

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 deficits in children from poor families are generated at early ages
- Families facing financial challenges 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 negative consequences for poor children in the long term (Almond et al. 2018) as well as for the next generation (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 program to attend families on the waiting list
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 - Ideal setting: high connectivity and universal coverage of cellphones in Uruguay
- We used 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)
 - Preschool attendance (Ajzenman et al. 2022)
 - Frequency and quality of parental investment and the quality of language interactions between caregiver and child (Bloomfield et al. 2023, Balsa et al. 2021)

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- 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

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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
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- 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
 - 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
 - N = 1360 families
 - Eligibility criteria: vulnerable families with children aged 0-3 years (PAF waiting list)

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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; 93% of families believe the number of messages per week is adequate

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

- Two follow-ups: one after 4 months of intervention and the other after 8 months
- Telephone survey and WhatsApp audios
- Scales defined based on validated instruments:
 - Access to government transfers and programs
 - Parental knowledge and involvement
 - Parental wellbeing and stress
 - Child anthropometry
 - Language interactions

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 (0.026) | 0.025 (0.028) | -0.031 (0.024) |
| Batch 2 | -0.111*** (0.029) | -0.049 (0.031) | 0.023 (0.027) |
| Batch 3 | -0.092*** (0.032) | -0.135*** (0.034) | -0.002 (0.029) |
| Control response rate | 0.753*** (0.025) | 0.587*** (0.027) | 0.242*** (0.024) |
| N | 1360 | 1360 | 1360 |

Results

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

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 C: Parental wellbeing and stress | | | | | | | | |
| Wellbeing index | 0.006 (0.094) [467] | 0.013 (0.094) [466] | | 0.307 | 0.156** (0.079) [697] | 0.156** (0.079) [696] | | 0.080 |
| Parental stress index | -0.066 (0.091) [479] | -0.061 (0.092) [478] | | 0.723 | -0.193** (0.078) [697] | -0.193** (0.078) [696] | | 0.080 |
| Panel D: Child's anthropometry | | | | | | | | |
| Weight for age | 0.186 (0.121) [329] | 0.185 (0.123) [328] | -0.152 (0.155) [155] | 0.673 | 0.116 (0.107) [389] | 0.109 (0.108) [388] | 0.029 (0.113) [269] | 0.228 |
| Height for age | -0.107 (0.128) [309] | -0.108 (0.130) [308] | -0.107 (0.166) [133] | 0.663 | -0.070 (0.106) [354] | -0.080 (0.106) [353] | -0.162 (0.127) [217] | 0.762 |
| 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 (1) | Vocalizations per hour (2) | Pitch range (3) | Average pitch (4) | Vocalizations per hour (5) | Turns with adult (6) |
| Coef. | 0.369* (0.216) | 0.114 (0.149) | -0.152 (0.176) | 0.355* (0.185) | 0.036 (0.171) | -0.064 (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 (1) | ITT x no TUS (2) | N (3) | ITT (4) | ITT x no TUS (5) | N (6) |
| Transfers | 0.086 (0.068) | 0.473*** (0.121) | 868 | 0.122 (0.083) | 0.453*** (0.140) | 701 |
| Labor programs | 0.156 (0.098) | 0.155 (0.143) | 934 | 0.173 (0.109) | -0.209 (0.158) | 743 |
| Parental knowledge - parenting | 0.119 (0.091) | -0.047 (0.132) | 927 | 0.002 (0.105) | 0.050 (0.156) | 729 |
| Parental knowledge - language | | | | 0.087 (0.100) | 0.124 (0.151) | 726 |
| Frequency of parental stimulation | | | | 0.075 (0.102) | 0.245 (0.151) | 736 |
| Quality of parental stimulation | | | | -0.090 (0.093) | 0.055 (0.145) | 736 |
| Wellbeing index | -0.149 (0.123) | 0.333* (0.188) | 464 | 0.085 (0.105) | 0.164 (0.158) | 693 |
| Parental stress index | 0.090 (0.127) | -0.333* (0.181) | 476 | -0.033 (0.106) | -0.368** (0.159) | 693 |
| Weight for age | 0.286 (0.175) | -0.201 (0.252) | 328 | 0.107 (0.139) | -0.035 (0.221) | 387 |
| Height for age | 0.076 (0.168) | -0.358 (0.263) | 308 | 0.062 (0.141) | -0.321 (0.214) | 353 |

Heterogeneous effects due to negative baseline shocks

| | First follow-up | | | Second follow-up | | |
|-----------------------------------|-----------------|---------------------|----------|------------------|---------------------|----------|
| | ITT (1) | ITT x shocks (2) | N (3) | ITT (4) | ITT x shocks (5) | N (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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 - 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
- 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