Frances McClelland Institute
Children, Youth, and Families

Allomaternal Caregiving Shapes Early Learning Outcomes in Infants Aged 13-18 Months

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Abstract

Humans are unique in our expression of extensive allomaternal care (AMC), or care for infants from individuals other than the mother. To understand why such extensive AMC evolved and was maintained in our species, we must understand the fitness benefits experienced by both mothers and their infants. This study investigates whether measurable developmental effects of exposure to AMC can be detected during early infancy prior to the onset of meaningful speech. Results suggest that exposure to more highly involved familial caregivers can improve developmental learning outcomes in measurable ways during early infancy.

Background

Extensive allomaternal care (AMC) is unique in humans (Burkart *et al.*, 2014; Hawkes, 2014; Isler & van Schaik, 2012; Meehan, 2014):

- Extensive networks of caregivers
- Enhanced maternal fertility
- Intense food sharing with infants

Energetic benefits are easy to measure:

- Count instances of AMC food sharing, then measure physical growth of infant and mom's inter-birth interval

The pre- and periverbal period (13-18 months) is a time of heightened need for AMC (Dettwyler, 1995; Kuzawa *et al.*, 2014):

- Mom's milk isn't enough to meet increasing energy demands
- Baby's brain energy needs are increasing, while fat deposits are decreasing

Environments rich in stimuli improve development (e.g., Kolb *et al.*, 2014; Lewkowicz, 2012; Nelson & Bloom, 1997)

- AMC provides opportunities for increased exposure to varied signals from multiple caregivers (e.g., Beebe & Steele, 2013; DiCarlo *et al.*, 2014; Hedenbro & Rydelius, 2013; Jamison *et al.*, 2002; Jung & Fouts, 2011; Super & Harkness, 1986; Voland & Beise, 2002)

Methods

Participants: 102 mothers & typically-developing infants in Tucson, AZ

- 50 female and 52 male infants between the ages of 13-18 months
- All infants born >37 gestational weeks (full-term)
- From households that primarily spoke English

Measures for Outcome Data:

- NCHS Motor and Social Development Scale (online; MSD)
- Bayley III Screening Cognitive Subtest (in lab; Bayley Cognitive)

Measures for AMC Predictor Data:

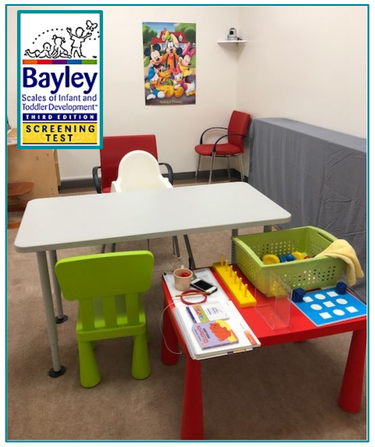
- Current Caregiver Involvement and Support Questionnaire (online)
- Structured daily diaries of care completed over 14 days (online)
- Longitudinal interviews about child's AMC exposure since birth (in lab)

Additional covariates:

- Child's sex, age at test, and birth order
- Family's income-to-needs ratio
- Mother's age, ethnicity, education level, and level of depressive symptoms (CESD-R)

Statistical Analyses (using R v3.5.1):

- PCA with varimax rotation to condense 21 AMC variables from 3 measures into 4 components (AMC PCs)
- Linear Regression Models for each outcome using all AMC PCs and additional covariates in the null model
- Backward Model Selection Analyses on each null model to determine the best fitting models using *AIC*



Results

Table 1. *Highly Involved Familial AMC* (AMC PC1) as a Predictor of MSD Score (Modified from Singletary, *under review*)

Predictor	*β*	*t*	*p*-value	Semi-Partial R^2
Child's Age at Test	0.29	3.076	0.0027**	0.0849
Child's Sex	0.21	2.280	0.0248*	0.0499
AMC PC1	0.22	2.304	0.0233*	0.0500

Table 2. *Highly Involved Familial AMC* (AMC PC1) as a Predictor of Bayley Cognitive Score (Modified from Singletary, *in prep*)

Predictor	*β*	*t*	*p*-value	Semi-Partial R^2
Child's Age at Test	0.62	3.076	0.0027**	0.3922
Child's Birth Order				0.0202
.... 2nd born	-0.06	-0.695	0.4890	
.... 3rd born	0.07	0.921	-0.3592	
.... 4th born or later	-0.20	-2.491	0.0145*	
Mom's Age	-0.15	-1.953	0.0537	0.0350
AMC PC1	0.23	2.934	0.0042**	0.0746

Note: Semi-partial R^2 values are calculated using the square of the semi-partial correlation between the predictor and outcome after controlling for all other variables in the model.

Table 3. Summary of Significant AMC Predictor Component – AMC PC1 (Modified from Singletary, *under review*)

AMC Predictor Component	Proportion of Overall Variance	Interpretation for High Component Score
Highly Involved Familial AMC	21%	More current and lifetime familial caregivers. In last 60 days, more caregivers that have been involved in AMC since birth. More caregivers that mother views as highly involved and highly depended on.

Note: AMC PC1 is the only significant AMC predictor component of differences in MSD and Bayley Cognitive scores identified through backward model selection analyses using the null model.

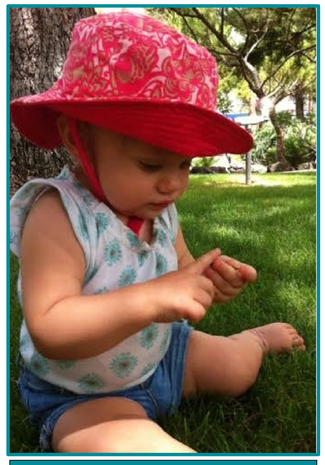


Table 4. Distribution of Scores

MSD	Mean ± SD
♂ 13-15 mo	90.42 ± 11.30
16-18 mo	94.33 ± 12.26
♀ 13-15 mo	94.74 ± 11.82
16-18 mo	102.04 ± 14.30
Bayley Cognitive	**Mean ± SD**
♂ 13-15 mo	16.03 ± 2.34
16-18 mo	18.14 ± 2.65
♀ 13-15 mo	15.93 ± 2.13
16-18 mo	19.61 ± 2.87

Conclusions and Implications

Infants score higher on early learning measures with increased exposure to highly involved familial caregivers

- AMC PC1 is predictive of both mother-rated and tester-rated learning outcomes
- Differences are attributable to informal networks of family and friends
  - There are no significant differences attributable to attending formal childcare or to facility type

AMC benefits infants outside of energetics → we should reconsider how we explain extensive AMC

Limitations: lack of cross-cultural comparison and need for more caregiver-quality focused measures

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