

CLINICAL RESEARCH ARTICLE



# Supporting responsive parenting in real-world implementation: minimal effective dose of the Video Interaction Project

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**BACKGROUND:** The Video Interaction Project (VIP) is a healthcare-based intervention that provides real-time video-feedback of parent-child play and reading interactions to families with children aged 0 to 36 months. Although evidence from randomized controlled trials demonstrates improved early relational health, including responsive parenting, after three to five VIP visits, the minimal effective dose in real-world implementations is unknown. This study aimed to determine the minimal effective dose of VIP during a real-world implementation for changing responsive parenting behaviors.

**METHODS:** We performed a longitudinal prospective study of 183 dyads at a public hospital pediatric clinic. Responsive parenting behaviors were assessed with an observational checklist utilized as part of standard VIP practice at baseline and two follow-up VIP visits.

**RESULTS:** Multilevel models adjusted for baseline sociodemographics (child's sex and age, and maternal education) and time between visits showed that responsive parenting behaviors during parent-child reading and play significantly increased after a single VIP visit (Cohen's  $d = 0.52$ ,  $p < 0.05$ ) with additional impact following completion of a second visit (cumulative for 2 visits:  $d = 0.76$ ,  $p < 0.05$ ).

**CONCLUSIONS:** A single VIP visit is associated with increased responsive parenting behaviors. Findings support offering VIP widely, regardless of capacity to ensure attendance at multiple visits.

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## IMPACT:

- This is the first study showing the minimal effective dose of the Video Interaction Project (VIP) for increasing responsive parenting behaviors.
- Responsive parenting behaviors increased by over 22% following a single VIP visit, with a cumulative increase of 37% following the second visit compared to baseline.
- Findings have important implications for implementation and scalability of pediatric-based preventive programs that support early relational health through activities such as reading and play.

## INTRODUCTION

Considerable research has documented the early emerging and lasting impacts of poverty on child development, which are further exacerbated by structural racism and unequal opportunities for children from racial and ethnic minority groups.<sup>1</sup> Early relational health (ERH), indicated by responsive parenting behaviors (including practices supporting early learning) and parent-child relationship quality, has been identified as important for buffering negative consequences of poverty on early childhood cognitive-linguistic and socioemotional development.<sup>1–4</sup> Therefore, there is increasing interest in identifying scalable interventions that support ERH starting early in life.

One promising strategy to promote ERH is to integrate parenting programs into pediatric primary care, which also maximizes participation and benefits. This is in part because

pediatric primary care provides the opportunity to universally reach families with young children, including those with low income, during up to 14 well-child visits within a child's first 5 years.<sup>5</sup> In addition, the pediatric setting builds on trusting relationships with pediatricians and other health care providers and capitalizes on existing infrastructure to support delivery of interventions at low cost.

Several widely-scaled pediatric primary care-based interventions have demonstrated positive effects on parenting behaviors and early child development. Two of the most widely-scaled early childhood programs offered in primary care to date are Healthy Steps and Reach Out and Read. For instance, HealthySteps, which addresses social determinants of health (e.g., food and housing insecurity) and parent mental health among families facing adversity, has been shown to reduce harsh discipline practices

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and is associated with improved well-child care adherence.<sup>6</sup> In addition, Reach Out and Read, which focuses on early literacy development and provides developmentally-appropriate books at each well-child visit, has been associated with increased parent-child reading and child vocabulary.<sup>7,8</sup>

The Video Interaction Project (VIP) is a primary care ERH intervention that can be considered to occupy a middle ground between Reach Out and Read and Healthy Steps, delivering more intensive, strengths-based support for a broader range of responsive parenting behaviors with a focus on positive child experiences and flourishing.<sup>9</sup> Specifically, VIP provides a bachelors-level, non-clinical coach who meets one-on-one with families at the time of well-child visits. VIP's core component is real-time video-feedback of brief interactions during parent-child reading and play, utilizing learning materials (books and toys) provided by the program to identify and reinforce family strengths. Each VIP visit consists of the same general structure, delivered in alignment with the child's age and developmental status. Participation in visits does not require enrollment at a specific age or sequential attendance, facilitating flexibility for families. As such, each additional visit has the potential to support gains in ERH, regardless of attendance in prior visits.

