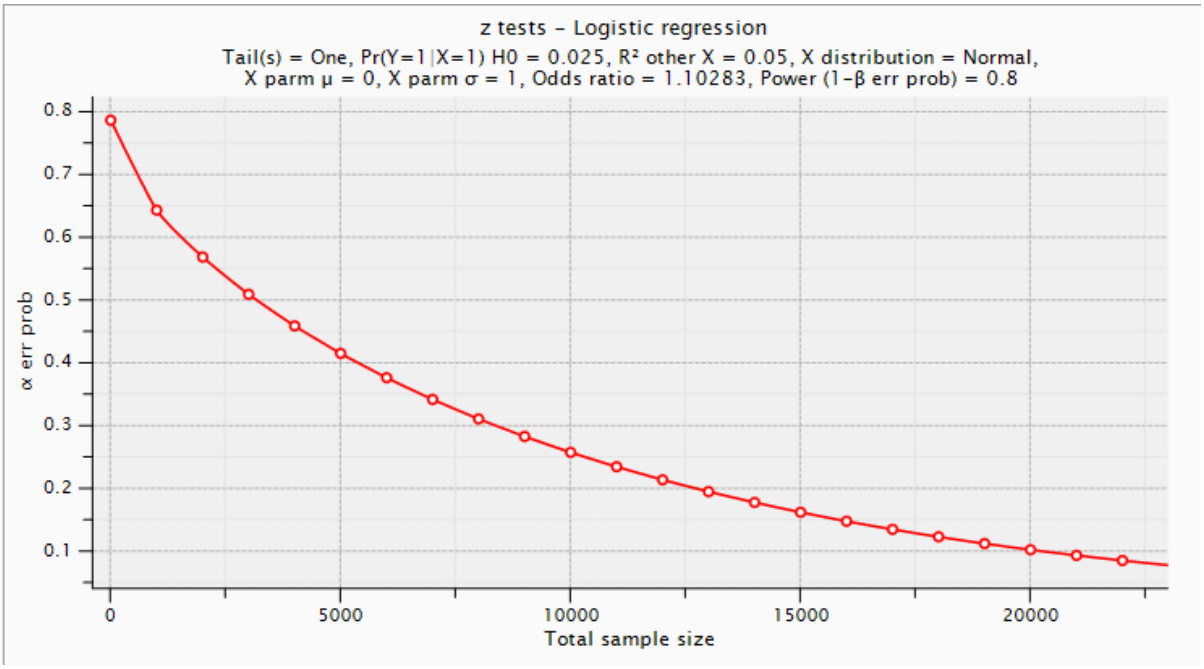


Figure 1 - The probability of the error decreasing when the sample size increases, considering a z-test with logistic regression and a two-tailed effect.

We also consider a power calculation with the same specification as the previous one but with a one-tailed effect to observe the consequences of a more conservative approach to the estimation of power. The results show the same critical z (1.405) but a much smaller probability of an error—0.08. Figure 2 shows that the probability of the error considering a one-tailed effect is non-linear. Still, the error decreases when the full sample size is employed.

