Using technology and behavioral economics to promote development in the early years: The effect of an over-the-phone program

Juanita Bloomfield   Ana Balsa   Alejandro Cid   Philip Oreopoulos

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Motivation

- Developmental delays in children from disadvantaged backgrounds emerge at an early age
- Families facing financial challenges 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)
- Challenge: designing *scalable* parental interventions

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- Evaluation opportunity: pilot to incorporate the use of mobile technology into early childhood public policy
  - Demand for the Family Assistance Program (PAF - home visits) of Uruguay Crece Contigo (UCC) greater than the capacity to provide assistance
  - Ministry of Social Development designed a teleassistance + messaging program to attend families on the waiting list
  - Ideal setting: high connectivity and universal coverage of cellphones in Uruguay

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  - Ideal setting: high connectivity and universal coverage of cellphones in Uruguay
- We use a randomized controlled trial (N=1360 families)

Early childhood parenting interventions using technology

- Electronic messaging for parents has positive effects
  - 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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- Social interaction is necessary to generate habit change (Gallego et al. 2023, Balsa et al. 2023)

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  - Preschool attendance (Ajzenman et al. 2022)
- Social interaction is necessary to generate habit change (Gallego et al. 2023, Balsa et al. 2023)
- Contribution: First work evaluating a family intervention via telephone (calls + messages) in a developing country

Teleassistance and messaging program 2022-2023

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- Two thematic modules:
  - Module 1 (4 months) parenting practices (bonding, formative, protective, reflective competences), health and nutrition, access to state benefits and services
  - Module 2 (4 months) language development (importance of child's nonverbal cues, two-way conversations, description of environment, stories, songs)

Teleassistance and messaging program 2022-2023

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

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 and mother's education
    - Treatment group receives four program components for 8 months, control group accesses restricted chatbot only

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- Implementation
 - 3 batches of implementation
  - 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

Descriptive statistics and balance

		Control			Treatment			Difference	
	N	Mean	s.d	N	Mean	s.d.	N	Diff.	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	0.515	0.500	1360	0.009	(0.028)
First child	509	0.456	0.498	851	0.504	0.499	1360	0.058**	(0.028)
Twin	509	0.033	0.180	851	0.039	0.193	1360	0.000	(0.011)
Attends early childhood center	509	0.517	0.500	851	0.485	0.499	1360	-0.018	(0.028)
Lives with mother	509	0.976	0.152	851	0.980	0.140	1360	0.003	(0.008)
Lives with father	509	0.607	0.489	851	0.618	0.486	1360	0.006	(0.028)
Panel B: Caregiver									
Female	509	0.994	0.077	851	0.988	0.108	1360	-0.007	(0.006)
Age (years)	509	27.179	7.526	851	28.381	35.150	1360	1.267	-1.598
Works	509	0.254	0.435	851	0.247	0.430	1360	-0.009	(0.024)
Mother of the child	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)
Completed secondary school	509	0.071	0.257	851	0.051	0.219	1360	-0.021	(0.013)
Risk of depression	509	0.394	0.489	851	0.366	0.482	1360	-0.030	(0.027)
Frequency with no internet = every week	509	0.256	0.380	851	0.258	0.376	1360	-0.005	(0.021)
Panel C: Household									
Number of members	509	4.786	1.957	851	4.708	2.206	1360	0.041	(0.118)
Number of children	509	2.177	1.375	851	2.041	1.205	1360	-0.096	(0.072)
Receives government assistance	509	0.964	0.185	851	0.953	0.212	1360	-0.007	(0.011)
Receives TUS	509	0.578	0.492	851	0.534	0.498	1360	-0.029	(0.028)
Receives AFAM-PE	509	0.794	0.403	851	0.783	0.412	1360	0.018	(0.023)
Montevideo	509	0.325	0.468	851	0.338	0.473	1360	-0.036	(0.025)
Experienced negative shock	509	0.848	0.356	851	0.842	0.363	1360	0.000	(0.020)
Number of negative shocks	509	2.177	1.570	851	2.083	1.489	1360	-0.052	(0.086)
Overcrowding	509	0.689	0.463	851	0.678	0.467	1360	-0.007	(0.026)

