Social Competence in Children with Chronic Illness: A Meta-analytic Review

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Objective To conduct a meta-analysis of social competence in children with a chronic illness.

Methods The meta-analysis included 57 studies comparing levels of social competence in children with chronic illness to those of children without chronic illness. A random effects model was used to calculate overall effect, subgroup, and meta-regression analyses. Results Overall, the meta-analysis calculated 90 unique outcomes, producing a summary standardized mean difference of $d = -0.44$, 95% confidence interval (95% CI) $-0.52$ to $-0.36$ indicating a medium overall effect for decrease social competence. Chronic illness, measure, and informant moderated social competence outcomes. Conclusions The impact of chronic illness on youth varied by individual child factors (e.g., gender, chronic illness type) and by measurement features such as informant and measure type. The current study demonstrates a need for further research of the assessment of social competence and has implications for the development of social skills programs for children with chronic illness.

Key words chronic illness; meta-analysis; pediatric; social competence.

Introduction

Chronic illness (CI) in childhood can be understood as a heterogeneous category encompassing diverse diseases with varying degrees of impact on children and their families (Newacheck & Taylor, 1992). Perrin and colleagues (1993) operationalized CI as a disease lasting, or expecting to last, at least three months and demonstrating some impact on the child, such as functional impairment or a greater than expected need for medical attention given a child’s age. A disease implies “a condition of the body or one of its parts that impairs normal functioning and is typically manifested by signs and symptoms” (Disease, 2011). According to these definitions, examples of chronic childhood diseases include diabetes, asthma, and cancer. Obesity does not meet this definition because obesity is regarded as a chronic medical condition, not a disease. However, given the current epidemic status (Wang & Beydoun, 2007) and its impact on diseases in adolescence and adulthood (Baker, Olsen, & Sorensen, 2007; Nathan & Moran, 2008), obesity was also included in the current study.

Despite the differing definitions of CI, it is undeniable that chronic medical conditions affect many children. One out of two Americans suffer from a chronic illness (Centers for Disease Control and Prevention, 2010). Prevalence rates of CI in children vary greatly depending on definitions used, ranging from 3.5% to 35.3% (van der Lee, Mokkink, Grootenhuis, Heymans, & Offringa, 2007). Rates of childhood CI have steadily increased from 1.8% in 1960 to 7% in 2004, mostly as a result of advances in healthcare, which have allowed children to live longer, and increased incidences of obesity and asthma (Van Cleave, Gortmaker, & Perrin, 2010).

Children with CI may be at increased risk for developing social deficits compared to their healthy peers because of limitations associated with their illnesses, such as fewer
social opportunities, restricted physical capabilities, or feelings of alienation from peers (La Greca, 1990). Establishing positive peer relationships is an important developmental task in childhood (Parker & Asher, 1993) with implications for later social adjustment. Studies have found high-quality friendships and peer acceptance to relate to higher levels of adjustment in children and adolescents (Ladd & Price, 1987; Waldrip, Malcolm, & Jensen Campbell, 2008). Emotional support from peers may serve as a protective factor against risk for social isolation in children with CI. For example, La Greca and colleagues (1992) found that peer emotional support for children with diabetes helped them feel more accepted. Therefore, understanding levels of social functioning in relation to pediatric CI is important for improving the outcomes of children who suffer from chronic medical conditions.

The quality of social interactions with other children has been broadly defined as social competence (Hops, 1983). Other definitions of social competence proposed in the literature include: an evaluation of a child’s level of social functioning (Rose-Krasnor, 1997) and the relationship between social information-processing patterns and children’s social behavior (Dodge, Pettit, McClaskey, Brown, & Gottman, 1986). Much like the term “chronic illness,” social competence is a nebulous construct in the literature that lacks an agreed-upon operational definition. Several reviewers of the literature have proposed heuristics for organizing and understanding the disparate theoretical and operational views of social competence (Cavell, 1990; Dirks, Treat, & Robin Weersing, 2007; Rose-Krasnor, 1997).

Cavell (1990) proposed a tricomponent model of social competence comprised of social adjustment, social performance, and social skills. Later, Rose-Krasnor (1997) incorporated Cavell’s subconstructs into four operational approaches: social skills, sociometric status, relationship quality, and functional outcomes. These categories provide a useful method for comparing and contrasting the disparate constructs tapped by existing measures of social competence. More recently, in an attempt to integrate theoretical, measurement, and intervention models for social competence in youth, Dirks and colleagues (2007) proposed a four-factor model of social competence based on four predictors associated with social competence—child, behavior, situation, and judge. According to the model, each predictor would explain unique variance in social competence, and the total variance would also include interactions among the predictor variables. Given the complexity inherent in the conceptualization and measurement of social competence, numerous measures tapping different constructs of social competence have been used to date to assess children’s social functioning.