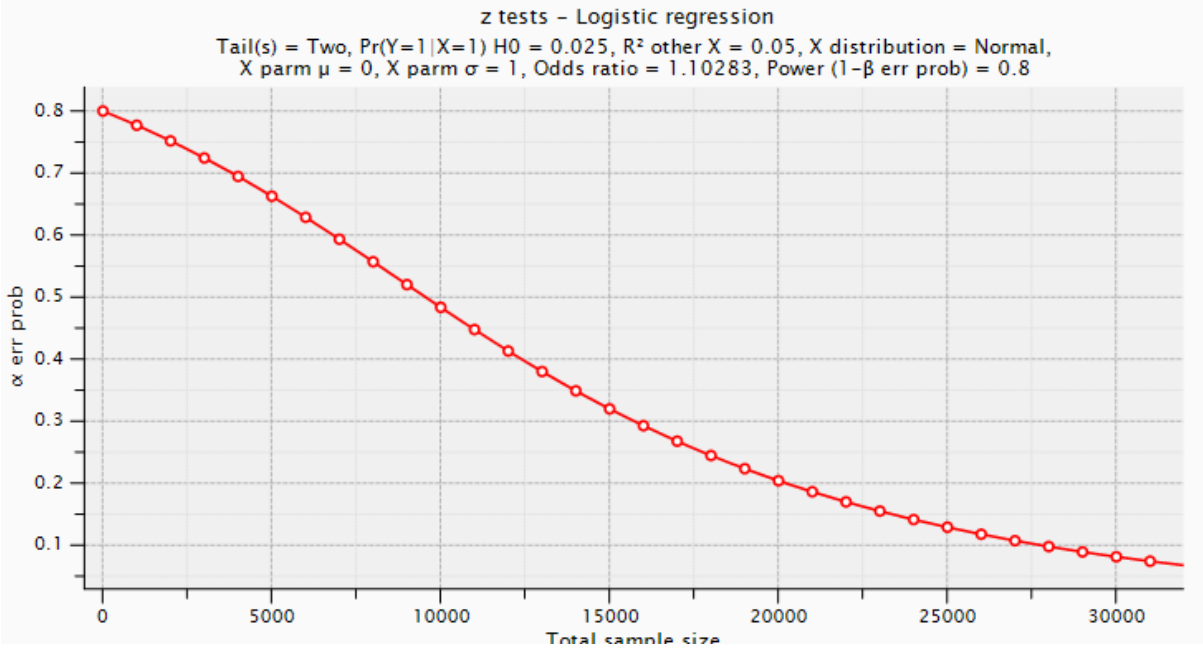


Figure 2 - The probability of the error decreasing when the sample size increases, considering a z-test with logistic regression and a one-tailed effect.

We also examine a different type of power calculation employing a generic linear multiple regression as a robustness check for completeness. When we specify a two-tailed effect, we achieve a lower critical R-squared of 0.024 and an upper critical R-squared of 0.026 together with a probability error of 0.61. The probability of an error is larger than the case in which we employ a logistic regression. Logistic regression is a more appropriate type of analysis for this study since it is the underlying formula of an MRQAP that simply corrects the errors in order to account for the employment of dyadic data. We observe in Figure 3 as well that the error decreases when the sample size increases.

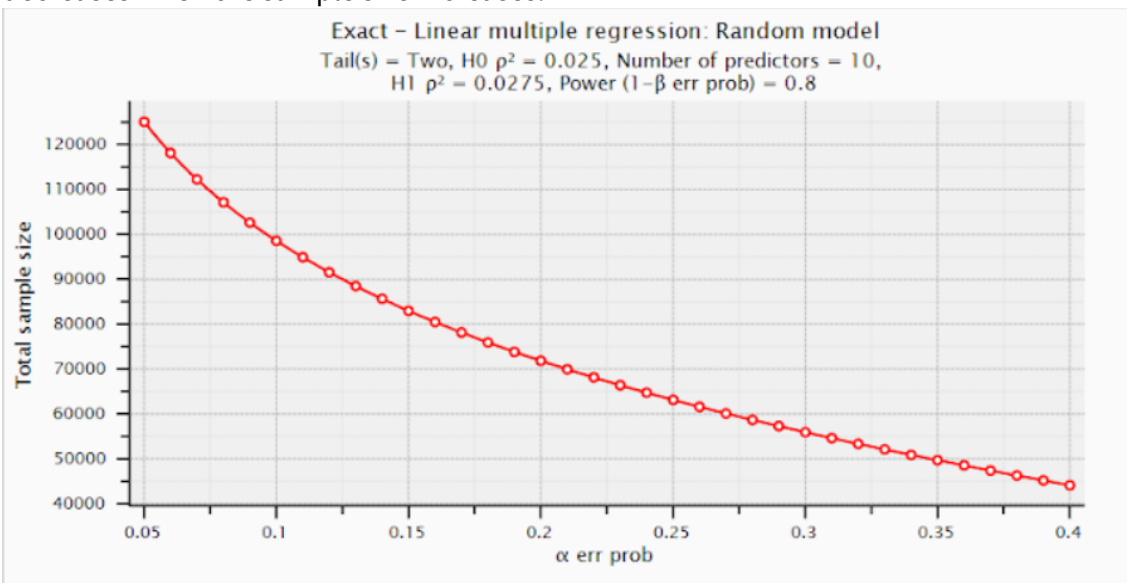


Figure 3 - The probability of the error decreasing when the sample size increases, considering an exact linear multiple regression with logistic regression and a two-tailed effect.

