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Talking Tots and the Terrible Twos: Early Language and Disruptive Behavior in Toddlers

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Abstract

Objective—The goal of this paper is to investigate the association between the two most commonly reported parental concerns about young children - disruptive behavior (e.g., irritable, aggressive, and noncompliant behaviors) and language delay in toddlers. To test for salient sub-group differences, individual differences by child sex and family poverty status were examined.

Methods—Participants included 1,259 mothers of children between 18 and 36 months of age. Mothers completed questions about their child's language development and disruptive behavior. Information regarding poverty status as well as child age and sex were also collected.

Results—Stronger language skills were associated with fewer disruptive behavior for children between 18 and 36 months of age. This negative association was stronger for girls than boys (*b* =

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Megan Y. Roberts: Dr. Roberts conceptualized and designed the study, drafted and approved the final manuscript as submitted.
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−0.243, $t(1251) = -3.555$, $p < .001$) and stronger for children living in poverty than those above the poverty line ($b = -2.04$, $t(1251) = -2.531$, $p = .011$).

Conclusions—Findings from our study suggest a developmental co-occurrence pattern that begins at a very early age. Individual differences suggest that there is substantial heterogeneity in these patterns; longitudinal investigation is needed to uncover causal pathways and underlying mechanisms. Awareness of the association between these two developmental domains about which parents frequently express concerns is critical to maximizing early detection and intervention.

Introduction

Language skills and disruptive behavior (e.g., irritable, aggressive and noncompliant behaviors) are the two most commonly reported parental concerns about young children.[1] In fact, 7 to 24% of toddlers display behavioral or socioemotional problems,[2] and 15 to 28% of toddlers exhibit language delays.[3,4] In addition, language delays and disruptive behavior often co-occur,[5,6] but little is known about this co-occurrence in the first years of life.[4] The goal of this paper is to investigate the association between disruptive behavior and language delay in early childhood.

The association between disruptive behavior and language difficulties is well established in school-age children, both concurrently and predictively.[5,6] Among school-age children with a behavioral disorder, 81% have below-average language skills.[6] Furthermore, children with a language disorder are twice as likely to have behavioral difficulties as typically developing children.[7] Emergent research from small samples suggests that links between language delays and disruptive behavior are evident at even younger ages.[4,8–10] Although several studies have examined the association between language skills and disruptive behavior in toddlers in population-based samples,[4,8–10] only one of these studies began before 24 months of age.[4]

In addition, a number of methodologic limitations constrain interpretation of prior work. First, most studies have treated disruptive behavior and/or language as categorical rather than continuous variables. Since developmental variation is extensive during this period, and categorical distinctions lose critical information about individual variation, the use of continuous measures is important for determining the nature of this association in very young children. For example, categorical comparisons preclude examination of whether the language-disruptive behavior association is present across the whole continuum of function or only at the extremes. In addition, the majority of studies have focused solely on expressive language skills. Given that expressive-only delays are most likely to resolve over time,[11] it is important to understand the association between disruptive behavior and multiple dimensions of language skills (i.e., expressive and receptive language).

Another major gap in the science base is exploration of sub-group differences in these patterns, which is crucial for generalizability. A central source of individual difference in developmental pathways is sex.[12–15] It is widely known that boys are more vulnerable to both disruptive behavior and impaired language.[16,17] However, sex differences at the intersection of language and disruptive behavior have received much less attention. This is in part because boys are overrepresented in studies of both disruptive behavior and language

impairment due to marked male preponderance.[18–20] Four studies have demonstrated an interaction between sex and disruptive behavior in relation to language development,[21–24] but the direction of these patterns is inconsistent. All four studies support the association between disruptive behavior and language for both girls and boys, but they varied in the strength of the association. That is, in two studies the association was stronger for boys[21,22] while this pattern was opposite in the other two studies.[23,24] There is grounding in developmental science to inform understanding of both of these alternate patterns. If replicated, the stronger association between language impairment and disruptive behavior in boys may reflect their greater vulnerability to developmental problems.[19,25] In contrast, the stronger pattern in girls might reflect the phenomenon that girls are less likely to have developmental problems but, when they do, the problems tend to be more severe and co-morbid.[26] Along these lines, disruptive behavior in young girls may be a marker for reduced social competence (in contrast to girls' typical advantage in social skills relative to boys), which is an important substrate of language learning.[19] Further, because disruptive behavior in girls is less common and inconsistent with sex-based stereotypes, it may more adversely affect the richness of linguistic interactions (e.g., reductions in parents' feelings of self-efficacy may have concomitant reductions in engagement).[20] These conflicting results may also be artefactual, reflecting variations in timing of measurement (e.g., cross sectional or longitudinal), socioeconomic diversity of samples, and methods of measuring disruptive behavior (e.g., classroom observation, teacher report). These inconsistent findings highlight the need for further research that includes parent report and a larger socioeconomically diverse sample.