Several comprehensive reviews of the literature on the relationship between CI and social competence in children have been written (Reiter-Purtill, Waller, & Noll, 2010; Spirito, DeLawyer, & Stark, 1991). In one such review, Spirito and colleagues (1991) concluded that some children with CI appeared to experience social difficulties as rated by teachers and classmates. However, studies showing deficits in social competence (Deasy-Spinetta, 1981; Sawyer, Crettenden, & Toogood, 1986) only included samples of children with cancer. The authors concluded there was a need for more research in order to better ascertain the impact of social competence on children with different types of CIs.

Since 1991, the pediatric psychology field has responded to Spirito et al.’s (1991) call for further research; however, the literature has narrowly focused on a select few CI categories (e.g., cancer, sickle cell) and includes many discrepant findings even within individual disease types. For example, one study of children with multiple types of cancer found children’s social competence levels to be the same or higher than matched healthy controls (Deasy-Spinetta, 1981; Noll et al., 1999). Conversely, other studies found poor social competence outcomes among child survivors of cancer (Barrera, Shaw, Speechley, Maunsell, & Pogany, 2005; Vannatta, Zeller, Noll, & Koontz, 1998). Studies investigating sickle cell disease found similar discrepancies (Lemanek, Horwitz, & Ohenefrempong, 1994; Noll, Reiter-Purtill, Vannatta, Gerhardt, & Short, 2007). These disparate findings within CIs demonstrate the need for further study of moderators, such as ethnicity, gender, and age, in order to examine whether they may account for some of the group differences.

Contrary to the previously discussed discrepant findings in the literature, studies investigating juvenile arthritis have demonstrated findings that are somewhat more consistent across studies. For example, Huygen, Kuis, and Sinnema (2000) found no differences on parent reports of social competence for children or adolescents with juvenile chronic arthritis (JCA) compared to healthy peers. In another study of children and adolescents with juvenile rheumatoid arthritis (JRA), children with JRA showed no differences on social competence compared to their matched peers, despite having participated in fewer reported social activities (Feldmann, Weglage, Roth, Foell, & Frosch, 2005). Despite the relative consistency across studies of children with arthritis, it is still difficult to compare results since each study employed varied types of social competence measures. Given the heterogeneous nature of children with CI as a group (van der Lee, et al.,
2007) and the methodological differences among studies, results on differences in social competence between children with CI and healthy peers currently present discrepancies. A systematic review of the literature is necessary to synthesize such a large body of empirical research with so many heterogeneous factors. Meta-analytic techniques provide a robust measurement tool for assessing the impact of social competence on children with CI while also serving as a review on the advancements of the literature in a particular area of research. Meta-analysis allows for statistical testing of effect sizes and potential moderators in order to more fully interpret the empirical evidence provided by previous research studies (Borenstein, Hedges, Higgins, & Rothstein, 2009). In the current study, we sought to explore the following research questions:

1. Is the overall social competence of children with CI different than that of healthy comparisons, and if so, how large is that difference?
2. Does social competence vary by the category of CI?
3. Does social competence in children with CI vary according to demographic features such as age, ethnicity, or gender?
4. Does social competence in children with CI vary according to the type of informant (e.g., parent, self)?

**Methods**

**Identification of Studies**

Potential studies for inclusion in our meta-analytic review were obtained through literature searches using the PsycInfo and Web of Knowledge electronic databases. The terms chronic illness and physical disorder, as well as associated truncated versions, were used in all possible combinations with the terms social competence, social skills, interpersonal skills, and social functioning. Searches were limited to studies published in 1976 or later, or after the first year of publication of the *Journal of Pediatric Psychology*. Reference lists were examined and forward searches were completed for all articles that were chosen for inclusion from the aforementioned literature searches. Finally, manual searches were completed of the *Journal of Pediatric Psychology* and the *Journal of Behavioral and Developmental Pediatrics*.

The authors mutually decided on the following criteria for inclusion in our meta-analysis: (a) studies needed to be empirical and original, (b) included studies needed to be in the English language, (c) studies needed to have the age of participants be below 18, (d) studies needed to have a CI group that fit our definition of a chronic illness, (e) studies needed to contain a comparison group or normative data so that effect sizes could be calculated, and (f) studies needed to have a measure of social competence included in the study. In order to establish some mechanism of quality control for articles selected for inclusion, studies were selected only if they were published in peer-reviewed journals. Based on the aforementioned criteria, 57 studies were selected for inclusion in our meta-analysis (see Supplementary Table for descriptive listing on studies employed in the meta-analysis as well as reference information).

