Calling All Parents: Leveraging Behavioral Insights to Boost Early Childhood Outcomes

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Early Adversity, Lasting Impacts

- Developmental delays in children from disadvantaged backgrounds emerge at an early age
- Families in poverty tend to spend less time with their children, express affection less frequently, and engage in fewer reading and interactive activities (Berlinski and Schady, 2015; Guryan et al. 2008)
- This has lasting negative consequences both for the children themselves (Almond, Currie, and Duque, 2018) and for future generations (Doepke et al. 2019)

Can scalable interventions improve child-rearing environments?

- Positive effects of home-visiting programs on parents and children (Campbell and Ramey, 1994; Heckman et al., 2010; Currie, 2001; Gertler et al., 2014; Attanasio et al., 2014, 2022; Jeong et al., 2021).
- Although effective, these programs face significant scalability challenges due to the intensive need for trained facilitators and high levels of oversight
- Challenge: designing *scalable* parenting interventions that can affect the child-rearing environment and improve child development.

This project

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- We design, evaluate and implement a pilot that combines mobile technology and AI with human assistance to improve family's environments
    - Following COVID, the Uruguayan Ministry of Social Development's Family Assistance Program (PAF - home visits) could not meet demand
    - Together with the Ministry, we designed a tele-assistance + e-messaging program to attend families on the waiting list
    - Ideal setting: high connectivity and universal coverage of cellphones in Uruguay

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  - Together with the Ministry, we designed a tele-assistance + e-messaging program to attend families on the waiting list
  - Ideal setting: high connectivity and universal coverage of cellphones in Uruguay
- We evaluate the program using an RCT (N=1360 families)

Early childhood parenting interventions using technology

- E-messaging parents works
  - Development of reading skills (York et al. 2019, Doss et al. 2017, Meuwissen et al. 2017, Mayer et al. 2018, Hurwitz et al. 2015)
  - Frequency and quality of parental investment and the quality of language interactions between caregiver and child (Bloomfield et al. 2023, Balsa et al. 2021)
  - Preschool attendance (Ajzenman et al. 2022)

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- Recent evidence suggests that social interaction may be necessary to promote sustainable change (Gallego et al. 2023, Balsa et al. 2023)

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    - Preschool attendance (Ajzenman et al. 2022)
- Recent evidence suggests that social interaction may be necessary to promote sustainable change (Gallego et al. 2023, Balsa et al. 2023)
- Contribution: Among the first studies to evaluate a multi-component family intervention combining calls, e-messages AI in a developing country

Tele-assistance and messaging program 2022-2023

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- Two thematic modules:
  - Module 1 (4 months): **parenting competencies** (sensitivity and affection, stimulation, protection, reflection), **health and nutrition**, access to **government benefits**
  - Module 2 (4 months): **language development** (importance of child's nonverbal cues, two-way conversations, description of environment, stories, songs)

Tele-assistance and messaging program 2022-2023

- Components of intervention:
  - Weekly **telephone calls** by the same teleoperator
  - Text and audio **messages** three times a week
    - Rooted in behavioral economics insights
    - Personalized by gender, name and age
  - **Chatbot** with information on local resources
  - **AI feedback** to WhatsApp audios of language interactions (DiviMe Software)

Tele-assistance and messaging program 2022-2023

- Implementation
    - Implemented in three **batches**
    - **Compliance**: UCC referred 8 % of the sample to other programs due to complexity of families; 7 % of the sample dropped off
    - **Intensity**
        - Average number of calls answered was 13
        - 76 % of messages were received

Experimental design

- Randomization and sample
  - Eligibility criteria: vulnerable families with children aged 0-3 years (PAF waiting list)
  - N = 1360 families
  - Randomization stratified by child's age, mother's education and batch
  - Treatment group receives four program components for 8 months, control group accesses restricted chatbot only