The effect of demographic variation on the association between language and disruptive behavior in young children is also understudied. Children living in poverty have more disruptive behavior[16] and poorer language skills than children who do not live in poverty,[27] but, to our knowledge, the effect of poverty on the association between disruptive behavior and language development has not been examined. We theorized that disruptive behavior would be more strongly associated with greater language impairment for young children growing up in poverty because of the dampening effect of poverty on social exchanges[12] that occur within the context of stressed and under-resourced environments.[28]

In this study, we drew on a large population-based sample and employed developmentally-sensitive methods to evaluate the association between disruptive behavior and language skills in young children from 18 to 36 months of age. Often, disruptive behavior checklists include symptoms that are highly overlapping with the normative misbehaviors of early childhood (e.g., temper tantrums) and/or extreme (e.g. fire setting).[29] Developmentally specified measures, in contrast, take a dimensional approach covering a broad spectrum of both normative (e.g., hits peers when frustrated; says "no") and dysregulated disruptive behaviors (e.g., tantrums until exhausted; shows off while misbehaving).[30] Coverage of a broad spectrum of developmentally sensitive behaviors from common to extreme, combined with assessment of frequency of occurrence, enables specification of a normal: abnormal continuum of behavior patterns.[31] We hypothesized: (a) a negative linear association between language skills and disruptive behavior evident as early as 18 months of age and (b) moderation of the association between language skills and disruptive behavior by sex and poverty status.

Method

Participants

Participants for this study included 1,259 mothers of children 18–36 months of age from a larger panel study of diverse parents of young children (n=2,001). Toddlers under 18 months were excluded from the present study because 18 months is an age at which children's expressive language skills increase drastically. Mothers with at least one child 12–38 months old were invited via email to complete the survey. A quota sampling approach was used to obtain approximately equal numbers of boys and girls and to reflect 2015 U.S. Census data on the proportion of residents from the two largest racial/ethnic minority groups (approximately 15% African Americans and 15% Hispanics), as well as the proportion of households living under the poverty line (approximately 25%). The sample was also educationally diverse, with nearly one quarter of mothers having a high school degree or less and approximately 35% holding a college degree or higher. Participants received $9 for completing the survey. All procedures were approved by the University's Institutional Review Board and respondents provided online informed consent. The socio-demographic characteristics of the 18–36 month-old sample are presented in Table 1.

Measures

Language Skills—Mothers completed 9 questions about child communication and language development (Table 2). These questions and the response options were developed by project investigators with expertise in early childhood clinical assessment, speech-language pathology, and language delays. All items were correlated with age at $r > .30$, except for Gesture Use, which plateaued at around 23 months ($r = .17$). As a result, Gesture Use was not included in the IRT analysis as its discriminant abilities would be low. A major assumption in many IRT models is that the items on the scale measure a single, unidimensional construct. Horn's Parallel Analysis was used to analyze the dimensionality of the eight retained language items. The results suggest that the items represent a single dimension. A principal components analysis was conducted using one factor, which accounted for 45% of the variance in language item responses, with high internal consistency ($\alpha = .85$). In order to create a single language score from the eight retained language items, a graded response model (GRM) was used to fit the data. Graded response models are a type of IRT model used for ordered polytomous categories.[32] The GRM model in the current analysis was fit in R using the grm() function of the ltm package.[33]

Table 3 provides estimates from the GRM for the threshold parameters (βi_k) and discrimination (α_i) for each item in the language scale. The threshold parameters for each response category represent the language ability at which there is a 50% probability that participants would select a higher response category. Ability estimates were calculated for each participant using the factor scores from this GRM model, and these factor scores were used in the regression analyses that follow.