Multiple measures of social competence were found in our literature searches. In order for a measure to be included for inclusion, it must have measured social competence directly. For example, all informant scales for the Achenbach school-age series of measures (Achenbach & Rescorla, 2001) include a Total Social Competence scale. The parent and child versions of the Pediatric Quality of Life Inventory™ (PedsQL™, Varni, Burwinkle, Seid, & Skarr, 2003) both include a Social Functioning scale. Similar scales and subscales of social competence were employed for other measures that were included in our meta-analysis (see supplemental table for more information).

**Coding Characteristics**

According to Lipsey and Wilson’s (2001) recommendations, a range of variables were coded from each study. Variables coded included: mean age, gender, ethnicity, CI type, type of informant (e.g., parent, teacher), as well as effect size information (e.g. sample size, mean). Nineteen categories of CI were represented in the current meta-analysis. In addition, data on the continuous moderators of sex and ethnicity were coded by noting the percentage of the CI group sample that was composed of females or ethnic minorities, respectively.

Studies were coded by the authors and a team of undergraduate research assistants. To calculate inter-rater agreement, 15 studies were randomly selected to be coded by an independent rater who was also a member of the original coding team. The percentage of agreement between the two independent raters was calculated using Cohen’s coefficient kappa (κ; 1960). Overall inter-rater agreement accounting for chance ranged from .81 to 1.0 for all coded items. According to Landis and Koch (1977), κ coefficients > .8 are considered near perfect agreement, indicating that inter-rater agreement in our present study was excellent.

**Data Analysis**

Statistical analysis was conducted using Version 2.2.048 of the Comprehensive Meta-Analysis™ software program...
(Borenstein & Rothstein, 2008). Means, standard deviations, and sample size were used to calculate the standardized mean difference (Cohen’s d) effect size. The standardized mean difference is defined as the difference between the group means, in the present study the CI and comparison group means, divided by the pooled standard deviation. When mean and standard deviations were not available and results were dichotomized as events versus nonevents, a log risk ratio was computed (Borenstein et al., 2009). The log risk ratio was then converted into a standardized mean difference to allow comparability among effect sizes. Similarly, when studies only provided correlational data, the data was first transformed to the Fisher’s z-scale and then converted into a standardized mean difference.

Fixed-effect or random-effects assumptions can be used when conducting meta-analytic techniques. In fixed-effect models, all studies are assumed to be measuring the same population parameter, and thus, the differences between observed effects are attributed to sampling error (Borenstein et al., 2009). In contrast, a random-effects model’s underlying assumption is that studies come from a population of studies that share the same mean. It is suggested that when one of the goals of an analysis includes generalizability, the random-effects model be employed. Since this was the authors’ goal, the random-effects model was chosen.

In order to assess for moderating variables, two procedures as outlined by Lipsey and Wilson (2001, 2005) were employed: subgroup analysis and meta-regression. For categorical moderators (e.g., CI type, type of measure), the effect sizes were grouped by the variables in an analysis of variance model. In the case of continuous moderators (e.g., sex, race/ethnicity), the variables were regressed against weighted effect sizes employing a random effects model. A two-tailed z-test, an analog of the t-test in primary studies, was used to determine the statistical significance of the impact of the potentially moderating covariate on the social competence effect size.

A number of measures included in the current study aimed to assess a child’s perceived level of social competence or social adjustment through self-report rating scales (e.g., Self Perception Profile for Children). Others took a broader approach by measuring global quality of life related to social functioning in children with chronic illnesses (e.g., Pediatric Quality of Life Questionnaire™). The sample was also characterized by multiple informants of social competence in children, including parents’, teachers’, and self-ratings of sociometric data and social skills (e.g., Social Skills Rating System). All sociometric measures (e.g., Revised Class Play) were grouped under one measure category.

A number of studies provided outcome data that employed multiple measures (e.g., Youth Self-Report, Pediatric Quality of Life) or multiple respondents (e.g., self, parent), therefore providing multiple effect sizes per study. For the purposes of the overall effect size, multiple outcome data were aggregated to get an overall mean effect per study. However, in instances where the sample was split on an individual characteristic (e.g., gender, CI type), each subsection of the sample was treated as an independent study. However, our moderator analyses employed all possible effects without aggregation. For example, if a study provided three separate effects for information (e.g., parent, teacher) each effect was treated as a unique contribution rather than aggregating the data. The value added in power for the present analyses exceeded the potential bias that this may introduce.

