Abstract: considerable research has been devoted to examining the relationships between self-esteem and social support. However the exact nature and direction of these relationships is not well understood. We administered measures of self-esteem, and social support quantity and quality to 961 adolescents across 5 yearly time points (mean age 13.41 years). Structural equation modelling was utilised to test between a self-esteem antecedent model (self-esteem precedes changes in social support), self-esteem consequence model (social support precedes change in self-esteem), and a reciprocal influence model. Self-esteem reliably predicted increasing levels of social support quality and network size across time. In contrast, the consequence model was not supported. We discuss the implications of this for helping adolescents to develop higher quality social support structures.
A commonly held notion in our society is that what we believe about ourselves shapes our interactions with the world, including our social interactions with others. The incredible array of self-help books on self-esteem with alluring titles such as “Ten Days to Self-Esteem” (Burns, 1993) and “Loving yourself Loving another” (Cole, 2001) is testament to our fascination with the topic and the importance that we believe self-esteem holds for our lives. Indeed, self-esteem has long been held as an important concept worthy of scientific study with many thousands of related publications (Baumeister, Campbell, Krueger, & Vohs, 2003; Leary, 1999).

Self-esteem can be understood as the positive or negative evaluations that one holds towards oneself (Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995). Neff (2011) describes self-esteem as an “evaluation of our worthiness as individuals, a judgement that we are good valuable people” (Neff, 2011, p. 1). For adolescents, popular psychology suggests self-esteem is seen as a critical factor in their development, yet, empirical research suggests a more complicated picture. In particular, Baumeister et al (2003; 2005) suggest that self-esteem appears to be a consequence of other processes, rather than a driving force of positive outcomes for individuals.

This paper therefore seeks to address the following question: To what extent is self-esteem an antecedent or consequence of social support in adolescence? Despite considerable lay interest, relatively little empirical research has addressed this question and thus the temporal ordering of these constructs remains unclear. An antecedent model suggests that positive self-concept leads adolescents to actively develop and maintain positive social support networks. That is, high self-esteem adolescents believe they have social worth and consequently engage in behaviours that build social support. In contrast, people with low self-esteem may avoid social relationships to avoid rejection and thereby fail to build or maintain social support systems. A self-esteem consequence model, however, suggests that positive social support produces higher self-esteem, or greater sense
of social worth. That is, self-esteem may be a mere reflection of being more socially connected or valued.

*What is self-esteem good for?*

A vast literature has been devoted towards examining the positive consequences of self-esteem, as well as links between low self-esteem and poor mental health and problematic behaviour (e.g. for reviews see Baumeister, et al., 2003; Mann, Hosman, Schaalma, & de Vries, 2004). However, the majority of this literature has been cross sectional, where evidence of temporal ordering is not possible. Some longitudinal studies exist, supporting associations between low self-esteem and poorer mental health outcomes. For example the relationship between low self-esteem as a predictor for depressive symptoms has been established in a number of large, multi-wave longitudinal studies among adolescents and young adults. However depression did not predict subsequent self-esteem over time (Orth, Robins, & Roberts, 2008; Orth, Robins, Trzesniewski, & Schmitt, 2009). Other longitudinal studies for example, highlight the relationship between low self-esteem and hopelessness in childhood and a later risk of suicidal ideation in early adulthood (McGee, Williams, & Nada-Raja, 2001). Orth and colleagues (2012) cross lagged analyses suggested that self-esteem was better modelled as a cause of various life outcomes, as opposed to a consequence. Specifically self-esteem had a moderate effect on life time trajectories of affect and depression, small to moderate effects on relationship and job satisfaction and limited effects on health. Findings are not always consistent, with some authors reporting that self-esteem in adolescence is, at best, a weak predictor of outcomes in young adulthood, when controlling for other psychosocial factors (Boden, Fergusson, & Horwood, 2008).

More recently the concept of self-esteem has come under considerable debate (e.g. see Baumeister, et al., 2003; Crocker & Park, 2004). As highlighted by Baumeister and colleagues, “the question of causality goes to the heart of the debate about the self-esteem movement and interventions aimed at boosting self-esteem” (2003, p. 9). Comparatively few studies use rigorous
methods or longitudinal designs to better understand the direction of proposed relationships (Baumeister, et al., 2003; Dubois & Tevendale, 1999). Additionally, there is a small but growing literature highlighting the darker side of self-esteem, including for example, self-esteem being associated with narcissism and the need to feel superior to others (Crocker & Park, 2004; Neff & Vonk, 2009; Ryan & Brown, 2003). Other research suggests that the combination of aggression and high self-esteem in children can lead to rationalisation of their conduct and devaluing of others (Menon et al., 2007). Thus it is unclear to what extent self-esteem is beneficial for social well-being.

Social Support

Perceived social support can be defined as an individual’s subjective judgement that their social network will provide effective help during times of need (Lakey & Scoboria, 2005) and can be distinguished from received support, which refers to the receipt of actual support usually provided within a specific time frame (Uchino, 2009). Research into social support originally stemmed from an interest in the effects of this variable on chronic illness and disease outcomes (e.g. for reviews see Martire, Lustig, Schulz, Miller, & Helgeson, 2004; Schwarzer & Leppin, 1989). However this literature has grown considerably to focus on non-clinical populations, including for example the impact of social support on the elderly (Kasser & Ryan, 1999; Lang & Cartensen, 1994; Pinquart & Sörensen, 2000), adolescents (Cripps & Zyromski, 2009; Mackinnon, 2012; Parker, Lüdtke, Trautwein, & Roberts, 2012; Rigby, 2000) and employees (Brough & Pears, 2004; Nahum-Shani, Bamberger, & Bacharach, 2011). The importance of positive social connections has been well established with respect to physical health and psychological wellbeing (Deiner & Seligman, 2002; Uchino, Cacioppo, & Kiecolt-Glaser, 1996). Indeed, some researchers define positive relations with others as a specific component of wellbeing (Ryff & Singer, 2000).

