

# Generating Individualized, Evidence-Based Treatment Recommendations: The Example of PECS

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**Background:** Practitioners seeking to help children with Autism Spectrum Disorders (ASDs) have increasingly relied on evidence-based practices (EBP), or those interventions consistently supported by high quality, peer-reviewed outcome research. There is a growing convergence regarding the general characteristics of high quality research and the number and quality of such studies needed to constitute EBP, although it remains difficult to translate EBPs identified thus far into specific objectives for specific individuals.

**Objectives:** To demonstrate a two-stage process for generating individualized, evidence-based intervention goals from methodologically sound outcome research by, using the example of the Picture Exchange Communication System, or PECS.

**Methods:** We conducted PSYCHLIT and PUBMED searches for outcome studies involving the use of PECS with children with ASD, and rated studies according to the Reichow, Volkmar, and Cicchetti (2008). We then summarized patterns of findings across at least two studies for a similar population as indicating Consistent evidence, Some evidence, or Emerging evidence.

**Results:** Patterns of evidence were noted to support goals addressing the acquisition of PECS itself, related social and communication skills, and criteria for selecting PECS over other interventions.

**Conclusions:** These findings demonstrate a two step approach to translating outcome research into individualized, evidence-based goals. We discuss characteristics of PECS that facilitate this approach, and some of the patterns of weakness in the outcome studies reviewed.

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## Background

Practitioners seeking to help children with Autism Spectrum Disorders (ASDs) have increasingly relied on evidence-based practices (EBP), or those interventions consistently supported by high quality, peer-reviewed outcome research. Recently developed rubrics for objectively evaluating the quality of outcome research, including specific standards for designating a practice as evidence-based, reflect a growing convergence regarding the general characteristics of high quality research (including the contribution of single subject designs, or SSDs). Reviewers have only been able to draw generic conclusions about practices, making it difficult to translate EBPs identified to date into specific objectives for specific children

### Objectives

To demonstrate a two-step process for generating individualized, evidence-based intervention goals from methodologically sound outcome research by

1. Establishing whether a given program (e.g., the Picture Exchange Communication System, or PECS) is an EBP for teaching communication and related skills, and;
2. Generating specific objectives based on studies of at least adequate quality, by considering main effects of PECS, as well as interactions between characteristics of the child, intervention method, and target.

## Methods

### Inclusion and exclusion criteria for outcome studies rated

We conducted PSYCHLIT and PUBMED searches for outcome studies in which PECS was used to improve communication, social skills, or behavior of children with ASD. We excluded studies that were (a) not published in English in peer-reviewed journals, (b) included adults, (c) did not focus primarily on the use of PECS to acquire communication and related social skills or to reduce problem behavior, (d) entailed a significant alteration of the PECS methodology, or (d) entailed an informal case study (refer to the [Bibliography](#) for a list of studies excluded).

### Step 1: Evidence Rating

We rated individual studies according the Reichow rubric (Reichow, in press; Reichow, Volkmar, & Cicchetti, 2008). Overall reliability was 88%, calculated on approximately 20% of the studies rated by both authors of individual components of the rating system.

### Step 2: Individualized, evidence-based treatment recommendations

#### Main effects

Selecting only studies of at least Adequate quality, we summarized simple patterns attained across at least two studies for a similar population as indicating:

- Clear Evidence, when similar findings were replicated across all children and in two or more studies from different groups of researchers;
- Generally Consistent Evidence or a generally positive trend replicated across children or across studies from different researchers, or when findings were replicated across two or more studies from the same group of researchers, or
- Emerging Evidence, for findings obtained from a single researcher.

#### Interactions

We also considered characteristics of the child, the target, or the design that might have contributed to the variations obtained, as:

- Clear Evidence, when tests of interactions were incorporated into the research design
- Generally Consistent Evidence, similar findings were replicated across 2+ studies; or
- Emerging Evidence, when the interaction was noted by one researcher only.

## Results

### Step 1: Overall Rigor Rating

Based on the results of the rigor ratings generated via the studies summarized in Table 1, we concluded the PECS is an Established EBP.