**Missing Data**

A number of studies contained missing data for either study-level characteristics or effect size. If study-level data were missing, they were coded as missing and the study was not included in our moderator analyses. For studies in which comparison group effect size data were missing, normative data was then used for the comparison group if it was easily accessible to the authors (e.g., Achenbach series of measurements). If the data were not easily accessible and those missing data were needed in order to calculate an effect size, efforts were made to contact the authors. To increase the probability missing effect size data would be recovered, authors were only contacted if their study was published in 2000 or later. Of studies selected for inclusion in the present study, eight contained missing data. Out of the eight studies, five authors were contacted since their studies were published in 2000 or later. All but one author was able to provide the missing information necessary to calculate an effect size.

**Publication Bias**

One particular limitation of meta-analyses is that they often fail to take into account unpublished data which more often than not contains non-significant findings relative to published data (Rosenthal, 1995). Therefore, studies often included in a meta-analysis may not be representative of a random sample of all studies completed on the topic. In order to investigate the extent of bias in our present analysis, we used a number of methods: fail-safe N (Rosenthal, 1979), a funnel plot, and Duval and Tweedie’s (2000) trim and fill method.
The fail-safe \( N \) (Rosenthal, 1979) provides a calculation of how many excluded studies it would take to render the results of a meta-analysis non-significant. A rule of thumb is that if the fail-safe \( N \) exceeds \( 5k + 10 \), then the meta-analysis is considered robust against publication bias. Two problems with the fail-safe \( N \) are that there is an assumption that the mean effect size in the missing studies is zero and that it depends on statistical significance rather than a significance level of importance to the study. Orwin’s (1983) fail-safe \( N \) helps rectify these two issues by allowing the researcher to select an appropriate mean effect other than zero. One can then examine how many missing studies it will take to get to that selected mean effect.

A funnel plot is a scatter plot of the effect size on the \( X \) axis and the standard error of the effect size on the \( Y \) axis (Borenstein et al., 2009). The plot allowed us to ascertain whether publication bias had any effect on our results. If publication bias was not present, we would expect to see the studies in our analysis distributed symmetrically along the mean effect size in our plot. If publication bias was present, we would expect an asymmetry along the mean effect size, with more studies missing towards the bottom of the funnel plot. Studies with smaller sample sizes should appear at the bottom of the funnel and be more spread out due to increased variability among their sampling errors, relative to studies with larger sample sizes.

The trim and fill method allows for an estimation of the unbiased effect size by removing the most extreme studies, creating an asymmetry in the funnel plot (Duval & Tweedie, 2000). An iterative procedure is then employed to recalculate each effect size that gets imputed back into the funnel plot, producing an adjusted standardized mean difference. The new unbiased standardized mean difference is then compared to the original summary effect. When they are similar, the results of the meta-analysis can be considered valid and free of publication bias.

**Results**

**Overall Effect Size**

In our meta-analysis, 57 studies met the inclusion criteria, providing 90 unique outcomes (see Supplementary Material for summary table of studies). The sample sizes for the CI groups ranged from 8 to 800, with a mean sample size of 77.95 and a total sample size of 7,015. The overall standardized mean difference using a random-effects model for all studies in the meta-analysis was \( d = -0.44, SE = .04, 95\% \text{ CI} = [-0.52 \text{ to } -0.36] \). The summary effect was found to be significantly different from zero according to a two-tailed test of the null hypothesis, \( z = -10.59, p < .001 \).

To assess the impact of potential outliers on the overall summary effect, computations were run to assess what the impact would be of removing each study from the overall analysis. According to the results, the range of effect sizes when one study was removed was \( d = (-0.44 \text{ to } -0.41) \) indicating that no study proved to have a large impact on the summary effect when removed. Therefore, all studies remained in our analyses. Homogeneity analysis indicated that there was significant heterogeneity among effects, \( Q (89) = 579.43, p < .001 \). Thus, subgroup and meta-regression analyses were conducted next to attempt to understand the nature of this heterogeneity.

**Sources of Variation**

**Chronic Illness**

In total, there were 14 CI categories represented in our sample. An “Other” group was composed of one study in which the sample used was heterogeneous with regards to chronic illness type. The most prevalent CI group included in our analyses was cancer, comprising 17% \((k = 29)\) of outcomes available in our total sample, followed by neurological disorder, which comprised 14.0% \((k = 24)\) of outcomes available in our total sample. Subgroup analyses, were employed to examine differences in effect size among different CI types. Only CI groups that contained at least five or more unique outcomes were included in the analyses, allowing us to compare effect size differences across nine different CI groups and 78 unique outcomes.