Descriptive statistics and balance

		Control			Treatment			Difference	
	N	Mean	s.d.	N	Mean	s.d.	N	Coefficient	s.e.
Panel A: Child									
Age (months)	509	25.105	13.012	851	27.127	12.086	1360	-0.102	0.578
Male	509	0.505	0.500	851	0.516	0.500	1360	0.011	0.028
First child	507	0.456	0.499	847	0.504	0.500	1354	0.058**	0.028
Twin	509	0.033	0.180	851	0.039	0.193	1360	0.000	0.011
Attends an early childhood center	509	0.517	0.500	851	0.485	0.500	1358	-0.018	0.028
Lives with mother	505	0.976	0.152	849	0.980	0.140	1354	0.003	0.008
Father or male caregiver in household	509	0.607	0.489	851	0.618	0.486	1360	0.006	0.028
Panel B: Caregiver									
Woman	509	0.994	0.077	851	0.988	0.108	1360	-0.007	0.006
Age (years)	506	27.175	7.548	849	28.382	35.191	1355	1.270	1.604
Works	508	0.254	0.436	847	0.247	0.431	1355	-0.009	0.025
Relationship = mother	509	0.953	0.212	851	0.951	0.217	1360	-0.001	0.012
Completed middle school	509	0.306	0.461	851	0.323	0.468	1360	0.020	0.026
Risk of depression	508	0.394	0.489	850	0.366	0.482	1358	-0.030	0.027
Frequency with no internet access = never	388	0.327	0.470	634	0.326	0.469	1022	0.000	0.031
Frequency with no internet access = once a month	388	0.157	0.364	634	0.156	0.363	1022	0.013	0.024
Frequency with no internet access = every 15 days	388	0.263	0.441	634	0.263	0.441	1022	-0.006	0.029
Frequency with no internet access = every week	388	0.253	0.435	634	0.254	0.436	1022	-0.007	0.028
Panel C: Household									
Number of members	509	4.786	1.957	850	4.708	2.207	1359	0.042	0.118
Number of children	505	2.178	1.380	849	2.041	1.206	1354	-0.098	0.072
Overcrowding	508	0.689	0.463	850	0.678	0.468	1358	-0.007	0.026
Government assistance	505	0.964	0.186	848	0.953	0.212	1353	-0.007	0.011
Receives TUS cash benefits	505	0.578	0.494	848	0.534	0.499	1353	-0.029	0.028
Receives AFAM-PE cash benefits	505	0.897	0.304	848	0.873	0.334	1353	-0.010	0.018
Experienced negative shock	501	0.848	0.359	841	0.842	0.365	1342	0.000	0.021
Number of negative shocks	501	2.180	1.582	841	2.083	1.498	1342	-0.053	0.087
Lives in Montevideo	508	0.472	0.500	851	0.442	0.497	1359	-0.047*	0.028

Notes: s.d=Standard deviations. * p<.1, ** p<.05, *** p<.01

Evaluation phases and outcomes

- Telephone survey and WhatsApp audios
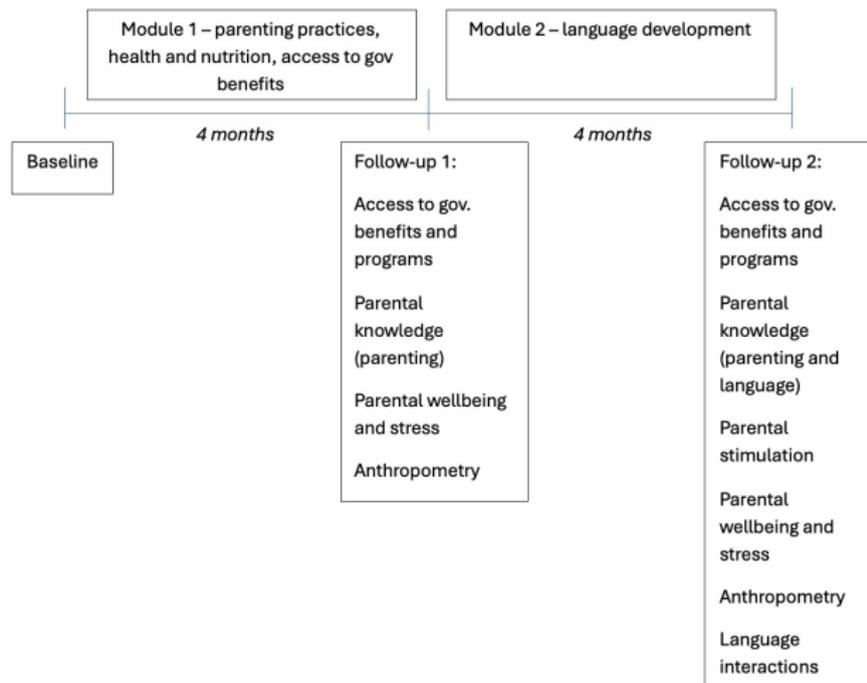
Attrition

| | Probability of completing telephonic survey | | Probability of sending audio |
	First follow-up	Second follow-up	Second follow-up
	(1)	(2)	(3)
Difference in response rate between treatment and control	-0.004	0.025	-0.031
	(0.026)	(0.028)	(0.024)
Batch 2	-0.111***	-0.049	0.023
	(0.029)	(0.031)	(0.027)
Batch 3	-0.092***	-0.135***	-0.002
	(0.032)	(0.034)	(0.029)
Control response rate	0.753***	0.587***	0.242***
	(0.025)	(0.027)	(0.024)
N	1360	1360	1360