Randomized controlled trials (RCTs) of VIP have shown large, sustained positive effects on responsive parenting and child development across domains, with impacts documented after participation in as few as three to five visits.<sup>10–16</sup> While these RCTs represent the gold standard of measuring efficacy, they are limited in their ability to determine the minimal effective dose needed to result in significant impact.<sup>17</sup> Minimal effective dose—the fewest number of sessions or least amount of interventionist support needed—is an important aspect of implementation, as it can ensure that resources, which are often limited, are used efficiently and that interventions respond to the needs of the target population.<sup>18,19</sup> In addition, families in real-world clinical settings may only participate in a subset of available sessions. Some reasons for variability in participation include changing residence or site of clinical care and competing obligations at the time of visits.<sup>20</sup> Furthermore, while enrollment age in RCTs is typically standardized across participants, population-level reach is likely to be enhanced when interventions are offered with flexibility of timing. As such, information about impact in real-world implementation is critical for informing scalability, and has potential to provide insights beyond that available from RCTs.<sup>20,21</sup> To date, there has been no study of impact of VIP in real-world settings, including minimal effective dose.

This study examined the real-world implementation of a pediatric-primary care based intervention, VIP, to determine the minimum effective dosage required to improve ERH. We hypothesized that even one or two VIP visits would contribute to enhancements of ERH with greater impact following completion of additional visits.

## METHODS

### Design

The current study was a secondary analysis of a prospective longitudinal study of mother-child dyads with children aged 0 to 36 months who attended routine well-child appointments at a pediatric clinic of the NYC H + H/Woodhull Medical Center (WMC), a public hospital in NYC offering VIP to all families. The study was approved by the NYU Grossman School of Medicine Institutional Review Board and the NYC Health+Hospitals (H + H)/WMC Research Review Committee. All participants provided informed consent before participation.

### Subjects

Enrollment began in the spring of 2013 and continued through 2016 at the WMC pediatric clinic. The hospital primarily serves patients from minority racial and ethnic groups, with 32.5% identifying as Black/African American and 46.5% as Hispanic/Latino. In addition, the hospital serves a

predominantly low-income population, with a high percentage of patients covered by Medicaid or uninsured.<sup>22</sup>

Mothers of children aged 0 to 36 months were offered enrollment if they were participating in VIP, spoke English or Spanish, and their children had no known neurodevelopmental disorders or genetic conditions. Two hundred and forty eight families enrolled in the study. The analytic sample consisted of 183 families (71% Spanish speakers) who completed a baseline VIP visit and at least one follow-up visit; 124 of the 183 completed two follow-up visits.

### Intervention

VIP is a one-on-one, manualized parenting intervention offered to families during each pediatric well-child visit from birth to 36 months. It is delivered by a non-clinical, bilingual coach who typically has a bachelor's level education and is from the community. Each visit begins with parents' observations of their child and reflections on their experiences as a parent, with embedded discussion of anticipated development and behavior. Next, the parent is provided with a developmentally appropriate toy and/or book, and plans are made together for playing and/or reading together for approximately 3 min. During this time, a video of the activity is recorded. Immediately after recording, the coach reviews the video in real time with the parents, using a standard observation checklist utilized as part of each visit (see Primary Outcome section below and Table S1 Supplementary Material). The purpose is to identify and reinforce strengths in parent-child interaction and provide suggestions for additional opportunities. Parents take home a copy of the video, the visit-specific toy and/or book, and a pamphlet with plans for interacting with their child through play, shared reading, and daily routines. Training for coaches is delivered through a 3-day course followed by observed, co-led, and independently led VIP visits. Their performance is evaluated based on a standardized rubric, an exam, and certification is awarded upon evidence of mastery.<sup>23</sup>

### Measures

**Primary outcome.** The primary measures for this study were coach-completed observational parenting behavior checklists. These checklists are utilized to facilitate real-time review of videos during every VIP visit and are completed by coaches as part of standard VIP practice while parents are being video recorded. Checklist items were informed by prior research on elements of parenting behaviors associated with subsequent development<sup>24–26</sup> and by validated instruments that assess parent-child interactions during play and reading.<sup>26–29</sup> Based on the 3-min video recorded interactions, VIP coaches noted the presence of up to 20 behaviors related to caregiver stimulation and responsivity to child (e.g., "Responds to child vocalizations/words") as well as play, reading, and pretend strategies (e.g., "Provides child with the opportunity to actively explore toy or book").