When considering the latter specification but a one-tailed effect, we have a lower critical R-squared of 0.026 and an upper critical R-squared of 0.026, which coincide. The probability error is 0.36, hence smaller than the two-tailed result. Figure 4 shows that this last analysis presents the same trend as the previous ones.

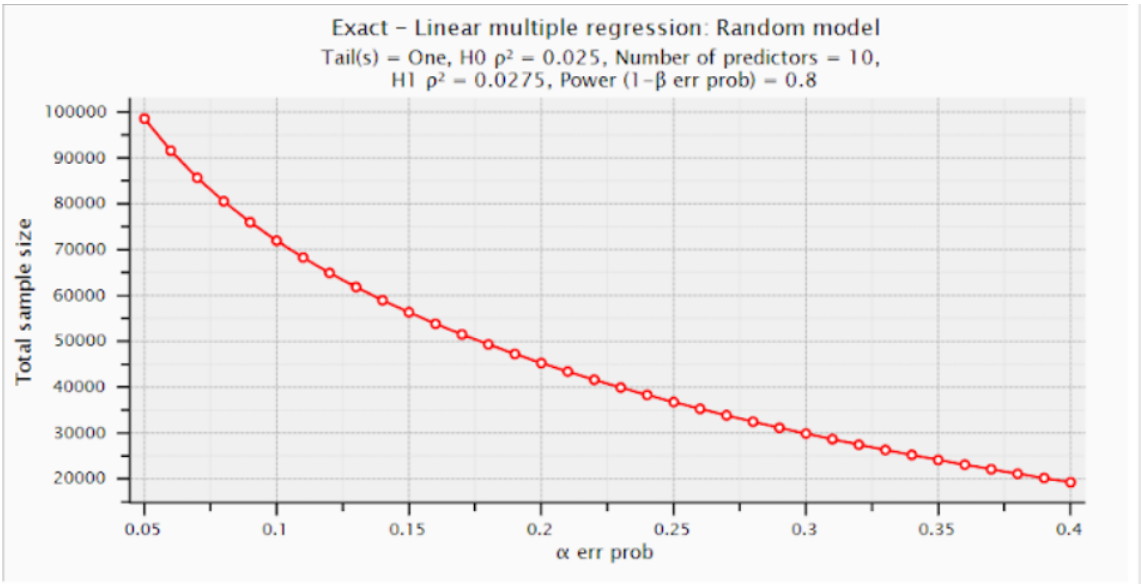


Figure 4 - The probability of the error decreasing when the sample size increases, considering an exact linear multiple regression with logistic regression and a one-tailed effect.

Inference criteria

Considering a two-tailed effect, we consider p <.10 (alpha = 0.10) as suggesting evidence for mental health status being associated with discrepancy.

Reliability and Robustness Testing

We will conduct sensitivity analyses using differing GHQ scoring thresholds for poor mental health, considering higher severity thresholds, and Likert rather than standard binarised item scoring.

For individuals named as providing emotional support to participants, Net4health also asked whether the participants would talk to them but hadn't or whether they had previously talked to them about their emotions. We will compare the findings of models including all perceived emotional support ties, and when restricting only to those where they had reported talking to them about emotions.