Disruptive Behavior—We adapted the Temper Loss, Aggression, and Noncompliance subscales of the preschool version of the Multidimensional Assessment of Preschool Disruptive Behavior (MAP-DB)[29] for use with infants/toddlers.[34,35] Based on the project

investigators' developmental expertise, as well as the qualitative results of three focus groups with 18 mothers of children aged 12–36 months, we modified existing items and created new items, resulting in 44, 41, and 38 items for the Temper Loss, Aggression, and Noncompliance domains, respectively. We reduced the item pool based on factor analyses and IRT analyses on each dimension, removing items with low factor loadings, balancing low vs. high severity, and reducing item overlap, to arrive at a final scale containing 70 items (30 for Temper Loss, 25 for Aggression, and 15 for Non-Compliance). As with the original MAP-DB, items were rated in terms of frequency over the past month: 0 = Never in the past month; 1 = Rarely (less once per week); 2 = Some (1–3) days of the week; 3 = Most (4–6) days of the week; 4 = Every day of the week; and 5 = Many times each day. The overall disruptive behavior factor and all subscales demonstrated good internal consistency; $\alpha = .98$ for Temper Loss, $\alpha = 0.99$ for Aggression, and $\alpha = .97$ for Noncompliance.

The individual MAP-DB items were scored using a unidimensional graded response model[32] fit to 70 MAP-DB items, each with 6 response categories. The graded response model assumes a sample mean of zero and standard deviation of one, with estimated scores deviating slightly from this constraint. Estimated scores in this sample showed a mean score of −.032 with a standard deviation of .995 (minimum −3.205, maximum 2.827). The theoretical framework and psychometric properties of the MAP-DB have been extensively described.[29,31]

Poverty Status—Mothers reported on family income and number of adults and children in the family. Poverty status (i.e., below or above the poverty threshold) was determined using the 2016 US Department of Health & Human Services poverty guidelines based on household size (https://aspe.hhs.gov/poverty-guidelines). We considered examining the extent to which maternal education was associated with disruptive behavior and language skills, however it was co-linear with poverty status (see Table 5). As such, we only included poverty status in all models.

Analytical Plan—In order to test the association between language skills and disruptive behavior and to determine whether sex and poverty status moderate this association, a series of nested models was created for each narrow band dimension of disruptive behavior on the MAP-DB: Aggression, Temper Loss, and Noncompliance. However, because the association with language did not vary across disruptive behavior dimensions, we used a unidimensional disruptive behavior score.

Each regression model contained the language IRT score, sex, and poverty status, with the child's age entered as a covariate. In addition, a quadratic language variable, created by squaring the language IRT score, was included in each model to test for the presence of a nonlinear association between language and disruptive behavior. The second model added an interaction between language scores and sex to the base model. The third model added an interaction between language scores and poverty status to the base model. The fourth model included both the language score and poverty interaction and the language score and sex interaction. The fifth model added a three-way interaction term between language scores, sex, and poverty status. These five models were then compared using likelihood ratio tests[36] in order to select the best-fitting model (see Table 4).

Results

Table 5 includes bivariate correlations between all variables. Table 6 presents regression coefficients for the model series with corresponding likelihood ratios. Results show that model 4, which contains interactions between language scores and both sex and poverty status, best fit the data (R^2 = .125, $F(7, 1251) = 25.51$, $p < .001$). Including a three-way interaction between language scores, sex, and poverty status in model 5 did not significantly improve model fit. The regression coefficients from model 4 reveal that, on average, children living in poverty had higher rates of disruptive behavior than children not living in poverty ($b = 0.258$, $t(1251) = 4.07$, $p < .001$). Additionally, females were rated as having higher rates of disruptive behavior than males ($b = 0.423$, $t(1251) = 7.34$, $p < .001$). The quadratic language term in this model was statistically significant ($b = -0.205$, $t(1251) = 6.77$, $p < .001$), demonstrating that as language skills increase, disruptive behaviors decrease. The fact that it was the quadratic term that was significant reveals that this association is non-linear – at higher levels of language skills, disruptive behaviors decrease at accelerated rates. The significant sex interaction indicates that the negative association between language and disruptive behavior is stronger for girls than boys ($b = -0.243$, $t(1251) = -3.555$, $p < .001$). That is, for females, as language skills increase, disruptive behaviors decrease more rapidly than in males. Similarly, the association between language and disruptive behavior was stronger for children living in poverty than those above the poverty line ($b = -2.04$, $t(1251) = -2.531$, $p = .011$). Specifically, for children living in poverty, as language skills increase, disruptive behaviors decrease more quickly than for children living above the poverty line.