An initial psychometric analysis of the checklist was conducted to understand its validity and potential to accurately measure the intended construct, as this is the first study using it as an outcome measure. First, interrater reliability was determined by recoding 5% of the videos by a second trained VIP coach who did not participate in the visits and was blind to the number of visits completed (Intraclass Correlation Coefficient [ICC] = 0.88). Second, a principal components analysis was conducted to investigate item-level adequacy for measuring parenting behaviors across different ages. After excluding items which were not relevant for the broad age-range (0 to 36 months) and those with factor loadings below 0.30, it was determined that a single-factor structure of 10 items would provide a robust measurement of parenting behaviors during parent-child reading and play across ages. Factor loadings for the final items varied from 0.40 to 0.78 (Table S1 Supplementary Material). Finally, analysis of internal consistency demonstrated a Cronbach's alpha of 0.76, indicating that the instrument has good reliability and consistency for measuring the intended construct. Each observed parenting behavior on the checklist corresponded to 1 point. Total scores were calculated by summing all identified behaviors (score range 0–10) during baseline and follow-up visits attended by each family at any child's age (between 0 and 36 months).

For the purposes of this study, the observational checklist completed during the first VIP visit was considered the baseline, as it occurred during video recording of the parent-child interaction, but prior to video-review, which is a core component of the intervention. Observations in the next two visits were considered to reflect the impacts of the review at the preceding visit and were therefore analyzed as the first and second follow-up assessments.

**Covariates.** Key sociodemographic characteristics were included as covariates in the adjusted models such as child's sex and age at baseline. Mother's years of schooling was used as a proxy for socio-economic status<sup>30</sup> and included due to association with participation in parenting programs.<sup>31</sup> Time between visits was also included in the models to account for variations between participants over time.

**Data analysis.** Sociodemographic characteristics and scores on the parenting behavior checklist were summarized means and standard deviation (SD). To investigate the minimal effective dose of VIP, a multilevel mixed-effects regression analysis was performed. The total score on the parenting behaviors checklist was included as the dependent variable in the models. Adjusted models accounted for covariates at baseline such as child's age and sex, mother's years of schooling, and time between VIP visits. Effect sizes were estimated using Cohen's  $d$ <sup>32</sup> for both one and two visits compared to the baseline and for the average additive effect of each visit.

## RESULTS

### Descriptive

Table 1 shows sociodemographic characteristics of 183 families who participated in a baseline VIP visit and at least one follow-up visit. On average, children were 5.00 (SD = 5.15) months old at baseline, with an average of 5.49 months (SD = 4.24) between visits. In addition, the variation in mother's years of education ranged from a few years of formal education to completion of secondary school.

The number of observed parenting behaviors during parent-child reading and play varied from 1 to 10 across each of the assessment points, with mean 4.64 (SD = 1.96) points at baseline, and 5.93 (SD = 2.22) and 6.37 (SD = 2.36) in the following assessments, respectively (Table 2).

### Dose-response analysis

Table 2 presents mean differences and corresponding significance levels for change in responsive parenting behaviors after one and two VIP visits for both unadjusted and adjusted models. Figure 1 illustrates adjusted results.

Unadjusted models showed a significant mean difference after both one and two visits compared to baseline. The effect sizes for one VIP visit were medium ( $d = 0.65$ ), and for two visits, they were large ( $d = 0.86$ ). These statistically significant findings persisted after controlling for covariates, indicating medium effect sizes for one visit ( $d = 0.52$ ) and large effect sizes for two visits ( $d = 0.76$ ) of the intervention. The results indicated an increase of 22.2% in parenting behaviors during parent-child reading and play following the first visit, with a cumulative increase of 37.3% after

completion of two visits compared to baseline. On average, the effect size per visit was medium, with  $d = 0.43$  before adjusting for covariates and  $d = 0.38$  after adjusting for covariates.