A random-effects model, which was estimated using iterative maximum likelihood procedures, indicated that effect size varied by CI type, \( Q (8, 69) = 22.59, p = .004 \) (Table I). Children with neurological disorders (e.g., seizure disorders, spina bifida) displayed a significant overall effect and was also the largest poor effect for social competence of all the groups \((d = -0.82; z = -8.19, p < .001)\), followed by a significant overall effect of children with obesity \((d = -0.61; z = -4.54, p < .001)\). Children with a blood disorder (e.g., hemophilia), displayed a moderate effect of poor social competence \((d = -0.51; z = -2.74, p = .006)\). Two CI groups, asthma \((d = -0.34; z = -1.75, p = .08)\) and diabetes \((d = -0.15; z = -0.93, p = .35)\), did not demonstrate statistically significant overall effect sizes. All of the other CI groups displayed small effect sizes consistent with the summary effect of the overall sample of studies, \( d = (-0.27 \text{ to } -0.48) \).
Table I. Summary Statistics for Effect Size Data by Chronic Illness Group

<table>
<thead>
<tr>
<th>Chronic illness type</th>
<th>k</th>
<th>Cohen’s d</th>
<th>SE</th>
<th>LL</th>
<th>UL</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>5</td>
<td>−0.34</td>
<td>0.19</td>
<td>−0.72</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Blood disorders</td>
<td>5</td>
<td>−0.51**</td>
<td>0.19</td>
<td>−0.88</td>
<td>−0.15</td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>12</td>
<td>−0.30*</td>
<td>0.12</td>
<td>−0.53</td>
<td>−0.07</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>8</td>
<td>−0.15</td>
<td>0.16</td>
<td>−0.45</td>
<td>0.16</td>
<td></td>
</tr>
<tr>
<td>Gastrointestinal disorders</td>
<td>8</td>
<td>−0.27*</td>
<td>0.14</td>
<td>−0.53</td>
<td>−0.00</td>
<td></td>
</tr>
<tr>
<td>JRA</td>
<td>7</td>
<td>−0.48**</td>
<td>0.16</td>
<td>−0.80</td>
<td>−0.16</td>
<td></td>
</tr>
<tr>
<td>Neurological disorders</td>
<td>17</td>
<td>−0.82</td>
<td>0.10</td>
<td>−1.01</td>
<td>−0.62</td>
<td></td>
</tr>
<tr>
<td>Obesity</td>
<td>8</td>
<td>−0.61***</td>
<td>0.14</td>
<td>−0.88</td>
<td>−0.35</td>
<td></td>
</tr>
<tr>
<td>Sickle cell</td>
<td>8</td>
<td>−0.40**</td>
<td>0.15</td>
<td>−0.69</td>
<td>−0.10</td>
<td></td>
</tr>
</tbody>
</table>

Note: k, number of outcomes; CI, confidence interval; LL, lower limit; UL, upper limit; JRA, juvenile rheumatoid arthritis.

*p < .05; **p < .01; ***p < .001.

Demographic Differences
Mean age information was available for 68 outcomes in our study. The mean age of the CI groups ranged from 4.8 years to 15.2 years old. Meta-regression using a random effects model was run on the continuous variable of mean age. According to our results, age was not related to differences in social competence between children with a CI and healthy comparisons, Q (1, 66) = .84, p = .36.

For studies reporting the distribution of male and female participants in the sample, the composition of females in the CI group ranged from 0% to 100%. Six studies did not provide information on the percentage of females that comprised the CI group. In total, there were 84 outcomes available for this analysis. The results of our meta-regression indicated that there was no relationship between the composition of females in a study and social competence effect, Q (1, 83) = 2.46, p = .12.

Among the studies available in our analyses, 38 provided information on the ethnic composition of their samples. For studies in which ethnic background information was provided, the composition of ethnic minorities in the CI group ranged from 0% to 100%. Meta-regression revealed that ethnic minority status was not associated with social competence, Q (1, 37) = 2.15, p = .14.

Informant
Subgroup analyses were conducted for all four informant categories of social competence measures for the CI group. Parent reports comprised the largest informant category with 43.4% (k = 56) of all outcomes, followed by self-reports, which comprised 40.3% (k = 52) of all outcomes. Peer reports comprised 7.0% (k = 9) and teacher reports comprised 9.3% (k = 12) of total available outcomes. In order to assess the moderating effects of the various categories of informants, a subgroup analysis was conducted. Differences in effects between informant groups approached significance, Q (3, 125) = 9.34, p = .07 (Table II).

