The following provisional norms for nominal reference errors in narrative should be used with caution. While our preliminary research indicates that the rate of nominal reference errors in narratives may be a sensitive screening measure for underlying abnormalities in the central nervous systems in school-aged children with prenatal alcohol exposure, there is need for further validation of the measure with a larger representative sample of children. The tables below provide the basic descriptive statistics for our typically developing group (N=80) for two measures of cohesive reference in narratives. This information is provided so that clinicians who are interesting in using the TREIN analysis as part of the assessment or evaluation can make an informed clinical judgment about the meaning of their results.

A TREIN analysis provides the following possible indicators of performance:

1. Total Nominal Reference Errors (NRE) = [ambigintro] + [ambigntie]
2. Rate of Nominal Reference Errors (rNRE) = NRE / number of total words (i.e., NTW)
3. Rate of Nominal Reference Errors by opportunity (rNREopp) = NRE/([ambigintro] + [ambigntie] + [defintro] + [indefintro] + [possintro] + [pntie] + [ntie] + [ambigpntie] + [pnintro])
4. Total Pronominal Reference Errors (PRE) = ([pnintro] + [ambigpntie])
5. Rate of Pronominal Reference Errors (rPRE) = PRE/NTW
6. Rate of Pronominal Reference Errors by opportunity (rPREopp) = PRE/ ([ambigintro] + [ambigntie] + [defintro] + [indefintro] + [possintro] + [pntie] + [ntie] + [ambigpntie] + [pnintro])
7. Total Reference Errors (ALL) = [ambigintro] + [ambigntie] + [ambigpntie] + [pnintro]
8. Rate of All Reference Errors (rALL) = (NRE + PRE)/ NTW
9. Rate of All Reference Errors by Opportunity (rALLopp) = (NRE + PRE)/ ([ambigintro] + [ambigntie] + [defintro] + [indefintro] + [possintro] + [pntie] + [ntie] + [ambigpntie] + [pnintro])


The two measures that appear to have the most clinical potential involve the number of nominal reference errors. Each is based on the number of errors produced in the narratives of these children, but each controls for the variability in the length of the narratives in different ways. In both, higher rates of errors indicates more difficulty maintaining referential cohesion in the narrative.

The first, and perhaps most practical, is the rate of nominal reference errors calculated as a percentage of referential opportunities in the child's narrative (rNREopp%). This measure tells us what percentage of a child's attempts to create a cohesive reference were unsuccessful because the nominal form was inappropriate.

rNREopp% = rNREopp*100

 rNREopp = NRE/(ambigintro + ambigntie + defintro + indefintro + possintro + pntie + ntie + ambigpntie + pnintro)

The second is the rate of nominal reference errors calculated as a percentage of total words in the narrative (rNRE%). This measure tells us, essentially, what percentage of words in the narrative were part of a nominal phrase that was referentially ambiguous.

rNRE% = (NRE/NTW)*100

The tables below indicate the performance of the 80 children in our sample using these measures.
We have highlighted values that might be of clinical interest.

**Summary statistics for typically developing group (TD)**

| Variable | **Rate of nominal reference errors by opportunity** (rNREopp%) |
|---|---|
| | rNREopp% = rNREopp*100 |
| | rNREopp = NRE/(ambigintro + ambigntie + defintro + indefintro + possintro + pntie + ntie + ambigpntie + pnintro) |
| | Higher rates indicate more errors, lower rates indicate better cohesion |
| Sample size | 80 |
| Lowest value | 0.0000 |
| Highest value | 14.5833 |
| **Arithmetic mean** | **5.5689** |
| 95% CI for the mean | 4.8538 to 6.2839 |
| Median | 4.8200 |
| 95% CI for the median | 4.1667 to 5.6769 |
| Variance | 10.3247 |
| Standard deviation | 3.2132 |
| **2 Standard deviations above mean (clinical cut-point)** | **12.00** |
| Standard error of the mean | 0.3592 |
| Coefficient of Skewness | 0.8486 (P=0.0032) |
| Coefficient of Kurtosis | 0.2910 (P=0.4709) |
| D'Agostino-Pearson test for Normal distribution | reject Normality (P=0.0100) |