### Sensitivity analysis

Sensitivity analyses were conducted to investigate potential bias related to (1) baseline differences in sociodemographic factors or responsive parenting behaviors between families who participated in only the baseline visit and those who participated in at least one follow-up visit, (2) missing data for families with baseline-only participation, and (3) data for families who had more than one eligible child participating in VIP.

First, we explored whether families who participated in follow-up visits ( $N = 183$ ) differed from those with only a baseline visit ( $N = 65$ ) on any of the sociodemographic variables collected or on parents' baseline levels of responsiveness. Results demonstrated no significant differences between those who attended the baseline visit only and those with at least one follow-up visit for child sex ( $\chi^2 = 1.50, p = 0.22$ ), child age ( $t(246) = 0.38, p = 0.70$ ), or maternal education ( $t(246) = 0.92, p = 0.36$ ). In addition, there were no differences between groups in their baseline levels of responsive parenting (participants with baseline only:  $M = 4.32, SD = 1.70$  vs. participants with follow-up visits:  $M = 4.64, SD = 1.96, t(246) = -1.18, p = 0.25$ ; Cohen's  $d = 0.17$ ).

Second, given that we did not have information on how parents who did not return for additional visits following the baseline would respond to the intervention, we investigated whether this could have biased the results of this study. We conducted additional multilevel models that included both families who had follow-up visits and families who participated in only the baseline visit. Significant differences in responsive parenting were retained with equivalent effects sizes after both one (unadjusted model: mean difference = 1.31, 95% CI = 1.02 to 1.61,  $p < 0.001, d = 0.45$ ; adjusted model: mean difference = 1.03,  $p < 0.001, 95\% CI = 0.69$  to 1.38,  $d = 0.37$ ) and two (unadjusted model: mean difference = 1.94, 95% CI = 1.60 to 2.28,  $p < 0.001, d = 0.64$ ; adjusted model: mean difference = 1.73, 95% CI = 1.36 to 2.09,  $p < 0.001, d = 0.60$ ) visits compared to baseline, as well as average difference (unadjusted model: mean difference = 1.01, 95% CI = 0.84 to 1.18,  $p < 0.001, d = 0.33$ ; adjusted model: mean difference = 0.87,  $p < 0.001, d = 0.31$ ).

Third, we investigated whether our results could have been biased by including families who had multiple children who were eligible for VIP participation in our analyses. Multilevel models (unadjusted and adjusted for covariates) were performed excluding families who had more than one child eligible to participate in VIP and had at least one child participate in a follow-up visit ( $N = 4$  families,  $N = 7$  children). Significant differences in responsive parenting were retained with equivalent effects sizes after both one (unadjusted model: mean difference = 1.34, 95% CI = 1.03 to 1.65,  $p < 0.001, d = 0.49$ ; adjusted model: mean difference = 1.13, 95% CI = 0.78 to 1.48,  $p < 0.001, d = 0.41$ ) and two (unadjusted model: mean difference = 2.01, 95% CI = 1.65 to 2.37,  $p < 0.001, d = 0.65$ ; adjusted model: mean difference = 1.87, 95% CI = 1.49 to 2.24,  $p < 0.001, d = 0.65$ ) visits compared to baseline, as well as average difference (unadjusted model: mean difference = 1.03, 95% CI = 0.81 to 1.16,  $p < 0.001, d = 0.34$ ; adjusted model: mean difference = 0.95, 95% CI = 0.76 to 1.13,  $p < 0.001, d = 0.33$ ).

## DISCUSSION

This longitudinal, prospective within-subjects study performed in a real-world setting investigated the minimal effective dose of VIP. In RCTs, VIP has been previously shown to have impacts across multiple domains of responsive parenting<sup>7,10–12,33</sup> and child development.<sup>14,15</sup> While these RCTs showed that even three to five visits were associated with large impacts on parenting and ERH,<sup>10–16</sup>