Perceived support has been found to predict a range of beneficial outcomes among adolescents (e.g. Danielsen, Wiium, Wilhelmsen, & Wold, 2010; Sakiz, Pape, & Hoy, 2012;
Schneider, Tomada, Sébastien, Tonci, & de Domini, 2008; Wentzel, 1998) and likewise perceived low support has been associated with more problematic behaviours and emotional difficulties during childhood and adolescence (Demaray & Malecki, 2002). Cross-sectional research suggests that perceived support is more strongly related to self-esteem, when compared to received support (Goodwin, Costa, & Adonu, 2004; Goodwin & Hernandez-Plaza, 2000).

*Quality versus quantity of social support.* Related research in this area has stressed the importance of the *quality* (i.e., quality of relatedness) of social relations, over the *quantity* of social networks (i.e., the size of networks) regarding wellbeing outcomes (Kasser & Ryan, 1999; Pinquart & Sörensen, 2000; Ryan & Deci, 2001; Vandervoort, 1999). Along similar lines, Dennisen et al., (2008) in their study of social interactions and self-esteem found that having high quality social interactions was the strongest and most consistent predictor of self-esteem, when compared with interaction quantity (or duration of time spent with significant others). Dekovic & Meeus (1997) found that the positive quality of peer relations was associated with increased self-esteem, whereas quantity (defined as time spent in activities with peers) was negatively associated with self-esteem. However existing research has not specifically examined social support and the relative importance of quality social support relationships over quantity in adolescence. Nonetheless, it seems plausible that as adolescents progress towards emerging adulthood, they may place increasing importance on the quality of their relationships, when compared to the size of their social networks. Adolescence marks an important time with marked changes to social relationships. In particular the transition into high school is associated both with increasing independence from the family, as well as the development of new social networks, with some authors suggesting that peer relationships take on increasing importance during early adolescence (Furman & Buhrmester, 1992). Other research has highlighted the importance of peer social support as a predictor for both positive and negative behavioural outcomes, stressing the importance of these networks from middle school to high school (Wang & Eccles, 2012).
Social support and self-esteem in adolescence: what influences what?

There is relatively little longitudinal research that addresses the temporal ordering of self-esteem and social support. Cross-sectional research has led to hypotheses consistent with quite different temporal models with the majority of studies focusing on the broader concept of relationship quality, as opposed to social support. Most of this research suggests that the quality of social relationships (Dekovic & Meeus, 1997; Laible, Carlo, & Roesch, 2004; Ryan, Stiller, & Lynch, 1994) and perceived social support (Goodwin, et al., 2004) is associated with higher self-esteem. Others have considered a reciprocal relationship with each variable influencing the other (Dekovic & Meeus, 1997; Kinnunen, Feldt, Kinnunen, & Pulkkinen, 2008). However, research that progresses beyond cross sectional designs, examining directional influences between self-esteem and social interactions are scarce.

A notable exception to this includes the work of Leary and colleagues with a number of experimental (e.g. Leary, Haupt, Strausser, & Chokel, 1998; Leary, Tambor, Terdal, & Downs, 1995; Thomaes et al., 2010) and longitudinal papers (e.g. Denissen, et al., 2008) examining sociometer theory. Sociometer theory suggests that people are not motivated to maintain their self-esteem per se; rather they are motivated to increase their value and acceptance in relation to others. Self-esteem therefore acts as an internal, subjective ‘gauge’ of perceived relations and when lowered, individuals are motivated to pursue establishment of social connections in order to increase their self-esteem (Leary, 2005). Hence this theory suggests a self-esteem consequence model, with social interactions influencing self-esteem.

To date research on the sociometer has largely focused on cross lagged associations between social interactions and state self-esteem. Experimental studies have demonstrated support for sociometer theory and the consequence model, with self-esteem appearing to act as a ‘gauge’ reflecting individual’s perceptions of social relatedness, at least when examined within a laboratory setting (e.g. Leary et al., 2003; Leary, et al., 1998; Leary, et al., 1995). Regarding trait self-esteem,
Leary et al., (1995, study 5) found a negative correlation between trait self-esteem and perceived exclusion. Further Leary et al (1998, experiments 2 & 3) found that state self-esteem, but not trait self-esteem moderated reactions to rejection-acceptance manipulations. However research examining trait self-esteem and social interactions in naturalistic settings over an extended period (e.g., across adolescence) is limited.

Research in this area has been conducted by Dennisen et al., (2008) who tested sociometer theory across three levels including cross-lagged analysis at the intraindividual level and cross-sectionally at the interindividual and international levels. Cross lagged analyses supported associations between perceptions of relationship quality, but not quantity, and changes in state self-esteem (self-esteem as consequence). The finding was strongest for intimate relationships but was also significant with respect to family and friends. In contrast, the alternative pathway from state self-esteem to social interactions did not generally approach significance (antecedent model). Social interaction also emerged as the strongest predictor of trait self-esteem in the second study, although of course conclusions about the directional nature of these findings would be strengthened by longitudinal analyses (Denissen, et al., 2008). Research in this area, however, has focused almost exclusively on state self-esteem and it is thus not clear if the same pattern of relationships hold for more stable conceptions of self-esteem.

Longitudinal studies that examine cross-lagged associations between trait self-esteem and social interactions, as well as social support more specifically are limited. An exception to this includes the work of Kinnunen and colleagues (2008) who examined cross lagged associations between self-esteem and social support among adults at two time points. They found evidence for a reciprocal relationship with high self-esteem predicting high social support at age 42 and, to a lesser extent, high social support at age 36 predicted high self-esteem at age 42. One notable limitation was the exclusive focus on network size as a predictor and failure to include ratings of perceived quality of support networks. In another related study, Stinson et al., (2008) examined the
Asendorpf & Van Aken (2003) examined cross-lagged associations between relationship quality and self-esteem among 230 adolescents assessed at 12 years and again at 17 years. Relationship quality was a single index score based on perceptions of instrumental help, intimacy, esteem enhancement and reliability. Relationship quality at age 12 predicted global self-esteem at age 17 (after controlling for personality traits), but not vice versa, supporting the self-esteem as consequence model. More specifically self-esteem was influenced by perceived support from fathers (not mothers or friends). Limitations included the limited assessment schedule with 2 time waves, separated by an extended time period and different measures of self-esteem utilised at the two time points which may have compromised the findings.