Discussion

Main Findings

The outcomes of this study indicate that the association between early language abilities and disruptive behavior is evident as early as 18 months of age. Toddlers between 18 and 36 months of age with better language skills had fewer disruptive behaviors. Although the present findings are correlational rather than conclusively causal, we theorize a number of pathways by which early language skills and disruptive behavior are linked. For example, a common risk across these domains may cause broad developmental weaknesses. One such common risk may be exposure to adverse environments (e.g. unpredictable, stressful, harsh, or under-stimulating), which impedes both language development and self-regulation by constraining learning and development opportunities.[37,38] Alternatively, this dual deficit may occur via their reciprocal influence on each other. For example, because language is inherently social, language delays may hinder social interactions, reducing adaptive coping strategies, which subsequently results in aggression, temper tantrums and defiance. Conversely, disruptive behavior may impede language development by reducing the quantity and quality of linguistic input because interactions with the child are aversive for social partners.

Furthermore, the outcomes in this national sample indicate that the language-disruptive behavior association in young children is influenced by both sex and SES. Language skills are more strongly negatively associated with disruptive behavior for girls than boys. Methodologic differences across prior work constrain interpretation of these findings. For

example, when teacher report of disruptive behavior is used, patterns are in this same direction, indicating a stronger association for girls than boys.[23,24] In contrast, studies that use direct classroom observation of disruptive behaviors of children show stronger associations for boys. Of note, these latter studies were restricted to children in low socio-economic environments.[21,22]

There are several possible reasons for the moderating effect of sex we found. When developing well, girls tend to have greater social competence[39] and stronger language skills that enable them to competently navigate their environments and modulate their behavior. As such, girls may have more to gain or more to lose. Thus, when young girls demonstrate disruptive behavior, they lose their typical social advantages that stimulate language learning. In contrast, boys may typically rely less on language for self-regulation and therefore may be less impeded by weaker language skills. However, these interaction analyses were exploratory and need to be replicated in longitudinal studies that chart these unfolding, bidirectional patterns over time.

Similarly, language skills are also more negatively associated with disruptive behavior for children living in poverty. For children living in poverty who are disproportionally more likely to experience significantly more malnutrition, insufficient health care, environmental hazards, and chronic stress,[40] any additional strain to an already taxed neurodevelopmental system may result in intensified strain on a corollary system, such as language. Consequently, when a child living in poverty experiences a language delay, this delay may exacerbate disadvantage for children already constrained by under-resourced and strained environmental experiences. In contrast, young children from better resourced environments may have access to more compensatory experiences and supports that prevent “spillover” from one developmental domain to another.

Limitations

These findings should be considered in the context of study limitations. First, disruptive behavior and language skills were measured by maternal report rather than performance-based assessment. This may introduce methodologic biases given differences in the rates of reported versus observed disruptive behaviors[5] and language skills. [41] Additionally, there was shared method variance because both disruptive behavior and language skills were obtained by maternal report. Extension of these findings using performance-based measures, such as direct assessments of language skills and standardized observation of disruptive behavior,[42] is needed. Second, language is a multi-dimensional construct that includes receptive and expressive grammar and vocabulary. Given the limited number of language-related questions, it is unclear the extent to which different aspects of language drive the association with disruptive behavior. Future research should include more comprehensive measures of language skills. Although we did not detect differences in this association based on varied dimensions of disruptive behavior with our limited language measure, examination with more nuanced measures of language domains may yield a more differentiated pattern. Third, given the cross-sectional nature of the study, we were unable to test the developmental sequence underlying the relation between disruptive behavior and language

skills. Future research should include longitudinal observational measures of language and disruptive behavior patterns.