**Table 1.** Sample characteristics ( $N = 183$ ).

Characteristics	Mean (SD)/%
Child's age (in months)	
Baseline <sup>a</sup>	5.00 (5.15)
First follow-up <sup>a</sup>	11.88 (9.79)
Second follow-up <sup>b</sup>	15.21 (10.13)
Child's sex—Female <sup>a</sup>	51.91%
Mother's years of schooling <sup>a</sup>	10.55 (3.24)
Mean time between VIP visits (in months)	5.49 (4.24)
Baseline to first follow-up <sup>a</sup>	6.86 (8.23)
First follow-up to second follow-up <sup>b</sup>	6.06 (5.83)
Baseline to second follow-up <sup>b</sup>	11.00 (8.51)

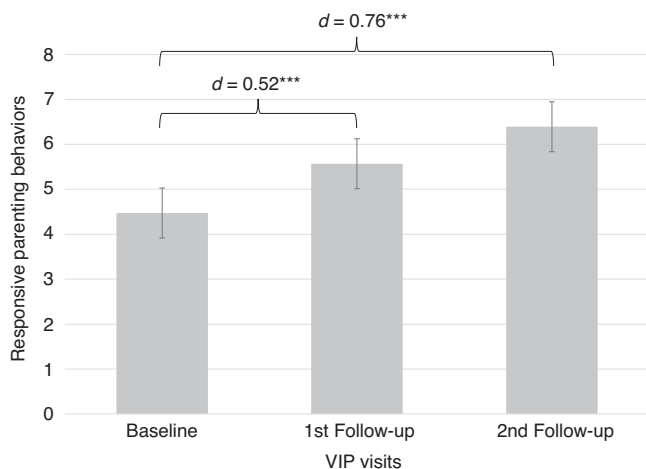
VIP Video Interaction Project, SD standard deviation.

<sup>a</sup> $N = 183$ .

<sup>b</sup> $N = 124$ .

**Table 2.** Effect of one and two VIP visits on responsive parenting behaviors.

Responsive parenting behaviors	Mean (SD)	Unadjusted mean difference (95% CI)	Cohen's <i>d</i> <sup>a</sup>	Adjusted mean difference (95% CI) <sup>b</sup>	Cohen's <i>d</i> <sup>c</sup>
Baseline	4.64 (1.96)	–	–	–	–
One visit <sup>d</sup>	5.92 (2.21)	1.28 (0.97 to 1.58)*	0.65	1.03 (0.69 to 1.38)*	0.52
Two visits <sup>e</sup>	6.37 (2.36)	1.90 (1.55 to 2.26)*	0.86	1.73 (1.36 to 2.09)*	0.76
Average per visit <sup>f</sup>	1.56 (2.14)	0.98 (0.81 to 1.16)*	0.43	0.87 (0.69 to 1.06)*	0.38

\* $p < 0.001$ .<sup>a</sup>Effect size for one and two visits compared with baseline, in SD units (Cohen's *d*) for unadjusted models.<sup>b</sup>Based on multilevel models adjusting for baseline covariates child's sex and age, mother's years of schooling, and time between VIP visits.<sup>c</sup>Effect size for one and two visits compared with baseline, in SD units (Cohen's *d*) for adjusted models.<sup>d</sup>Reflecting one VIP visit compared to baseline.<sup>e</sup>Reflecting two VIP visits compared to baseline.<sup>f</sup>Average additive value per visit.**Fig. 1** Adjusted means of number of observed responsive parenting behaviors after first and second VIP follow-up visits. Error bars 95% CI. \*\*\* $p < 0.001$ .

there has been no prior study of minimal effective dose of VIP in a real-world setting. Corroborating our hypothesis that VIP may improve ERH at each visit, responsive parenting behaviors increased by over 22% after participation in a single VIP visit with a cumulative increase of 37% after two visits. Notably, findings were independent of child's age at baseline and time between visits. The effect sizes reported here (Cohen's *d* 0.52 after one visit and 0.76 after two visits, average per visit = 0.38) are similar and, in some cases, larger than effect sizes reported in previous RCTs of VIP that examined impact on responsive parenting behaviors after three visits, which is the closest comparison to the current study (Cohen's *d* 0.23–0.40).