Evaluation

- Telephone survey and WhatsApp audios
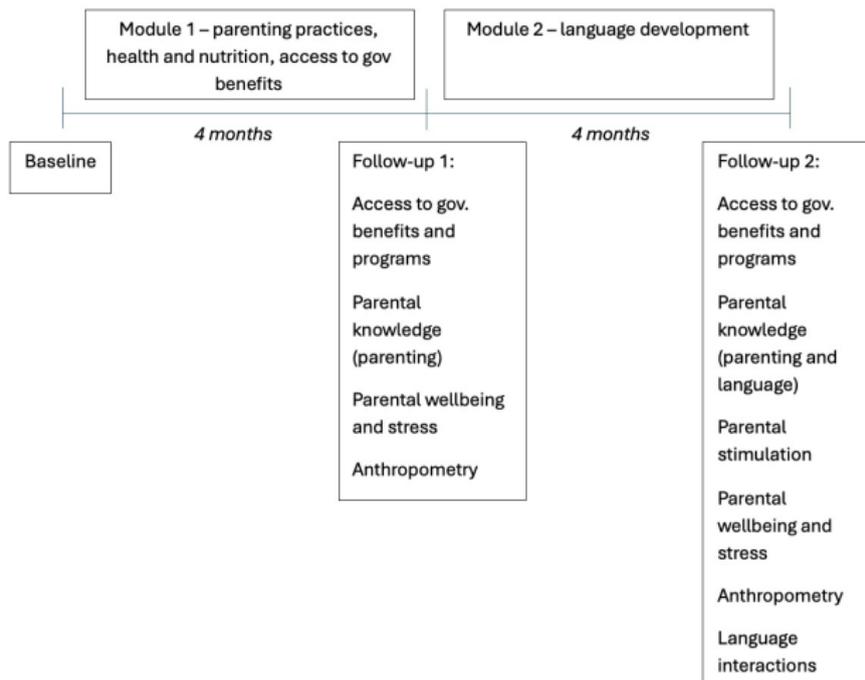
Attrition

	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

| | First follow-up | | | | Second follow-up | | | |
| | (ITT=1)-(ITT=0) | | | MHT p-value | (ITT=1)-(ITT=0) | | | MHT p-value |
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Government transfers and programs								
Transfers	0.296***	0.306***	0.300***	0.010	0.301***	0.329***	0.337***	0.010
	(0.068)	(0.066)	(0.059)		(0.076)	(0.074)	(0.069)	
	[873]	[871]	[866]		[705]	[704]	[700]	
Labor programs	0.230***	0.232***		0.010	0.074	0.068		0.594
	(0.071)	(0.072)			(0.079)	(0.079)		
	[939]	[937]			[747]	[746]		
Panel B: Parental knowledge and involvement								
Parental knowledge – Parenting	0.097	0.099		0.010	0.029	0.015		0.713
	(0.068)	(0.067)			(0.079)	(0.078)		
	[932]	[930]			[733]	[732]		
Parental knowledge – Language					0.150**	0.145*		0.099
					(0.075)	(0.075)		
					[730]	[729]		
Frequency of parental stimulation					0.187**	0.181**		0.059
					(0.077)	(0.076)		
					[740]	[739]		
Quality of parental stimulation					-0.082	-0.069		0.891
					(0.071)	(0.071)		
					[740]	[739]		
Controls								
Strata and unbalanced vars at baseline	N	Y	Y		N	Y	Y	
Variable at baseline	N	N	Y		N	N	Y	

Results

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	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel C: Parental wellbeing and stress								
Wellbeing index	0.006	0.013		0.307	0.156**	0.156**		0.080
	(0.094)	(0.094)			(0.079)	(0.079)		
	[467]	[466]			[697]	[696]		
Parental stress index	-0.066	-0.061		0.723	-0.193**	-0.193**		0.080
	(0.091)	(0.092)			(0.078)	(0.078)		
	[479]	[478]			[697]	[696]		
Panel D: Child's anthropometry								
Weight for age	0.186	0.185	-0.152	0.673	0.116	0.109	0.029	0.228
	(0.121)	(0.123)	(0.155)		(0.107)	(0.108)	(0.113)	
	[329]	[328]	[155]		[389]	[388]	[269]	
Height for age	-0.107	-0.108	-0.107	0.663	-0.070	-0.080	-0.162	0.762
	(0.128)	(0.130)	(0.166)		(0.106)	(0.106)	(0.127)	
	[309]	[308]	[133]		[354]	[353]	[217]	
Controls								
Strata and unbalanced vars at baseline	N	Y	Y		N	Y	Y	
Variable at baseline	N	N	Y		N	N	Y	