In a related study, Caldwell and colleagues (2004) examined reciprocal influence models between early adolescents’ relational self-views (i.e. their social self-worth), peer engagement and peer stress (M = 11.7 years). Reciprocal processes were supported within this 3-wave longitudinal design covering a 1 year period. That is, negative views of social-worth predicted social disengagement among peers which, in turn, predicted peer stress. In addition, peer stress contributed to disengagement from peers and more negative views with respect to social self-worth. It is of interest to examine whether such findings hold when examining more time waves over an extended period in adolescence and specifically with respect to directional influence between global self-esteem and social support, not limited to peers.

Current research

In recognition of previous research limitations, the aim of the current study was to examine the longitudinal relationships between self-esteem and perceived social support network size and
social support quality utilising a 5 wave, 4 year design among Australian adolescents. More specifically, we aimed to examine 1) antecedent effects of self-esteem on change in social support, 2) consequence effects of social support on change in self-esteem. A third possibility was that both models held. That is, a reciprocal relationship existed between self-esteem and social support. Given that many data points across a considerable time frame were used, we also considered whether there was a consistent trend over the time period in these relationships, or whether the relationships between self-esteem and social support varied as participants progressed through adolescence. The potential moderating effect of gender was also considered.

We did not predict *a priori* that the antecedent, consequence, or reciprocal model would be more strongly supported, as limited prior evidence was available to support such claims. However, it was anticipated that social support quality would most strongly predict self-esteem and, likewise, that self-esteem would most strongly predict social support quality, when compared with social support network size as suggested by previous research (e.g. Dekovic & Meeus, 1997; Denissen, et al., 2008; Pinquart & Sörensen, 2000).

**Method**

*Participants*

During the course of five years a total of 961 adolescents participated in at least one wave of the study and were surveyed mid-year during grades 8 to 12. The sample consisted of participants from the Wollongong Youth Study who attended five Catholic High Schools in a Diocese in New South Wales, Australia. In Australia, nearly two thirds of non-government schools are Catholic, accounting for 21.5% of secondary schools (Australian Bureau of Statistics, 2012). The Diocese is concentrated on the city of Wollongong, but also includes schools within south-western metropolitan Sydney thereby ensuring a diverse socio-economic and cultural mix of participants. The mean age of participants at Time 1 was 13.41 years (SD = .53). Gender was evenly distributed among the 961 adolescents consisting of 51.2% males and 48.8% females.
Occupations for fathers included 35.2% professionals, 21.1% trades, 22.9% labourer/transport/production, 8.5% community service and 10.5% in sales or clerical roles. Reported occupations for mothers comprised 30.4% professionals, 0.9% trades, 4.6% labourer/transport/production, 9.5% community service and 33% in sales or clerical roles. In addition 1.8% of fathers and 21.6% of mothers were reported as homemaker or pensioner. Parent’s marital status was reported as 84.5% married or in a cohabiting relationship, 13.3% separated or divorced, 1.9% reported that a parent was deceased and 0.3% not known.

**Instruments**

**Self-esteem.** Global trait self-esteem was measured using the 10-item Rosenberg scale (RSE; Rosenberg, 1979). Participants were asked to indicate their agreement with statements such as, “generally I feel satisfied with myself” and “I think that I am a failure”. A binary forced response scale (“yes” or “no”) was utilised. This scale has been validated in previous research (Heaven, Ciarrochi, & Hurrell, 2010). The mean Cronbach’s alpha for the 10 item scale across the five time waves was $\alpha = .83$.

Item parcels were created for the purpose of latent variable analysis. Due to the large number of items in the RSE three item parcels were created each consisting of randomly selected items (two parcels containing three items and one parcel containing four items). For models where items measure a single construct, parcels can be created through random assignment of items to individual parcels (Coffman & MacCallum, 2005). Numerous authors (Bagozzi & Heatherton, 1994; Coffman & MacCallum, 2005; Kishton & Widaman, 1994; West, Finch, & Curran, 1995) have noted the advantages of using item parcels since they are more normally distributed, reliable, less influenced by unique characteristics of individual items and require the estimation of fewer parameters.

**Social support.** Perceived social support network size and quality were measured using a revised 4-item version of the Social Support Questionnaire (SSQ, Ciarrochi, Chan, & Bajgar, 2001;
For each item, participants listed the persons perceived to be available for support and then rated how satisfied they were with these supports using a 6 point rating scale (‘very dissatisfied’ = 1 to ‘very satisfied’ = 6). Participants are further asked to provide their relationship to the participant (e.g. friend, mother, brother, teacher). The four key areas of social support include: 1) who do you feel really appreciates you as a person, 2) who can you count on to help you out in a crisis situation, even though they would have to go out of their way to do so, 3) whose lives do you feel you are an important part of, and 4) who can you really count on for help. The revised SSQ has been validated in previous research with adolescents (Ciarrochi, Scott, Deane, & Heaven, 2003). The response scale ranged from 1 to 6 (“very dissatisfied” to “very satisfied”). The mean Cronbach’s alpha for the 4 social support quality ratings across the five waves was α = .86 (SD = .03). The Cronbach’s alpha for the four social support network size totals across the five waves was α = .89 (SD = .02).