Results: ITT effects on access to government benefits

	1st follow-up				2nd follow-up		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Government benefits and programs							
Government transfers	0.293***	0.315***	0.329***	0.000	0.358***	0.368***	0.376***
	(0.065)	(0.064)	(0.056)		(0.071)	(0.071)	(0.065)
	[934]	[932]	[927]		[745]	[743]	[738]
BIS preschool scholarship	0.144*	0.147*		0.067	0.046	0.045	
	(0.076)	(0.078)			(0.080)	(0.082)	
	[935]	[933]			[745]	[743]	
Labor programs	0.230***	0.212***		0.002	0.074	0.046	
	(0.071)	(0.072)			(0.079)	(0.080)	
	[939]	[937]			[747]	[745]	
Controls: Strata and unbalanced vars	N	Y	Y		N	Y	Y
Controls: Variable in baseline if available	N	N	Y		N	N	Y

Note: p<.1, ** p<.05, *** p<.01. Rows depict different outcomes. We adjust for multiple hypothesis testing the p-values of

the coefficients in columns (2) and (6) and report these in columns (4) and (8) respectively.

Results: ITT effects on parental knowledge and involvement

	1st follow-up				2nd follow-up		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel B: Parental investment and knowledge							
Parental Knowledge – Childrearing	0.097	0.112*	0.160		0.029	0.013	
	(0.068)	(0.067)			(0.079)	(0.080)	
	[932]	[930]			[733]	[731]	
Parental Knowledge – Language					0.150**	0.145*	0.143
					(0.075)	(0.075)	
					[730]	[728]	
StimQ - Frequency					0.187**	0.200***	0.061
					(0.077)	(0.076)	
					[740]	[738]	
StimQ - Quality					-0.082	-0.077	
					(0.071)	(0.071)	
					[740]	[738]	
Controls: Strata and unbalanced vars	N	Y	Y		N	Y	Y
Controls: Variable in baseline if available	N	N	Y		N	N	Y

Note: p<.1, ** p<.05, *** p<.01. Rows depict different outcomes. We adjust for multiple hypothesis testing the p-values of

the coefficients in columns (2) and (6) and report these in columns (4) and (8) respectively.

Results: ITT effects on parental wellbeing and child anthropometry

	1st follow-up				2nd follow-up		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel C: Parental Wellbeing and Stress							
Wellbeing Index	0.006	0.009			0.156**	0.162**	0.033
	(0.094)	(0.094)			(0.079)	(0.080)	
	[467]	[466]			[697]	[695]	
Parental Stress Index	-0.066	-0.054			-0.193**	-0.203**	0.029
	(0.091)	(0.093)			(0.078)	(0.080)	
	[479]	[478]			[697]	[695]	
Panel D: Child's anthropometry							
Weight for age	0.081	0.048	-0.135		0.054	0.037	-0.002
	(0.106)	(0.107)	(0.125)		(0.084)	(0.085)	(0.079)
	[441]	[440]	[222]		[671]	[669]	[503]
Height for age	0.057	0.039	0.103		-0.070	-0.124	-0.179*
	(0.115)	(0.116)	(0.146)		(0.084)	(0.082)	(0.092)
	[410]	[409]	[191]		[620]	[618]	[414]
Controls: Strata and unbalanced vars	N	Y	Y		N	Y	Y
Controls: Variable in baseline if available	N	N	Y		N	N	Y

Note: p<.1, ** p<.05, *** p<.01. Rows depict different outcomes. We adjust for multiple hypothesis testing the p-values of the coefficients in columns (2) and (6) and report these in columns (4) and (8) respectively.