Results

	Mother				Child	
	Words per minute	Vocalizations per hour	Pitch range	Average pitch	Vocalizations per hour	Turns with adult
	(1)	(2)	(3)	(4)	(5)	(6)
Coef.	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

Heterogeneous effects due to receipt of the Uruguay Social Card at baseline

	First follow-up			Second follow-up		
	ITT	ITT x no TUS	N	ITT	ITT x no TUS	N
	(1)	(2)	(3)	(4)	(5)	(6)
Transfers	0.086	0.473***	868	0.122	0.453***	701
	(0.068)	(0.121)		(0.083)	(0.140)	
Labor programs	0.156	0.155	934	0.173	-0.209	743
	(0.098)	(0.143)		(0.109)	(0.158)	
Parental knowledge - parenting	0.119	-0.047	927	0.002	0.050	729
	(0.091)	(0.132)		(0.105)	(0.156)	
Parental knowledge - language				0.087	0.124	726
				(0.100)	(0.151)	
Frequency of parental stimulation				0.075	0.245	736
				(0.102)	(0.151)	
Quality of parental stimulation				-0.090	0.055	736
				(0.093)	(0.145)	
Wellbeing index	-0.149	0.333*	464	0.085	0.164	693
	(0.123)	(0.188)		(0.105)	(0.158)	
Parental stress index	0.090	-0.333*	476	-0.033	-0.368**	693
	(0.127)	(0.181)		(0.106)	(0.159)	
Weight for age	0.286	-0.201	328	0.107	-0.035	387
	(0.175)	(0.252)		(0.139)	(0.221)	
Height for age	0.076	-0.358	308	0.062	-0.321	353
	(0.168)	(0.263)		(0.141)	(0.214)	

Heterogeneous effects due to negative baseline shocks

| | First follow-up | | | Second follow-up | | |
| | ITT | ITT x shocks | N | ITT | ITT x shocks | N |
	(1)	(2)	(3)	(4)	(5)	(6)
Transfers	0.494*	-0.196	205	0.354**	-0.063	705
	(0.271)	(0.308)		(0.148)	(0.172)	
Labor programs	-0.207	0.537	219	0.195	-0.161	747
	(0.321)	(0.368)		(0.133)	(0.163)	
Parental knowledge - parenting	0.309	-0.576*	218	-0.088	0.155	733
	(0.250)	(0.293)		(0.158)	(0.180)	
Parental knowledge - language				0.242*	-0.123	730
				(0.133)	(0.160)	
Frequency of parental stimulation				-0.120	0.419**	740
				(0.154)	(0.176)	
Quality of parental stimulation				0.010	-0.109	740
				(0.134)	(0.159)	
Wellbeing index	-0.065	-0.090	208	-0.051	0.293*	697
	(0.282)	(0.319)		(0.141)	(0.169)	
Parental stress index	0.032	0.183	215	-0.176	-0.025	697
	(0.293)	(0.331)		(0.137)	(0.166)	
Weight for age	0.415	0.030	167	-0.074	0.227	389
	(0.352)	(0.413)		(0.189)	(0.231)	
Height for age	0.296	-0.505	154	-0.258	0.244	354
	(0.404)	(0.455)		(0.190)	(0.232)	

Conclusions

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- 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

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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 teleoperators and messages: program works on caregiver self-care and reflection

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    - Importance of teleoperators and messages: program works on caregiver self-care and reflection
- Effects on parental involvement are greater for families with more negative shocks - messages target cognitive fatigue
- Next steps: administrative record data, third face-to-face follow-up to assess child development and stress