Covariates. A number of adolescent and parental characteristics were included as covariates in the structural analyses. This included participant gender, Non-English speaking background (NESB), participant’s country of birth, parental country of birth, socio-economic status (SES) and IQ. Proxy for socio-economic status was taken from adolescent’s reports of their mother and fathers occupation status. Participants completed standardized numerical and verbal assessments which were included as a proxy for IQ in the structural analyses in keeping with past publications (Ciarrochi, Heaven, & Davies, 2007; Heaven & Ciarrochi, 2012). Whilst these tests are strictly classified as aptitude or ability tests as opposed to IQ tests, they do assess learning which has occurred up to the time of administration. Tests are curriculum based, administered by the NSW Department of Education and consist specifically of six numerical (numeracy, number, measurement, space, data, numeracy problem solving) and three verbal (writing, reading and language achievement) subtests. Scores on subtests were summed to provide a total verbal and total numeracy score for inclusion as covariates.
Procedure

Participation in the study was voluntary and required both school, parental and student consent to administer the questionnaires at each time wave (i.e. consent was renewed for each year of the study). The study was approved by the University ethics committee as well as the Catholic Diocese Schools Authority. Information sheets invited participants to take part in a study relevant to ‘Youth issues’. Questionnaires were completed anonymously within class under exam style conditions, in the presence of a school teacher as well as a study author.

Statistical Analysis

We used Mplus 6.1 to estimate a series of structural equation models representing the relationships between adolescents’ self-esteem, social support network size and perceptions of social support quality across the five years of the study. All analyses were conducted with latent variables for self-esteem and social support. A latent variables approach in SEM is advantageous as it enables measurement error to be estimated (Weston & Gore, 2006). To control for measurement error in the current research self-esteem, social support network size and social support quality were estimated by the use of latent variables. Specifically we used a parcelling procedure in accordance with Little et al., (2002). Robust Maximum Likelihood estimation was used such that standard errors and a chi-square test statistic were robust to non-normality. The data for this study had a nested structure with student’s nested within schools. Our research hypotheses were not focused on multi level hypotheses (e.g., interest in both student and school). However even when interest is at a single level, failure to account for the nested structure can result in underestimated standard errors and too liberal tests of statistical significance (see Hox, 2010 for a general introduction). To control for this we used a sandwich estimator in Mplus via the TYPE=COMPLEX command. This sandwich estimator adjusts standard errors for the effects of clustered data and provides more appropriate tests of statistical significance. Models were considered to fit the data well if a) the solution was well-defined, b) parameter estimates were consistent with the theory proposed, and c)
the fit indices were acceptable, giving emphasis to fit indices which are appropriate for larger sample sizes (Marsh, Balla, & McDonald, 1988; McDonald & Marsh, 1990). Specifically we provide three additional fit indices in addition to chi-square, considering its sensitivity to sample size. The Tucker-Lewis Index (TLI) and Comparative Fix Index (CFI) ≥ .90 and RMSEA < .08 were considered to provide evidence of model fit in accordance with commonly accepted criteria.

**Tests of invariance for Time and Gender**

Multiple-group SEM tests of invariance were used to test the generalizability of the results based on analyses of separate covariance matrices for males and females (measurement invariance across gender), as well as across the five waves (longitudinal measurement invariance). More specifically, measurement invariance across gender refers to the degree to which a test measures the same construct across varied groups, whereas longitudinal measurement invariance refers to whether a test reflects the same constructs in the same group but tested on different occasions (Widaman, Ferrer, & Conger, 2010). For the purposes of these analyses, we began with separate CFA models for the three factors (self-esteem, social support network size and social support quality) across the five measurement occasions and gender. We firstly tested invariance separately for gender and time for the three constructs. Following this we tested measurement across gender and time simultaneously for all three constructs. This last approach is akin to testing invariance across the interaction between gender and time and is thus the more conservative approach.

Tests of invariance commenced with the least restrictive configural model where all model parameters are freely estimated across time and between genders (or time and genders independently). If the hypothesis of configural invariance is not rejected, stronger forms of measurement invariance can be utilised.

In the second model, termed weak factor invariance, factor loadings of each indicator were constrained to be equal across time and for both boys and girls. If this hypothesis is retained it means that the constructs have the same meaning in each group. Weak factorial invariance is an
assumption of covariance based models such as cross-lagged models performed here (Nagengast et al., 2011). Finally in the third model, termed strong factorial invariance, both the factor loadings and the intercepts were held to be constant across groups. Strong factorial invariance is an assumption of analyses which compare or utilise latent means. If this hypothesis is retained it indicates that any changes in the mean levels of the indicators are adequately captured as changes in the underlying means of the latent construct (Little et al., 2007).

Evidence of invariance comes from comparing a well-fitting baseline model to alternate nested models. Invariance sensitivity to sample size of the chi-square that underlies the widespread use of fit indices (e.g., RMSEA, CFI, and TLI) does not merely relate to model fit but additionally log-likelihood ratio tests, that are often used to conduct such model comparisons. Therefore in this study we used the criteria by Cheung and Rensvold (2002) who suggest invariance between nested models if ΔCFI is ≤ .01 (we utilised the same criteria for the TLI) and the criteria described by Chen (2007) who suggest invariance between nested models if ΔRMSEA is ≤ .015.

**Missing Data**

As with most longitudinal data which covers a long time period attrition was a concern (see Graham, 2012). From the 961 participants a total of 281 had data from all five waves (53% female), 246 had data from four waves (50.4% female), 219 had data from three waves (46.6% female), 129 had data from two waves (44.5% female) and 86 had data from only one wave (41.9% female). With respect to each time wave the gender ratio was as follows at Time 1 (N=793, 49.1% female), Time 2 (N=786, 48.6% female), Time 3 (N=778, 49.7% female), Time 4 (N=565, 52.5% female) and Time 5 (N=468, 51.9% female).