The results indicated the overall effect for parent reports (d = −0.51; z = −9.05, p < .001) was significant and moderate. In addition, the overall effect of self reports was significant but small (d = −0.34; z = −5.60, p < .001). The overall effects for peer reports approached significance (d = −0.25; z = −1.93, p = .05) while overall effect for teacher reports (d = −0.26; z = −1.40, p = .16) was not significant, although it should be noted that these were also the two informant types with the least number of available outcomes in our analyses.

Measure
In our sample, 28 measures were represented in the studies. However, in order to be included in our subgroup analyses for measure type, studies had to include at least five discrete outcomes. Therefore, only five measure types were included in our subgroup analysis, and these five measure types comprised 67.3% (k = 74) of all possible measure outcomes. The Achenbach series of measures comprised the largest measure category in our analysis with 40.5% (k = 30) of available outcomes, followed by the PedsQL™ which comprised 24.3% (k = 18) of all outcomes in our study. Sociometric data comprised 16.2% (k = 12), Self Perception Profile for Children (SPPC; Harter, 1985) constituted 12.2% (k = 9), and the Perceived Competence Scale for Children (PCSC; Harter, 1982) comprised 6.8% (k = 5). In order to assess the heterogeneity among the effects for different measure types, a subgroup analysis was run. There were significant differences in effects among measure types, Q (4, 73) = 14.24, p = .007 (Table II).

The results indicated the overall effect for the Achenbach series of measures was significant and moderate (d = −.52; z = −7.67, p < .001). In addition, the overall effect of the PedsQL was also significant, but smaller (d = −.44; z = −6.13, p < .001). The overall effects for sociometric measures was significant and small (d = −0.25; z = −2.29, p = .022), and overall effects for the SPPC were approaching significance and small (d = −0.22; z = −1.75, p = .081). Finally, the overall effects for the PCSC were not significant (d = .09; z = 0.47, p = .640).

In order to assess the potential bias that informant type may introduce into our subgroup analyses of measures, further subgroup analyses were conducted examining informant type within each measure. Sociometric data, by definition, only included peer reports; therefore, this
measured type was not included in our analyses. In addition, the SPPC only allows for self-reports so subgroup analysis of informant type was not possible with this measure. The PCSC measure did not have enough total outcomes to provide at least five outcomes per informant group. Finally, outcomes of the Achenbach series overwhelmingly consisted of parent reports (85.3%; \(k = 29\)) in our sample. Neither self (\(k = 3\)) nor teacher reports (\(k = 2\)) provided at least five outcomes to examine subgroup differences with the Achenbach series of measures. As a result, subgroup analyses by informant type were also not performed on the Achenbach series of measures.

The PedsQL\textsuperscript{TM} was the only measure in the present study that had enough outcomes to examine subgroup differences by informant type. Self-reports composed 52.9% (\(k = 18\)) of all available outcomes employing the PedsQL\textsuperscript{TM}; the rest of the outcomes were comprised of parent reports (47.1%; \(k = 16\)). A subgroup analysis examining parent versus self report effect differences on the PedsQL indicated there was no significant difference between informant group, \(Q(1, 33) = 1.55, p = .213\).

**Publication Bias**

In order to assess for publication bias, the Comprehensive Meta-Analysis\textsuperscript{TM} software program (Borenstein & Rothstein, 2008) was used. A funnel plot of the effect size plotted against the effect size standard error was examined. The majority of studies displayed symmetry around the mean with the majority of studies clustered towards the top of the plot. However, one data point was located at the bottom left of the plot and lacked a symmetrical counterpart, indicating a very slight bias in the sample.

In order to assess the impact of any potential bias, Duval and Tweedie’s (2000) Trim and Fill method was employed. The results of the Trim and Fill method indicated no study needed to be trimmed and imputed when bias to the right of the mean was examined. These results indicated little to no bias for studies that may have had effects showing better social competence than our overall effect. However, when the Trim and Fill method was employed to assess bias to the left of the mean or bias in studies demonstrating poorer overall social competence, 11 studies needed to be trimmed and imputed, resulting in an adjusted standardized mean difference of \(-0.50 [-0.59 to -0.42]\). This adjusted standardized mean difference suggested a slight bias in our sample toward studies that display lesser overall poorer social competence, indicating that the poor social competence of children with CI may be underestimated by our meta-analysis.