Exploratory analysis

We will investigate how differences in the use of the subdimensions of emotional social support (e.g. co-rumination, changing the subject, joking) might explain the occurrence of discrepancies within the Net4Health data set. Egos were asked for each of their perceived emotional support providing alters, on a scale of 1 to 5 how frequently they: changed the subject, made a joke, offered support, or talked about their own emotions. We will include these measures as tie-level covariates in the model to assess whether their inclusion attenuates any association between gender, mental health status, and discrepancy.

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Conflict of interest disclosure

The authors declare that they comply with the PCI rule of having no financial conflicts of interest in relation to the content of the article.

Knowledge of Data

Prior Publication/Dissemination

Heike Krüger: Worked as a research assistant in the SOCIALBOND project and was involved in the planning and implementation of the data collection. Her previous analyses with the SOCIALBOND data were focused on the social cognitive maps, friendship networks form free recall name generator as well as the individual-level attributes of mental health, loneliness, and demographics (for more information, see: https://orcid.org/0000-0003-4648-922X). She has had no prior access to the Net4Health dataset.

Thomas Grund: Currently also working on other publications based on the SOCIALBOND data. The analyses focus on the friendship networks from the free recall name generator as well as the individual-level attributes of mental health, loneliness, and demographics. He has had no prior access to the Net4Health dataset.

Mark McCann: has worked on Net4health data collection and analysis, and previously analysed individual level and network questions. These findings have been presented to participating schools, at Education and Health conferences and scientific conferences. He has not conducted analysis using dual perspectives on the emotional support questions.

Srebrenka Letina: has worked on Net4health data collection and analysis, and previously analysed individual level and network questions. These findings have been presented to participating schools, at Education and Health conferences and scientific conferences. She has not conducted analysis using dual perspectives on the emotional support questions.

Julie Riddell: has worked on Net4health data collection and developing the documentation and codebook for archiving the data. She has not conducted analysis using dual perspectives on the emotional support questions.

Claudia Zucca: has worked on Net4health data collection and analysis, and previously analysed individual level and network questions. These findings have been presented to participating schools, at Education and Health conferences and scientific conferences. She has not conducted analysis using dual perspectives on the emotional support questions.

Emily Long: has worked on Net4health data collection and analysis, and previously analysed individual level and network questions. These findings have been presented to participating schools, at Education and Health conferences and scientific conferences. She has not conducted analysis using dual perspectives on the emotional support questions.

Prior knowledge

Heike Krüger: Prior data access and analysis using the SOCIALBOND dataset. Access to the codebook and general study information for the Net4Health study, but no prior data access.

Thomas Grund: Prior data access and analysis using the SOCIALBOND dataset. Access to the codebook and general study information for the Net4Health study, but no prior data access.

Mark McCann: Prior access to the Net4Health dataset. Access to the codebook and general study information for the SOCIALBOND study, but no prior data access.

Srebrenka Letina: Prior access to the Net4Health dataset. Access to the codebook and general study information for the SOCIALBOND study, but no prior data access.

Julie Riddell: Prior access to the Net4Health dataset. Access to the codebook and general study information for the SOCIALBOND study, but no prior data access.

Claudia Zucca: Prior access to the Net4Health dataset. Access to the codebook and general study information for the SOCIALBOND study, but no prior data access.

Emily Long: Prior access to the Net4Health dataset. Access to the codebook and general study information for the SOCIALBOND study, but no prior data access.

Data, scripts, code, and supplementary information availability

Data availability

Socialbond: The datasets are not yet publicly available. Data is not publicly available yet but will be available after an embargo period at the GESIS research data repository ("Leibniz Institute for the Social Sciences").

Net4Health: The datasets are not yet publicly available. Data is not publicly available yet but is in preparation for submission to the UK Data Archive or the University of Glasgow repository. Social network data will only be made available under managed access. Data access requests can be made to Mark.McCann@Glasgow.ac.uk.

Codebook

Socialbond: The codebook is not publicly available yet. However, it will be available after an embargo period at the GESIS research data repository ("Leibniz Institute for the Social Sciences") and is now available upon request.

Net4Health: The codebook is not publicly available yet. However, it will be available after an embargo period at the UK Data Archive or the University of Glasgow research data repository and is now available upon request.

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