Typically, attrition leads to data that are not missing completely at random and thus parameter estimates may be biased particularly when traditional methods such as listwise deletion are used (see Enders, 2010). Of particular concern are selectivity effects where individuals with certain characteristics are more likely to remain within the sample across time waves. We compared
those participants who completed all 5-waves of data with those who completed less than 5 time waves on the key variables of self-esteem, social support quality and network size for each Time wave (see Table 1). As can be viewed from Table 1 the only significant difference between completers and non-completers was for social support network size for Grade 9 (p = .05). Moreover effect sizes were small for all comparisons (d= ≤ .20). Completers and non-completers did not differ by gender for Grades 8 (phi =.05), 9 (phi =.04), or 10 (phi =.06) but were more likely to be female at Grade 11 (phi =.10) and Grade 12 (phi =.08). While selectivity effects were present the differences were typically small. This was not surprising given that the unit of selection was school and thus random factors like absenteeism on the day of testing or participants changing schools accounted for much of the attrition. Nevertheless, to deal with these missing data we used full-information-maximum-likelihood estimation (FIML) in contrast to traditional listwise deletion approaches. FIML uses all the available information for parameter estimation (Enders, 2010).

Results

Measurement invariance across time and gender

Table 2 reports the measurement invariance for time and gender tested separately as well as simultaneously. When testing gender and time separately Models 1-3 showed a good fit to the data. Since testing gender and time simultaneously is the most stringent test for measurement invariance we will focus on this invariance test. The configural invariance model for gender and time showed a good fit to the data. Subsequently the fit for the weak factorial model was similar and within the criteria specified by Chen (2007) and Cheung & Rensvold (2002) indicating that the latent constructs had the same meaning for males and females and the same meaning over time (ΔRMSEA= .01, ΔCFI= .01, ΔTLI= .00). Weak factorial invariance is an assumption of covariance based models (e.g., autoregressive cross-lag models). Finally the strong factorial model for gender and time held indicating that any changes in the mean levels of the indicators for males and females
were adequately captured in the mean levels for the latent constructs and further changes in the mean level of indicators over time were adequately captured in the mean levels of the latent constructs (ΔRMSEA = .01, ΔCFI = .00, ΔTLI = .01). Since the strong factorial model held when testing time and gender simultaneously these constraints were used in subsequent analyses.

Changes in constructs over time and by gender

Table 3 provides the means and SD for all key variables self-esteem, social support network size and social support quality across the five waves. Self-esteem dropped in Grade 9, stayed relatively stable in year 10, increased slightly in Grade 11, before dropping again in Grade 12. Social support network size increased most dramatically during Grades 9 and 10, and less so from Grade 10 to 11, before decreasing somewhat in year 12. Finally social support quality stayed relatively stable during Grades 9 and 10, increased somewhat during Grade 11 and remained fairly stable during Grade 12.

Network size and support type

Social network size reported across time by gender and support type (i.e. parental, peer, sibling, extended family, other support) is available in Table 4. A small number of adolescents reported receiving support from ‘no one’ in grades 8-12 (mean = 2.8, SD = 1.72). This included 6 students in grade 8 (5 of whom were male), 1 male student in grade 9, 2 students in grade 10 (1 male, 1 female), 3 male students in grade 11 and 2 male students in grade 12.

Evaluation of Structural Models

In the current study we tested a series of increasingly restrictive structural equation models in order to identify the most parsimonious model concerning the longitudinal relationships between self-esteem, social network size, and social network quality (see Figure 1 for conceptual illustration). The autoregressive paths, or latent factors predicting themselves at later time points, provide information about relative stability of constructs, with higher values indicating higher
stability. Conversely, the paths measured across latent variables provide information about the effect of one variable on change in another variable over time (Martens & Haase, 2006).

With data spanning more than two time periods a number of models are possible including autoregression and cross-lag paths spanning more than a single time lag. The aim of the current research was not to establish the best fitting model, but rather to identify the most parsimonious model which adequately represented the data. More specifically this is achieved by comparing Model 1 (baseline model) to subsequent models and observing whether the fit for each subsequent model (which is a product of constraining parameters) is not significantly worsened based on specified cut off values.

We tested a series of four models in which successive nested models were increasingly parsimonious (see Figure 1). Model 1 tested a fully forward model in which latent factors at Time 1 predicted all latent variables at each subsequent time point (and similarly for Time 2, Time 3 and Time 4). This model is equivalent in degrees of freedom and fit to a CFA model in which all latent factors are correlated. Model 2 maintained all autoregression paths but constrained the cross-lag effects to single year spans (e.g. from Time 1 to Time 2 but not Time 1 to Time 3). Model 3 constrained both autoregression and cross-lag to a single year span. Finally, Model 4 constrained all autoregression and cross-lag effects from Model 3 to be consistent across time. This model was thus a test of whether the relationship between self-esteem and the social network and social support quality constructs had consistent developmental effects across time and was the most parsimonious solution. Model 1 was used as a baseline model from which all subsequent models were compared using the invariance criteria above. The aim of this approach was to identify the most parsimonious model that still provided an appropriate account of the data.

As can be seen from Table 5 all models provided an adequate fit to the data. Model 1 as determined by necessity (greater number of parameters and the least constraints) provided the best fit with fit statistics decreasing somewhat for each subsequent model (see chi-square values in Table 5).
5). Utilising criteria specified by Cheung & Rensvold (2002) and Chen (2007) when exploring ΔCFI, ΔTLI, and ΔRMSEA, evidence for invariance was present up to and including Model 4. Model 4, the most parsimonious model, had satisfactory fit which changed little from the baseline fully forward model. This strongly suggests that the relationship between self-esteem and social network size and quality had consistent developmental effects across time. The coefficients for Model 4 are reported in Figure 2.