Interpretation

Results from this study suggest that children's disruptive behavior is associated with their language skills. However, pediatricians and parents may weigh these developmental difficulties differently. For example, a child with a language delay may have tantrums or act aggressively when they are unable to communicate their wants and needs or exhibit noncompliance when they have trouble understanding those around them. These disruptive behaviors may be more immediately salient to the parent than the language delays. However, given the early life co-occurrence of disruptive behavior and language delays, if a parent reports concerns about either developmental domain, pediatricians should consider screening for both language delays and disruptive behaviors.

Conclusions

In this study, we examined the extent to which early disruptive behavior and language skills are related in toddlerhood. Findings from our study advance the field in the following ways. First, these findings suggest that the co-occurrence of language difficulties and disruptive behaviors begins at an early age. Second, these findings suggest that the association between disruptive behavior and language is stronger for girls in toddlerhood and for children living in poverty. This is the first large scale study to examine the moderating effects of sex and poverty on the association between disruptive behavior and language in a sample of toddlers. Awareness of association between two domains about which parents frequently express concerns, is critical to maximizing early detection and intervention.

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Table 1.

Demographic information.

Variable	Mean (SD) or %	Min	Max
Child Age in Months	28.24 (5.93)	18.00	36.00
Male	50	n/a	n/a
Poor	25	n/a	n/a
Language IRT Scores	0.35 (0.78)	−2.60	2.28
Disruptive Behavior IRT Scores	−0.02 (0.99)	−3.21	2.83
Maternal Education			
Less than high school	1.75		
High school or GED	21.13		
Associates Degree	13.3		
Some College (No Degree)	27.64		
Bachelor's Degree	27.16		
Graduate Degree	9.05		
Child Race/Ethnicity			
Asian	7.704		
Black/African American	15.330		
Hispanic	15.568		
White/Caucasian	56.473		
Native Hawaiian/Pacific Islander	0.874		
Native American/Alaskan Native	0.874		
Other	3.177		

Table 2.

Language questions and response options

Question	Response options
How often does your child imitate things they've just heard (such as new words)?	0=Never (my child imitates close to 0% of words heard), 1=Sometimes, (my child imitates about 25% of words heard), 2=Often (my child imitates about 50% of words heard), 3=Always or almost always (my child imitates 75% or more of words heard)
How often does your child pretend during play (for example, pretend to put a baby to bed, pretend a block is a phone)?	0=Never (almost none of my child's play includes pretending), 1=Sometimes (about 25% of my child's play includes pretending), 2=Often (about 50% of my child's play includes pretending)
How often does your child use gestures to communicate (for example, to greet someone, to share information, or to tell you what he/she wants or likes)?	0=Never (close to 0% of my child's communication is a gesture),1=Sometimes (about 25% of my child's communication includes a gesture), 2=Often (about 50% of my child's communication includes a gesture),3=Always or almost always (about 75% or more of my child's communication includes a gesture).
How often does your child respond correctly to spoken directions (for example, "give me the ball", "get your shoes")?	0=Never (my child follows close to 0% of directions),1=Sometimes (my child follows about 25% of directions),2=Often (my child follows about 50% of directions),3=Always or almost always (my child follows about 75% of directions or more).
How many different words does your child say?	0=No words, 1=1–2 words, 2=3–10 words, 3=11–50 words, 4=Between 51 and 200 words, 5=Between 200 and 500 words, 6=More than 500 words
How well do strangers understand what your child says?	0=Strangers understand none (0%) of what my child says, 1=Strangers understand very little (25%) of what my child says, 2=Strangers understand about half (50%) of what my child says, 3=Strangers understand most (75%) of what my child says, 4=Strangers understand nearly all (100%) of what my child says
Does your child use correct endings on words (for example, words that end in: -ing, plural -s, -ed)?	0=Never (close to 0% of my child's words include correct word endings), 1=Sometimes (about 25% of my child's words include correct word endings), 2=Often (about 50% of my child's words include correct word endings), 3=Always or almost always (about 75% or more of my child's words include correct word endings)
On average how many words does your child say in a sentence?	0=None, 1=1 word (e.g. "ball"), 2=2 words (e.g. "more water", "mommy up"), 3=3 words (e.g. "I want juice"), 4=4+ words (e.g. "I want more juice").
Is your child combining words (for example, "more juice", "want banana")?	0=No, 1=Yes

Table 3.