Results: ITT effects on language interactions

	Outcome					
	Mother's avg. word rate/min	Mother's vocaliza- tions/hr	Mother's pitch range	Mother's pitch	Child's vocaliza- tions/hr	Turn transitions/hr
	(1)	(2)	(3)	(4)	(5)	(6)
Coefficient	0.369*	0.114	-0.152	0.355*	0.036	-0.064
	(0.216)	(0.149)	(0.176)	(0.185)	(0.171)	(0.162)
N	123	123	123	123	123	123

Note: p<.1, ** p<.05, *** p<.01. We control for strata, batch, and for a dummy that indicates whether the child is the first of

his or her family. We also control for the age of the child and the outcome at baseline.

Mechanisms: Theory of change

- The program is designed to influence early environments through a multi-component approach that combines human support and behavioral tech-based outreaches
- Access to **cash transfers**, food baskets and labor programs $\rightarrow$ alleviates economic constraints, and favors child development and parental well-being
- Access to **childcare support** $\rightarrow$ releases family time, increases community support, and favors parental well-being
- Telephone **calls and e-messages**:
  - $\rightarrow$ increase parental knowledge
  - $\rightarrow$ redirect parent's attention towards more stimulating and affective practices
  - $\rightarrow$ increase sense of support and parental well-being
- **AI feedback** $\rightarrow$ increases parental awareness about language interactions

Heterogeneous effects by receipt of cash transfers at baseline

Outcome	1st follow-up			2nd follow-up		
	ITT (1)	ITT x no TUS (2)	N (3)	ITT (4)	ITT x no TUS (5)	N (6)
Panel A: Government benefits and programs						
Government transfers	0.038 (0.058)	0.685*** (0.117) 0.000	927	0.128* (0.065)	0.556*** (0.136) 0.000	738
BIS preschool scholarship	0.034 (0.106)	0.262* (0.148) 0.156	928	0.004 (0.101)	0.086 (0.174)	739
Labor programs	0.156 (0.099)	0.123 (0.144)	932	0.141 (0.111)	-0.204 (0.159)	741
Panel B: Parental investment and knowledge						
Parental Knowledge - Childrearing	0.148 (0.091)	-0.090 (0.133)	925	-0.005 (0.106)	0.046 (0.157)	727
Parental Knowledge - Language				0.082 (0.100)	0.118 (0.151)	724
StimQ - Frequency				0.075 (0.103)	0.276* (0.152) 0.262	734
StimQ - Quality				-0.090 (0.095)	0.037 (0.146)	734

Heterogeneous effects by receipt of cash transfers at baseline

Outcome	1st follow-up			2nd follow-up		
	ITT (1)	ITT x no TUS (2)	N (3)	ITT (4)	ITT x no TUS (5)	N (6)
Panel C: Parental Wellbeing and Stress						
Wellbeing Index	-0.163 (0.123)	0.355* (0.191) 0.115	463	0.057 (0.107)	0.225 (0.161)	691
Parental Stress Index	0.100 (0.128)	-0.334* (0.182) 0.073	475	-0.042 (0.107)	-0.358** (0.159) 0.052	691
Panel D: Child's anthropometry						
Weight for age	-0.025 (0.148)	0.183 (0.219)	438	0.039 (0.115)	-0.018 (0.173)	665
Height for age	0.203 (0.151)	-0.336 (0.238)	407	-0.026 (0.109)	-0.231 (0.165)	616

Heterogeneous effects by attendance to preschool at baseline

Outcome	1st follow-up			2nd follow-up		
	ITT (1)	ITT x no attendance (2)	N (3)	ITT (4)	ITT x no attendance (5)	N (6)
Panel A: Government benefits and programs						
Government transfers	0.275***	0.079	932	0.418***	-0.101	741
	(0.087)	(0.126)		(0.095)	(0.140)	
BIS preschool scholarship	0.225**	-0.163	933	0.020	0.052	741
	(0.107)	(0.152)		(0.109)	(0.168)	
Labor programs	0.100	0.228	937	0.159	-0.236	743
	(0.103)	(0.142)		(0.109)	(0.156)	
Panel B: Parental investment and knowledge						
Parental Knowledge - Childrearing	0.138	-0.057	930	-0.022	0.063	729
	(0.097)	(0.132)		(0.108)	(0.155)	
Parental Knowledge - Language				0.067	0.154	726
				(0.104)	(0.150)	
StimQ - Frequency				0.149	0.104	736
				(0.107)	(0.151)	
StimQ - Quality				-0.027	-0.108	736
				(0.095)	(0.143)	