**Table 1: Rigor Ratings for Studies Reviewed**

	Group Design	Single Subject Design
Strong	Yoder & Stone (2006a & b); Yoder & Lieberman (2009);	Ganz et al (2009; 2010); Markel, Neef, & Ferreri (2006); Tincani (2004);
Adequate	Magiati & Howlin (2003); Howlin et al (2007)	Adkins & Axelrod (2002); Angermeier et al (2008); Buckley & Newchuck (2005); Chaabane et al (2009); Charlop-Christy et al (2002); Ganz & Simpson (2004); Ganz et al (2008); Kravitz et al (2002); Tincani et al (2006)
Weak	Bondy & Frost (1994);	Anderson et al (2007); Cummings & Williams (2000); Dooley et al (2001); Frea et al (2001); Jurgens et al (2009)

**Table 2: Individualized treatment recommendations**

Clear Evidence	PECS can be mastered relatively quickly <sup>1,9</sup> , at least up to Phase II <sup>2,8</sup> , Phase III <sup>4,14</sup> , Phase IV <sup>11,15</sup> , or Phase VI <sup>7,18</sup> , even by children with no functional communication skills <sup>+</sup> with one exception <sup>10</sup>
	PECS results in increased requesting <sup>*15,20</sup>
Generally Consistent Evidence	PECS can be generalized across people and/or contexts <sup>1,7,11,14,18,20</sup>
	Children can improvise when a corresponding picture is unavailable <sup>6,16</sup>
	Improvement in PECS is associated with improvements in observed speech: Frequency of vocalization <sup>17</sup> and speech acts <sup>7,11,14,19</sup> , complexity of vocalization and speech <sup>7,14,15,17</sup> , and increased length of utterance <sup>7,11</sup>
Emerging Evidence	Improvement in PECS was associated with gains in other social-communicative behavior, such as response to other initiations <sup>5,7,14</sup> and joint attention <sup>*7,20</sup>
	Improvement in PECS is associated with the emergence of speech in some children <sup>5,18</sup> for both non-verbal and verbal children <sup>+15</sup> but does not necessarily result in improvements in overall vocabulary measures <sup>13</sup>
	Improvements in PECS are usually <sup>8</sup> but not always maintained over time <sup>13</sup>
	Improvement in PECS is generally but not universally associated with other improvements in speech, such as the frequency of speech acts for most <sup>7,19</sup> but not all children <sup>+8,9,10</sup>
Emerging Evidence	Improvement in PECS is associated with decreases in problem behaviors <sup>*7</sup> though this depends on the child <sup>9</sup> and on the effort required <sup>3</sup>
	PECS treatment is associated with gains in other social behavior, such as improvements in free play <sup>7</sup> , and overall reciprocal social interaction <sup>13</sup> as well as the duration of peer interaction <sup>14</sup>
	PECS picture vocabulary <sup>15</sup> and verbal vocabulary <sup>*19</sup> increases with intervention
Emerging Evidence	PECS use is generalized to untrained items <sup>8</sup>
	Increased use of PECS is not associated with decreases in non-word utterances <sup>11</sup>

<sup>+</sup> More advanced language or cognitive levels at baseline were associated with better outcomes.

<sup>\*</sup> Results for which relative gains were greater as a function of the characteristics of the child (aside from initial skill level) or the intervention (please refer to Table 3 for more information)

**Table 3: Interaction between child and treatment characteristics and outcomes**

Evidence	Child characteristics and treatment methods
Clear	PECS leads to greater acquisition of joint attention (JA) behavior among children with little or no JA at outset of study; otherwise, RPMT is superior <sup>19,20</sup>
	Both effective in increasing turn-taking, but RPMT superior <sup>19,20</sup>
	Gains in PECS in frequency and range of words were maintained only for children who were relatively high in initial object exploration: otherwise, children relatively low in initial object exploration benefited more from RPMT <sup>19,20</sup>
Generally consistent	PECS is better than signing at increasing requesting <sup>1</sup> , except perhaps among children with good imitation skills <sup>17</sup>
Emerging	PECS may decrease aggressive behavior only when relatively little effort is required to communicate <sup>3</sup>

## Step 2: Individualized, evidence-based treatment recommendations

After summarizing the conclusions of the eligible studies (see Appendices A & B), we generated individualized recommendations according to the pattern of evidence observed (see Table 2). For both Tables 2 and 3, numbers in superscript indicate the study from which the finding was derived (see attached Bibliography).

We also considered whether there was evidence of interactions between specific characteristics of the child, the intervention method, or the specific treatment targets that could impact upon individual treatment recommendations (Table 3).

## Conclusions

These findings demonstrate the utility of a two step approach to translating outcome research into individualized, evidence-based goals. This approach is feasible because of the large number of studies, and the relatively limited range of targets addressed via research on PECS. The fact that the phases of PECS training are specified, and that a manualized program of training has been adopted by researchers, lends further weight to these findings.

We can objectively rate the rigor of the evidence in support of broadly defined practices such as PECS because of a general consensus regarding the characteristics of high-quality research. Other attempts to translate specific findings into individualized recommendations should consider ways of weighting these recommendations in terms of the number and range of children on whom the finding was based, and the quality of the supporting evidence. Nevertheless, the approach outlined in this paper clearly has potential to translate research findings into evidence-based treatment goals that can be immediately applied to children in community-based settings.

## References

### Rubric for rating studies

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### Empirical studies included

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