Item parameter estimates from the GRM

Item	β_{i1}	β_{i2}	β_{i3}	β_{i4}	β_{i5}	β_{i6}	α_i
Combining Words	−0.726						2.933
Vocabulary Size	−2.100	−1.463	−0.480	0.355	1.078	1.807	2.925
Sentence Length	−1.734	−0.707	0.193	0.871			4.179
Imitates	−2.863	−0.558	0.876				1.519
Pretend Play	−2.297	−0.133					1.250
Following Directions	−3.220	−0.995	0.672				1.202
Word Endings	−1.021	0.626	2.072				1.554
Intelligibility	−2.340	−0.584	0.685	2.069			1.617

Note. Each item had a different number of response options, and so not all cells are filled.

Table 4.

Model comparisons using deviance-based chi-square tests

	Temper Loss		
Model	χ^2	**df**	***p***
1. Base Model	--	--	--
2. Including Language * Female	12.077	1	<.001
3. Including Language * Poverty Status	6.731	1	0.005
4. Including both two-way interactions	5.499	1	0.011
5. Including Language * Female * Poverty Status	1.164	2	0.508

* p < .05

** p <.01

*** p <.001

Table 5.

Bivariate correlations

	1	2	3	4	5	6	7	8
1. Child Age	--							
2. Aggression IRT Score	−0.009	--						
3. Temper Loss IRT Score	−0.028	0.811***	--					
4. Noncompliance IRT Score	0.020	0.779***	0.909***	--				
5. Language IRT Score	0.476***	−0.166***	−0.159***	−0.106***	--			
6. Sex (Female)	0.025	0.138***	0.164***	0.154***	0.049†	--		
7. Poverty Status (Poor)	−0.024	0.153***	0.117***	0.089**	−0.120***	0.019	--	
8. Maternal Education (Polychoric)	0.032	0.066*	0.061	0.100**	0.050***	0.042	−0.403***	--

† p < .1;

* p < .05;

** p <.01;

*** p <.001

Table 6.

Regressions models for disruptive behavior scores

	Dependent variable:				
	Disruptive Behavior				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Constant	−0.449**	−0.479***	−0.473***	−0.499***	−0.495***
	(0.142)	(0.142)	(0.142)	(0.142)	(0.142)
Child Age (months)	0.014**	0.014**	0.015**	0.014**	0.014**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
Poor	0.209***	0.210***	0.262***	0.258***	0.239**
	(0.061)	(0.061)	(0.064)	(0.063)	(0.089)
Female	0.336***	0.427***	0.337***	0.423***	0.405***
	(0.053)	(0.058)	(0.053)	(0.058)	(0.069)
Language IRT Score	−0.127**	−0.013	−0.070	0.032	0.010
	(0.042)	(0.052)	(0.046)	(0.054)	(0.058)
Language IRT Score^2	−0.217***	−0.195***	−0.227***	−0.205***	−0.202***
	(0.030)	(0.030)	(0.030)	(0.030)	(0.030)
Female *Language IRT Score		−0.255***		−0.243***	−0.105
		(0.068)		(0.068)	(0.117)
Poor *Language IRT Score			−0.225**	−0.204*	−0.201**
			(0.081)	(0.080)	(0.078)
Poor *Female					0.046
					(0.127)
Poor *Female *Language IRT Score					−0.187
					(0.161)
Observations	1,259	1,259	1,259	1,259	1,259
R^2	0.111	0.121	0.116	0.125	0.126
Adjusted R^2	0.107	0.117	0.112	0.120	0.120
Residual Std. Error	0.933 (df = 1253)	0.928 (df = 1252)	0.931 (df = 1252)	0.926 (df = 1251)	0.927 (df = 1249)
F Statistic	31.26*** (df = 5; 1253)	28.66*** (df = 6; 1252)	27.49*** (df = 6; 1252)	25.59*** (df = 7; 1251)	20.04*** (df = 9; 1249)

*p < .05;

**p <.01;

***p <.001