The results of the fail-safe \(N\) and Orwin’s variation on the fail-safe \(N\) also indicated that our sample does not appear to be heavily biased. The classic fail-safe \(N\) demonstrated that 2,579 excluded studies would be needed in order to render the effects of our meta-analysis insignificant. This number is far above the rule of thumb of 5\(k + 10\), or 295, in the present meta-analysis. Orwin’s fail-safe \(N\) was set to the value \(-0.19\), which is just below (0.20) what would be considered a small effect. The results of Orwin’s test were that 156 excluded studies would be needed to drive down our effect to \(-0.19\).

**Discussion**

The purpose of the current study was to examine the total effect size for social competence in children with CI as well as to determine whether there were any differences in this effect size according to the type of illness, social competence measurement, informant, and demographic features such as age, ethnicity, and gender. Overall, we found a small negative effect across 57 studies along with 90 unique outcomes indicating that children with CI had poorer social competence than children without CI. Effects varied according to illness type: children with neurological disorders and obesity had the poorest social competence of all groups while children with blood disorders had moderate levels of poor social competence. Children with asthma and diabetes did not have social competence scores that differed from comparison groups, and all other illness groups had small effect sizes.

Measurement effects were also present, with the Achenbach series (Achenbach & Rescorla, 2001) and the Pediatric Quality of Life Questionnaire\textsuperscript{TM} (Varni et al., 2001).
showing the largest effect sizes. Furthermore, parent reports produced larger effects than self-reports. Neither teacher nor peer reports were significant, although this could be due to the small number of outcomes in each of these categories. Analyses that compared informants within the same measure were conducted with the PedSQL™ and showed that there was no significant difference between parent and child report on this measure. Finally, no age, gender, or race/ethnicity group differences were found.

The small effect size for social competence reflects previous literature showing that youth with some CIs had poorer social competence than healthy controls or normative groups (La Greca, 1990; Reiter-Purtill et al., 2010). Whereas previous reviews documented a number of significant findings related to social competence, this is the first study to use all currently available data to obtain an overall estimate of the social competencies of children with CI. Although the effect size was smaller than expected, overall results supported typical study hypotheses that children with CI would show deficits in social competence. This was in contrast with a previous review suggesting that most children with CI did not have impairments in social functioning (Spirito et al., 1991).

Another finding of the current study was that youth with particular types of illnesses are more likely to have deficits in social competence than other types of chronic illness. The large effect size findings for children with neurological conditions, such as spina bifida and seizure disorders, were consistent with previous research showing that youth with illnesses impacting the central nervous system are at greatest risk for social deficits (for a review, see Nassau & Drotar, 1997; Yeates et al., 2007). Three major categories of limitations found in youth with spina bifida have been defined in the literature, including physical limitations, neurological limitations, and psychological reactions to these limitations (Holmbeck et al., 2003). Thus physical status and disability associated with spina bifida might mediate or moderate the effects of spina bifida on social competence, although research that has explicitly examined those features has not found differences in social competence to be related to these features (Wallander, Feldman, & Varni, 1989). Similarly, the cognitive impairments, academic difficulties, and social stigma associated with epilepsy might contribute to the poorer social competence in children with this disorder compared to other disorders (Deidrick, Grissom, & Farmer, 2009; Freilinger et al., 2006). The visibility of the illnesses (Curtin & Siegel, 2003) as well as emotional and behavioral symptoms may also play mediating roles in levels of social competence (Caplan et al., 2005).

The current study provided evidence that children with obesity have moderate deficits in social competence compared to healthy controls. Several recent reviews have focused on the psychosocial correlates of obesity (Wardle & Cooke, 2005; Zeller & Modi, 2009), finding that specific features of social relationships, including overt and relational victimization and perpetration of verbal bullying, are related to obesity and overweight status (Janssen, Craig, Boyce, & Pickett, 2004; Pearce, Boergers, & Prinstein, 2002; Puhl & Latner, 2007). More research is needed to understand the bidirectional relationships likely to exist between weight and social competence in this population, as well as explorations of self-esteem and body satisfaction as potential mediators or moderators of these relationships (Young-Hyman, Schlundt, Herman-Wenderoth, & Bozylinski, 2003).

Children with cystic fibrosis and diabetes were the only groups of children that did not show deficits in their cognitive functioning. It is possible that these illnesses have characteristics, such as low visibility, that serve as protective factors for children against developing deficits in social functioning. However, only a relatively small number of studies have examined youth with these particular illnesses so it is possible that not enough information was obtained to accurately determine the social competence of these youth.