**Antecedent and consequence effects for self-esteem**

All three constructs (self-esteem, social support quality and social support network size) over five time periods were fitted within the same model (see Figure 1 for conceptual diagram). Figure 2 displays key findings from Model 4 which was the most parsimonious solution. Standardized coefficients are reported for all cross-lags and autoregressive paths. For the results from Model 4 we provide two standardized estimates. Beta 1 ($\beta_1$) is an effect size based on pooled standard errors from across all time lags taken from averaging the parameter specific standardization coefficients obtained from Mplus. We also report effect size ranges or Beta 2 ($\beta_2$) based on time lag specific standard errors.

In brief the effect of self-esteem on change in both social support network size and social support quality had significant and consistent developmental effects across time. Most notably, self-esteem predicted increasing levels of social support quality across time ($\beta_1 = .13; \beta_2$ range = .12-.13, $p < .001$). In addition, self-esteem emerged as a significant predictor of social network size across time ($\beta_1 = .10; \beta_2$ range = .10-.11, $p < .001$). In contrast the consequence model, or effect of social support network size on change in self-esteem, was not supported across time ($\beta_1 = .02; \beta_2$ range = .02-.03, $p = \text{NS}$). Similarly, the effect of social support quality on change in self-esteem was not supported across time ($\beta_1 = .01; \beta_2$ range = .01-.01, $p = \text{NS}$).

We compared Model 4 for girls and boys to examine whether autoregression and cross-lag effects were the same across gender. Using the delta method to compare these structural paths for
boys and girls, gender generally did not moderate the relationship between self-esteem and social network size or quality. The single exception to this was for social support satisfaction predicting social support network size where there was a small but significant difference, in which this relationship was significant for males but not for females. The delta method is a means of approximating standard errors for a transformation of a set of parameter where the variance-covariance matrix of the parameters is known (Oehlert, 1992). In the current case the transformation of interest was the difference between two cross-lagged paths ($\beta_1 - \beta_2 = Diff_{\beta_1,\beta_2}$) where standard errors were required to test whether this difference was significantly different from zero (i.e. testing the hypothesis that the parameter estimates were of different magnitudes).

Sensitivity analysis including participants with two or more waves of data only. It is considered appropriate to include data from all participants when utilising full-information-maximum likelihood estimation (FIML) such is used here (Enders, 2010; Graham, 2012). Nonetheless as an additional precaution and to ensure the robustness of our findings we re-ran the analyses including only those participants who had data for two or more waves (N=875). The findings of this sensitivity analysis with the reduced subset of participants indicated that changes to coefficients were minimal in all instances and were in keeping with findings reported above and in Figure 2. Indeed averaged coefficients for the cross-lags were identical in almost all instances. Self-esteem predicted increasing levels of social support quality ($\beta = .12, p < .001$) and social network size across time ($\beta = .10, p < .001$). In contrast social support quality and network size were not found to predict changes in self-esteem across time ($\beta = .01, NS$ and $\beta = .02, NS$ respectively.)

Discussion

This study employed a longitudinal 4-year, 5-wave design which aimed to clarify the directional nature of the relationships between adolescents’ self-esteem and their perceptions
regarding social support. The broad findings suggest that how adolescents feel about themselves influences both their perceptions of social support quality, as well as their social support network size, albeit to a lesser degree.

Specifically, self-esteem reliably predicted increasing levels of social support quality and social support network size. Importantly, a model in which this effect was consistent over time provided an adequate account of the data indicating consistency over the 5 time periods. As anticipated, this finding was most reliable for the relationship between self-esteem and perceived quality of support, when compared with individuals’ perceptions of the size of their support network.

In contrast, the consequence model for self-esteem was not supported. That is, the effect was not significant in the case of social support quality and social network size. This is somewhat surprising considering the growing literature supporting sociometer theory and established relationships between individuals’ social relations and state fluctuations in self-esteem (e.g. Denissen, et al., 2008; Leary, et al., 1998; Leary, et al., 1995). Unlike many previous studies, ours focused on trait self-esteem and perceptions of social support, as one aspect of interpersonal functioning within a longitudinal 5-wave design during adolescence.

Existing research on sociometer theory has been directed towards examining the quality of social relations in general and, in particular, experiences of inclusion and exclusion in interpersonal interactions. Commonly this has been within experimental designs focused on adult populations with state based measures of self-esteem (e.g. Leary, et al., 2003; Leary, et al., 1995). Cross-lagged analyses have not focused on the relationships between trait self-esteem and social interactions. Our findings in support of the antecedent model are inconsistent with sociometer theory which proposes that “self-esteem has no more causal influence on behavior than the fuel gauge has on the operation of a car” (Leary, 2003, p.273). Indeed, our findings suggest that global perceptions of self-worth do influence adolescents support networks, including both perceived quality and network
size, in a manner that is consistent across high school. Of course, this does not imply that self-esteem does not develop over time, within a social context, and in response to an individual’s social context.

With respect to existing longitudinal studies in this area, our findings are partially consistent with the work of Kinnunen and colleagues (2008) who found that self-esteem at age 36 predicted social support at age 42. However, these authors also found that, to a lesser degree, social support predicted self-esteem. It is possible that these differences could be attributed to a number of factors such as the age of the participants, as well as methodological differences such as the limited time waves and exclusive focus on network size. Our research builds on this former work by demonstrating the importance of self-esteem for perceived social support quality, relative to support network size.

Our findings diverge from those of Asendorpf & Van Aken (2003) in one of the only known cross-lag studies examining relationship quality and self-esteem among adolescents. This particular study supported a consequence model with relationship quality predicting self-esteem. However, there were a number of methodological differences with respect to the design and analysis which may, in part, account for our divergent findings. For example the former paper had a different assessment of social support, a younger starting time period (12 years), smaller sample, and only two assessments across five years. The strength of our study is the use of SEM and five assessments across five years.