Heterogeneous effects by attendance to preschool at baseline

Outcome	1st follow-up			2nd follow-up		
	ITT (1)	ITT x no attendance (2)	N (3)	ITT (4)	ITT x no attendance (5)	N (6)
Panel C: Parental Wellbeing and Stress						
Wellbeing Index	0.107 (0.129)	-0.186 (0.187)	466	-0.030 (0.107)	0.389** (0.159) 0.034	693
Parental Stress Index	-0.243* (0.126)	0.381** (0.179) 0.074	478	-0.074 (0.108)	-0.261* (0.157) 0.095	693
Panel D: Child's anthropometry						
Weight for age	-0.165 (0.140)	0.441** (0.214) 0.076	440	-0.041 (0.119)	0.155 (0.166)	667
Height for age	-0.023 (0.158)	0.126 (0.229)	409	-0.015 (0.112)	-0.232 (0.165)	616

Note: p<.1, ** p<.05, *** p<.01. We control for strata, batch, and for a dummy that indicates whether the child is the first of his or her family. We also control for the age of the child and the outcome at baseline.

Heterogeneous effects by economic shocks at baseline

Outcome	1st follow-up			2nd follow-up		
	ITT (1)	ITT x shocks (2)	N (3)	ITT (4)	ITT x shocks (5)	N (6)
Panel A: Government benefits and programs						
Government transfers	0.243*	0.102	932	0.328**	0.059	743
	(0.125)	(0.145)		(0.139)	(0.160)	
BIS preschool scholarship	0.127	0.030	933	-0.011	0.085	743
	(0.132)	(0.160)		(0.129)	(0.166)	
Labor programs	0.171	0.061	937	0.191	-0.187	745
	(0.125)	(0.153)		(0.132)	(0.163)	
Panel B: Parental investment and knowledge						
Parental Knowledge - Childrearing	0.055	0.086	930	-0.086	0.148	731
	(0.126)	(0.147)		(0.158)	(0.181)	
Parental Knowledge - Language				0.244*	-0.134	728
				(0.133)	(0.160)	
StimQ - Frequency				-0.110	0.421**	738
				(0.154)	(0.177)	
					0.063	
StimQ - Quality				0.001	-0.108	738
				(0.135)	(0.161)	

Heterogeneous effects by economic shocks at baseline

	1st follow-up			2nd follow-up		
Outcome	ITT (1)	ITT x shocks (2)	N (3)	ITT (4)	ITT x shocks (5)	N (6)
Panel C: Parental Wellbeing and Stress						
Wellbeing Index	-0.256	0.362*	466	-0.053	0.280	695
	(0.181)	(0.210)		(0.142)	(0.170)	
					0.170	
Parental Stress Index	-0.212	0.217	478	-0.174	-0.038	695
	(0.170)	(0.199)		(0.136)	(0.167)	
Panel D: Child's anthropometry						
Weight for age	0.072	-0.033	440	0.027	0.018	669
	(0.216)	(0.252)		(0.147)	(0.178)	
Height for age	0.075	-0.048	409	-0.278*	0.216	618
	(0.220)	(0.259)		(0.149)	(0.181)	

Conclusions

- We evaluated an over-the-phone program that combines teleassistance, e-messages and AI tools for families with children aged 0 to 3 years. It focuses on parenting skills and facilitating access to government benefits.

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- We evaluated an over-the-phone program that combines teleassistance, e-messages and AI tools for families with children aged 0 to 3 years. It focuses on parenting skills and facilitating access to government benefits.
- Chatbot/messages: well received by treated families (90 % is useful) and teleoperators (anchors the sequence of calls around topics)
- Results at four months: positive effects on access to government benefits
- Outcomes at eight months: positive effects on access to government benefits, parental involvement, parental knowledge, parental wellbeing, and stress reduction

Conclusions

- Results in terms of parental involvement are in line with our previous research (Balsa et al. 2021, 2023; Bloomfield et al. 2023).
  - Effects on parental involvement are greater for families with more negative shocks: e-messages target cognitive fatigue
- We now find, in addition, a drop in parental stress.

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  - Highly vulnerable families (baseline households: 68 % overcrowding, 84 % negative shocks, 39 % depression)
  - Effects on parental stress are greater for families accessing government benefits during the intervention
  - Importance of tele-operators and messages: program works on caregiver self-care and reflection

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    - Effects on parental stress are greater for families accessing government benefits during the intervention
    - Importance of tele-operators and messages: program works on caregiver self-care and reflection
- Next steps: administrative record data, third face-to-face follow-up to assess child development and stress