There have been only a limited number of studies of responsive parenting interventions in primary health care focused on impact resulting from low levels of dose or seeking to determine minimal effective dose. For example, Play Nicely has shown meaningful improvements in parenting outcomes following a single visit.<sup>34</sup> Similarly, Reach Out and Read has observed positive impacts on reading and reading behaviors after receiving at least 2 books (mean 2.3).<sup>35,36</sup> In contrast, a number of studies of home visiting programs have addressed this issue. For example, Family Connects has been shown to have impacts after a single visit,<sup>37</sup> and Family Check-Up has been shown to have impacts following delivery of two core sessions.<sup>38</sup> Furthermore, a study of the Triple P Online Brief adaptation demonstrated impacts following two modules.<sup>39</sup> As such, findings from the current study provide further evidence for potential impact for low dose parenting interventions delivered in pediatric health care settings.

The study's results have large implications for the scaling and feasibility of VIP. The finding that a single VIP visit was effective with greater effect sizes after a second visit, in addition to the robust results from previous RCTs, strongly supports wide implementation of VIP, even for families unlikely to participate in multiple visits. The study further supports the role of pediatric healthcare as a universal platform for supporting delivery of parenting interventions. Importantly, VIP plays this role by offering multiple opportunities to engage with families during well-child visits, with each visit presenting a valuable opportunity to support ERH. Nonetheless, the results also indicate that even a single visit can result in significant benefits, emphasizing the importance of early intervention that is both brief and accessible.

It is important to acknowledge that these data were collected prior to the onset of the COVID-19 pandemic, which likely impacted and may continue to influence both parenting behaviors and the efficacy of preventive interventions. Future studies should examine this question using samples collected pre- and post-pandemic.

Also of note, analyses of the VIP observational parenting behavior checklist support its reliability and suggest the possibility that it might have the potential to be utilized as a tool for assessment of ERH for both research and intervention purposes. Additional study of feasibility, reliability and validity, and potentially further adaptation would be needed to determine whether the instrument could have these broader applications.

This study has several strengths, including its utilization of an observational measure, supporting internal validity and its use of use of real-world data with a representative study population, which supports external validity. However, there are a number of limitations. First, while the study's analyses were adjusted for key covariates, observational within-subject designs may be susceptible to bias from temporal and other factors. Second, the sample was predominantly Latino, and findings may not generalize to other populations. Third, because this study was a real-world implementation of VIP and data were not collected in the context of a clinical trial, the outcome measure of responsive parenting was scored by the interventionist during the VIP visits. While this has the potential to result in bias, we achieved high interrater reliability (ICC = 0.88) when the measure of responsive parenting was scored by a second coder who was blind to the number of visits parent-child dyads had completed. This provides some confidence that the scoring on the outcome measure was not influenced by the VIP coach's knowledge of or prior experience with the parent and child. Fourth, another potential bias is that families who participated in follow-up visits were already more responsive than those who participated only in the baseline visit, and this influenced the increases in responsiveness seen across sessions; however, sensitivity analysis indicated no difference between these groups. Fifth, the current data do not provide the

opportunity to examine sustainability of these effects over time. Prior study of VIP in RCTs has shown sustained impacts of the program on responsive parenting and child outcomes 1.5 years after program completion.<sup>11,40</sup> However, additional work is needed to determine whether these effects are sustained in the context of real-world implementation.

## CONCLUSION

This study demonstrates that a single VIP visit can result in significant benefits, with additional benefits seen following a second visit. Findings of benefit in real-world implementation complement prior findings in RCTs documenting benefits across multiple domains, including parenting and child development. Taken together, these studies support population-level implementation of VIP, particularly among families facing barriers in ERH to support positive child experiences and child flourishing.

## DATA AVAILABILITY

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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## AUTHOR CONTRIBUTIONS

The authors confirm contribution to the paper as follows: study conception and design: L.R.P., E.R., A.M.S., C.F.C., and A.L.M.; draft manuscript preparation: L.R.P., E.R., C.F.C., A.M.S., C.B.C., L.T., and A.L.M.; data collection: C.F.C., A.M.S., A.W., M.M., and A.C.; analysis and interpretation of results: L.R.P., E.R., C.F.C., A.M.S., A.W., C.B.C., M.M., A.C., L.R., and A.L.M.; intervention design and implementation: A.W., C.B.C., A.M.S., M.M., A.C., L.R., and A.L.M. All authors approved the final manuscript as submitted. If accepted, this paper will not subsequently be published in the same or similar form in any language without the consent of publishers.

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