The finding that self-esteem emerged as the stronger predictor of social support quality may in part reflect the increasing importance placed on emotional closeness during this developmental period, when compared to the early adolescent years (Buhrmester, 1990). For example it is possible that holding more positive self-beliefs in later adolescence may lead to a greater confidence in managing relationships, resulting in a greater tendency towards developing desired intimate and close connections, in turn leading to increases in perceived social support quality. It should be noted
that these suggestions are tentative and were not directly examined in this study. Concerning gender there was no difference in the relationship between self-esteem and social support when examined by gender. This is important as it suggests that the self-beliefs of both males and females predict the perceived quality of their social supports, as well as the size of their social networks across adolescence. Consequently practical implications discussed in the following section are equally relevant to both males and females, although of course future research is needed, both to confirm and build on our findings.

Practical implications

Baumeister and colleagues (2003) argue that the emphasis on ‘self-esteem boosting’ interventions is not empirically supported and specifically that self-esteem has not been shown to predict quality or quantity of social interactions. In contrast, Swann and colleagues (2007) contend that “self-views do matter” and consequently empirical research should be devoted towards the development of interventions to promote self-esteem. The present study is consistent with the latter argument, that is, self-esteem appears to be generally beneficial. However, what our study and previous longitudinal studies do not address is the best way to raise self-esteem. Baumeister et al., (2003) criticized self-esteem interventions that seek to increase self-esteem in a non-contingent way (e.g. telling everybody they are special regardless of what they do). However, we would suggest that these criticisms of certain kinds of self-esteem intervention should not be taken as evidence that self-esteem, as a construct, has no utility. There are ways to influence self-esteem that don’t require the practitioner to “build” self-esteem in non-contingent ways. Specifically, a new wave of mindfulness-based interventions seeks to alter one’s relationship to self-relevant thoughts, rather than altering content.

For example, Acceptance and Commitment Therapy (ACT) teaches people to create distance from, and to let go, of unhelpful negative self-concepts (Ciarrochi & Bailey, 2008). These negative self-concepts then have less of an influence on future behavior (Forman et al., 2007;
Similarly, self-compassion interventions seek to help people to accept their flaws and treat themselves kindly when they are experiencing self-criticism (Neff, 2011). ACT and self-compassion interventions seek to alter one's relationship to thoughts, so that those thoughts occur but no longer have power over behavior. These interventions are quite different from “content” interventions that seek to increase the positivity of thoughts. Baumeister and colleagues (2003) are premature in their conclusions that self-esteem does not predict the quality or quantity of social interactions. Our research suggests that self-esteem may be a worthy target of intervention to influence social support networks; moreover, our data suggest that intervening at any stage during the high school years may be of benefit.

Limitations and future directions

A major limitation was that it was not possible to disentangle state versus trait effects in this study as time periods were a year apart. Considering our findings within the context of existing research (e.g. Leary and colleagues (1995, 1998, 2003) work on the sociometer), future longitudinal studies should seek to examine cross-lagged associations between both state and trait self-esteem, across shorter time periods. Further to this, whilst the current study provides valuable information regarding the antecedent and consequence model (i.e. whether self-esteem or social support is likely to precede the other) our study still has a limitation common to practically all real world, non-experimental research; that is the possible presence of third-variable explanations for the observed effects (Morgan & Winship, 2007).

A limitation of the Rosenberg self-esteem scale is that a dichotomous response format was used in this study, rather than the 4-point Likert scale typically associated with this instrument. A potential advantage of Likert scales over the dichotomous response format is that an increase in points allows for greater variance. Some research suggests that whilst dichotomous scales may rate highly on ease of use, they are likely to be rated low with regards to facilitating adequate expression of feelings and reliability. Improvements in reliability may be most evident when moving from two
to six or seven point scales (Preston & Colman, 2000). Of course practicalities such as time demands and ease of use must also be considered. Additionally social support quality was not reported separately for individuals nominated within a particular participant’s social network, but rather as an average indicator of quality across all nominated persons within that network. Considering our finding that self-esteem most reliably predicted social support quality, future research would benefit from obtaining further detail with regard to the nature of that support (e.g. peer, parents etc.). This would allow, for example, analysis of self-esteem and social support quality separately by support type to ascertain whether perceived quality for parental and peer support contributes differentially to outcomes. Existing research in this area is limited. However one cross sectional study demonstrated that both parental and peer attachment contribute uniquely to adolescents self-esteem (Laible, et al., 2004). In the broader domain of school engagement, the combination and degree of support from peers, teachers and parents has been found to contribute differentially to outcomes. Considering school outcomes for example, adolescents most at risk have been found to be those with limited parental and teacher support paired with strong peer support (Wang et al., 2012).

This study focused specifically on perceived social support, and future research would benefit from examining other aspects of social relations such as belongingness and social inclusion and directional relationships with trait self-esteem within multi wave, longitudinal designs. Such a focus would also coincide more closely with sociometer theory. Future research may also benefit from attempts to include more objective ratings of received social support, for example, from significant others including parents, teachers and peers. Consistent with O’Mara et al (2006), we also recommend that future researchers consider utilizing measures of both domain specific and global self-esteem.

Whilst acknowledging the limitations of the current research, this study has a number of notable strengths. Firstly, the study involved a longitudinal four year, five wave design with more
time waves and a notably larger sample than existing studies in this area. Secondly, we employed
rigorous statistical procedures, involving Structural Equation Modeling which allowed us to partial
out measurement error and examine directional influences between self-esteem and perceptions of
social support quality as well as social support network size.

Conclusions

Our research suggests that how adolescents view themselves predicts the perceived quality
of their social support as well as the size of that support network, albeit to a lesser degree across the
high school years. In contrast, our findings do not support a consequence model. Further
longitudinal research is clearly needed both to confirm and build on the research presented here,
including examination of directional influences. Intervention research is needed to establish whether
experimentally increasing self-esteem leads to subsequent increases in social support.
Table 1.
Comparisons on key variables for completers and non-completers by Grade

<table>
<thead>
<tr>
<th>Grade</th>
<th>Self esteem</th>
<th>Social support quality</th>
<th>Social support network size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Completers</td>
<td>Non completers</td>
<td>Completers</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
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<tr>
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<td>.82</td>
<td>.21</td>
<td>.81</td>
</tr>
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<td>.79</td>
<td>5.35</td>
</tr>
<tr>
<td></td>
<td>5.57</td>
<td>2.36</td>
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<td>9</td>
<td>.78</td>
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<td>.77</td>
</tr>
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<td></td>
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<td></td>
<td>6.22</td>
<td>2.26</td>
<td>6.04</td>
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</tbody>
</table>

*a effect size Cohen’s d
Table 2.