| Percentiles | | 95% Confidence Interval |
|---|---|---|
| 0.1 | | |
| 0.25 | | |
| 0.5 | | |
| 1 | 0.2941 | |
| 2.5 | 0.9902 | |
| 5 | 1.5395 | 0.1965 to 2.1828 |
| 10 | 2.1742 | 1.0675 to 2.5819 |
| 20 | 2.8235 | 2.2176 to 3.3592 |
| 25 | 3.0536 | 2.4947 to 4.0816 |
| 40 | 4.1667 | 3.3932 to 4.8780 |
| 60 | 5.5692 | 4.7502 to 6.8156 |
| 75 | 7.6436 | 6.1615 to 8.7266 |
| 80 | 8.0945 | 6.9580 to 9.7863 |
| 90 | 10.0434 | 8.6130 to 12.3327 |
| 95 | 11.9634 | 9.9973 to 14.5237 |
| 97.5 | 13.4921 | |
| 99 | 14.4940 | |
| 99.5 | | |
| 99.75 | | |
| 99.9 | | |

**Subgroup: older_aged = ages 9-12.99**

| | |
|---|---|
| Sample size | 34 |
| Lowest value | 1.0000 |
| Highest value | 11.7647 |
| **Arithmetic mean** | **4.9993** |
| 95% CI for the mean | 4.0419 to 5.9567 |
| Median | 4.5759 |
| 95% CI for the median | 3.2288 to 5.1103 |
| Variance | 7.5296 |
| Standard deviation | 2.7440 |
| **2 Standard Deviations above mean (clinical cut-point)** | **10.50** |
| Standard error of the mean | 0.4706 |
| Coefficient of Skewness | 0.9947 (P=0.0183) |
| Coefficient of Kurtosis | 0.4275 (P=0.4525) |
| D'Agostino-Pearson test for Normal distribution | reject Normality (P=0.0467) |

**Summary statistics for typically developing group (TD)**

| Variable | Rate of Nominal Reference Errors as percentage (rNRE%) rNRE% = (NRE / NTW)*100 |
|---|---|
| Sample size | 80 |
| Lowest value | 0.0000 |
| Highest value | 3.8889 |
| Arithmetic mean | 1.5212 |
| 95% CI for the mean | 1.3287 to 1.7136 |
| Median | 1.2862 |
| 95% CI for the median | 1.1701 to 1.5637 |
| Variance | 0.7477 |
| Standard deviation | 0.8647 |
| 2 Standard Deviations above mean (clinical cut-point) | 3.25 |
| Standard error of the mean | 0.09667 |
| Coefficient of Skewness | 0.7157 (P=0.0107) |
| Coefficient of Kurtosis | -0.09294 (P=0.9956) |
| D'Agostino-Pearson test for Normal distribution | reject Normality (P=0.0385) |

| Percentiles | | 95% Confidence Interval |
|---|---|---|
| 0.1 | | |
| 0.25 | | |
| 0.5 | | |
| 1 | 0.08174 | |
| 2.5 | 0.2747 | |
| 5 | 0.4096 | 0.05462 to 0.5795 |
| 10 | 0.5769 | 0.2979 to 0.6873 |
| 20 | 0.7371 | 0.5946 to 0.9536 |
| 25 | 0.8666 | 0.6597 to 1.1047 |
| 40 | 1.1869 | 0.9555 to 1.2906 |
| 60 | 1.5585 | 1.2821 to 1.9984 |
| 75 | 2.0863 | 1.7075 to 2.4348 |
| 80 | 2.3810 | 2.0032 to 2.5289 |
| 90 | 2.6638 | 2.4143 to 3.3641 |
| 95 | 3.25 | 2.6174 to 3.8040 |
| 97.5 | 3.45 | |
| 99 | 3.76 | |
| 99.5 | | |
| 99.75 | | |
| 99.9 | | |

**Subgroup: older_aged = ages 9-12.99**

| | |
|---|---|
| Sample size | 34 |
| Lowest value | 0.2770 |
| Highest value | 3.3333 |
| Arithmetic mean | 1.3698 |
| 95% CI for the mean | 1.1022 to 1.6373 |
| Median | 1.2038 |
| 95% CI for the median | 0.9421 to 1.3875 |
| Variance | 0.5880 |
| Standard deviation | 0.7668 |
| 2 Standard deviations above the mean (clinical cut-point) | 2.90 |
| Standard error of the mean | 0.1315 |
| Coefficient of Skewness | 1.0179 (P=0.0162) |
| Coefficient of Kurtosis | 0.4449 (P=0.4413) |
| D'Agostino-Pearson testfor Normal distribution | reject Normality (P=0.0413) |