The present meta-analysis found strong evidence for differences in youth’s social competence based on both type of informant and the particular measure used. Consistent with previous research, parent reports were the most widely used, and parents reported the highest levels of impairment, followed by self-reports, with teachers, and peers reporting the smallest effects (Reiter-Purtill et al., 2010). According to best practice, whenever information from multiple informants is collected, it is important to determine inconsistencies between informants’ perspectives and their access to information in order to most accurately evaluate the construct of interest (De Los Reyes & Kazdin, 2006). Parent reports on social competence in youth with CI may be most accurate for younger children whose social interactions are still closely monitored by their parents, in contrast to early adolescence when children begin to spend more time alone or with friends than with their families (Larson & Richards, 1991). However, it is also likely that different informants have access to different information. Using social competence scales that include discrete, easily observable behaviors would increase reliability (Achenbach, 2011).

Two measures emerged as showing strong effects for deficits in social competence in youth with CI: the Achenbach series (Achenbach & Rescorla, 2001) and the
Pediatric Quality of Life Questionnaire™ (Varni et al., 2003). Furthermore, enough parent and child reports on the PedsQL™ were available to determine whether there were inter-informant differences on the same measure. In fact, results showed that parents and children reported similar levels of social competence. Both of these measures may show strong effects due to their large normative populations and the tendencies for researchers to make comparisons based on these normative samples rather than using control group data (Lavigne & Faier-Routman, 1992), but their scales on social competence are relatively brief. Additional criticisms of the Achenbach measure of social competence have been noted in the literature, including the aggregation of social and academic items into one measure, poor sensitivity at higher levels of social functioning, and failure to take into account restrictions in access to social activities due to finances or illnesses and disabilities (Drotar, Stein, & Perrin, 1995).

Therefore, more research is needed to closely analyze how we are measuring social competence in our studies. For example, research has found that having at least one high-quality friendship may protect children with CI from deficits associated with peer rejection (Hodges, Boivin, Vitaro, & Bukowski, 1999). More studies like this one are necessary to fill in the current knowledge gaps in the area of social competence in children with chronic illness and help inform the construction of measures of social competence. Frameworks that integrate measurement, theory, and intervention are needed (Dirks et al., 2007). Furthermore, researchers in this area should focus on developing measures of social competence that do not assume that children with chronic illness have equal access to participation in social activities (Drotar et al., 1995).

The current study found that demographic features such as ethnicity, gender, and age were not associated with differences in effect sizes for CIs. Few studies examined outcomes across developmental groups which might have made it difficult to find these effects (see Brosig, Musssato, Kuhn, & Twedell, 2007; Holmbeck et al., 2003). Future research should examine the interactions between age and gender, as there are likely to be changes in gender effects over time (Phillipsen, 1999).

**Limitations**

There are many factors related to social competence in children with CI that were not able to be included in the current study because they were not included in a sufficient number of studies. Disorder severity and visibility, cognitive impairments, physical limitations, and school absences are all illness-related variables that have been associated with social competence (Barton & North, 2004; Cobb, Cohen, Rubin, & Houston, 1998; Feldmann, et al., 2005; Noll et al., 2007). Family support, coping style, and contextual factors, such as access to services and culture, are additional constructs that warrant further consideration (Kazak, 1992; McCubbin, Thompson, Thompson, McCubbin, & Kaston, 1993; Meijer, Sinnema, Bijsta, Mellenbergh, & Wolters, 2002; Sameroff, Bartko, Baldwin, Baldwin, & Seifer, 1998). Future research examining social competence in children with CI should examine these types of moderators and mediators. Furthermore, certain diseases, such as HIV, were particularly under-represented in the literature; therefore, we were unable to separate some CIs into their own groups for comparison purposes, limiting our results to well-studied disorders in the literature. Finally, we did not include injuries or disabilities such as traumatic brain injury in the review even though there is an emerging body of literature specifying the mechanisms through which TBI impacts social functioning (Warschausky, Cohen, Parker, Levendosky, & Okun, 1997; Yeates et al., 2004).

**Implications and Directions for Future Research**

The current study suggests youth with CI demonstrate overall deficits in social competence, and children with neurological disorders and obesity have the largest deficits. Therefore, these youth require prevention and intervention programs to increase their social skills and social supports. Promising research has shown that social skill interventions for children with cancer and sickle cell disease have been effective in improving social functioning (Barakat, et al., 2003; Hazzard, Celano, Collins, & Markov, 2002; Varni, Katz, Colegrove, & Dolgin, 1993). Social skills interventions that include multiple components such as social problem solving, modeling, and social perception training may be especially effective ways for improving social competence in these at-risk youth (Spence, 2003).

**Conflicts of interest**: None declared.

**References**