**Gender and Longitudinal Invariance Statistics**

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>df</th>
<th>RMSEA</th>
<th>CFI</th>
<th>TLI</th>
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<td><strong>Gender Invariance</strong></td>
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<tr>
<td>M1 – Configural</td>
<td>3935</td>
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<td>M2 – Weak Factorial</td>
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<tr>
<td>M3 – Strong Factorial</td>
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<td></td>
<td></td>
</tr>
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<td><strong>Longitudinal Invariance</strong></td>
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<td></td>
</tr>
<tr>
<td>M1 – Configural</td>
<td>1800</td>
<td>1215</td>
<td>.022</td>
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<td>.959</td>
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<tr>
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<td>.967</td>
<td>.960</td>
</tr>
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<td></td>
</tr>
<tr>
<td>M1 – Configural</td>
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<td>.926</td>
<td>.912</td>
</tr>
<tr>
<td>M2 – Weak Factorial</td>
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<td>2539</td>
<td>.034</td>
<td>.927</td>
<td>.915</td>
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<tr>
<td>M3 – Strong Factorial</td>
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<td>2571</td>
<td>.034</td>
<td>.925</td>
<td>.913</td>
</tr>
</tbody>
</table>

*a* Chi square, *b* Root Mean Square of Approximation, *c* Comparative Fit Index, *d* Tucker-Lewis Index
### Table 3

**Descriptives for key variables reported by grade**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Self esteem</th>
<th>Social support quality</th>
<th>Social support network size</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
</tr>
<tr>
<td>Grade 8</td>
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</tr>
<tr>
<td>Grade 9</td>
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<td>5.32</td>
</tr>
<tr>
<td>Grade 10</td>
<td>0.76</td>
<td>0.25</td>
<td>5.35</td>
</tr>
<tr>
<td>Grade 11</td>
<td>0.81</td>
<td>0.23</td>
<td>5.43</td>
</tr>
<tr>
<td>Grade 12</td>
<td>0.77</td>
<td>0.25</td>
<td>5.41</td>
</tr>
</tbody>
</table>

### Table 4

**Social support network size reported by support type and gender**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Parental support</th>
<th>Peer support</th>
<th>Sibling support</th>
<th>Extended family</th>
<th>Other support</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Girls</strong></td>
<td><strong>SD</strong></td>
<td><strong>Boys</strong></td>
<td><strong>SD</strong></td>
<td><strong>Girls</strong></td>
</tr>
<tr>
<td>8</td>
<td>1.55</td>
<td>0.59</td>
<td>1.58</td>
<td>0.61</td>
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</tr>
<tr>
<td>9</td>
<td>1.41</td>
<td>0.32</td>
<td>1.47</td>
<td>0.66</td>
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<td>10</td>
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<td>11</td>
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<td>1.46</td>
<td>0.73</td>
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<tr>
<td>12</td>
<td>1.44</td>
<td>0.62</td>
<td>1.37</td>
<td>0.76</td>
<td>2.96</td>
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</table>
Table 5

Model 1 to 4 for self-esteem, social support network size and social support quality

<table>
<thead>
<tr>
<th>Model</th>
<th>X²&lt;sup&gt;a&lt;/sup&gt;</th>
<th>df</th>
<th>RMSEA&lt;sup&gt;b&lt;/sup&gt;</th>
<th>CFI&lt;sup&gt;c&lt;/sup&gt;</th>
<th>TLI&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>M1 Fully forward model</td>
<td>2652</td>
<td>1959</td>
<td>.02</td>
<td>.96</td>
<td>.96</td>
</tr>
<tr>
<td>M2 Single year span cross-lags only</td>
<td>2712</td>
<td>1998</td>
<td>.02</td>
<td>.96</td>
<td>.96</td>
</tr>
<tr>
<td>M3 Single year span structural paths only</td>
<td>2820</td>
<td>2013</td>
<td>.02</td>
<td>.96</td>
<td>.95</td>
</tr>
<tr>
<td>M4 Constrained structural paths</td>
<td>2904</td>
<td>2040</td>
<td>.02</td>
<td>.96</td>
<td>.95</td>
</tr>
</tbody>
</table>

<sup>a</sup> Chi square, <sup>b</sup> Root Mean Square of Approximation, <sup>c</sup> Comparative Fit Index, <sup>d</sup> Tucker-Lewis Index
Figure 1 Conceptual diagram-Models 1-4

Note. This illustration is provided to facilitate understanding of structural models, hence all latent variables and time waves are not displayed. Model 1: All latent factors at Time 1 predicted all latent factors at Times 2 to 5 (similarly, all latent factors at Times 2, 3, and 4 predicted all latent factors at later waves). Model 2: All autoregression paths maintained but constrained cross-lag effects to single year span. Model 3: Constrained autoregression and cross lag effects from Model 3 to be consistent across time. Model 4: Paths with the same letter were constrained to be equal.
Figure 2. Model 4-Constrained structural model displaying standardized coefficients

Note. In Model 4 the unstandardized coefficients for the cross-lag paths were set equal. In order to provide a common effect size for this estimate we provide a single standardized coefficient that utilises a pooled standard error taken from averaging the parameter specific standardization coefficients obtained from Mplus. NS = non-significant
References


Australian Bureau of Statistics. (2012). *Yearbook Australia: Primary and Secondary Education Schooling Structures (Document 1301.0).* Canberra: Government Printer


