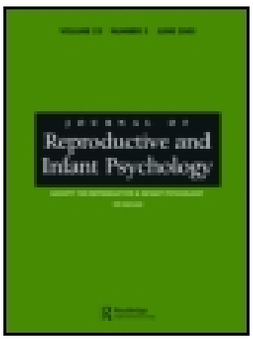

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Development and feasibility of the prenatal video-feedback intervention to promote positive parenting for expectant fathers

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ABSTRACT

Objective: the transition period in which men become fathers might provide an important window of opportunity for parenting interventions that may produce long-term positive effects on paternal care and, consequently, child development. Existing prenatal programs traditionally focus on maternal and infant health and seldom involve the father.

Study design: This paper describes an interaction-based prenatal parenting intervention program for first-time fathers using ultrasound images, the Prenatal video Feedback Intervention to promote Positive Parenting (VIPP-PRE). We randomised a group of expectant fathers (N = 73) to either the VIPP-PRE or a control condition.

Results: Expectant fathers thought the VIPP-PRE was more helpful and influenced their insights into their babies to a greater extent than the control condition. Expectant fathers receiving the VIPP-PRE reported that they particularly liked seeing and interacting with their unborn children as well as receiving feedback on these interactions. The intervention was well received and was considered feasible by both expectant fathers and sonographers and midwives.

Discussion: We discuss the VIPP-PRE based on the experiences and perspectives of fathers, interveners, and sonographers and midwives.

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Parenting intervention; prenatal parenting; fathers; video feedback; ultrasound

Introduction

The Video-feedback Intervention to promote Positive Parenting (VIPP; Juffer et al., 2008, 2017) is an evidence-based parenting intervention program aimed at improving parenting sensitivity as defined in attachment theory (Ainsworth et al., 1974). The intervention attempts to increase the caregiver's ability to accurately observe and interpret the signals of a child, and to react promptly and appropriately to the child's attachment-related behaviours and explorations. VIPP is a brief, home-based intervention that uses videotaped recordings of individual parent–child dyads for reinforcing and building upon

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Supplemental data for this article can be accessed here.

existing positive interactions. In the past 25 years, the intervention has been successfully adapted for various clinical and non-clinical populations (e.g. Hodes et al., 2014; Iles et al., 2017; Poslawsky et al., 2014; Stein et al., 2006; Van den Broek et al., 2017). Moreover, a meta-analysis showed a combined effect size of d = 0.47 for twelve randomised controlled trials (RCT) evaluating the effects of VIPP on parenting sensitivity (Juffer et al., 2017). Whereas mothers are the most common participants, some pilot work indicated that VIPP is also feasible and potentially successful for fathers (Lawrence et al., 2012). Here, we describe the development of the first prenatal VIPP in a particularly important and understudied period and population: men in the transition to fatherhood.

Fathers have been found to contribute substantially to child development, in some aspects even over and above mothers' influences (N. J. Cabrera et al., 2007). Even in the prenatal period, fathers' influence on children's wellbeing is substantial. Fathers' perinatal behaviour and involvement during pregnancy is known to benefit maternal health behaviours and foetal outcomes (see Alio, Salihu, Kornosky, Richman and Marty, 2010; Lamb, 2010, for reviews) and the quality of later affective and behavioural involvement with his children (e.g. N. Cabrera et al., 2008; Cook et al., 2005; Fagan et al., 2007; Witte et al., 2019). Additionally, parenting sensitivity originates in the prenatal period (Leifer, 1977; Lucassen et al., 2015; Steele et al., 1996) and early postnatal parenting quality is likely founded on prenatal mental representations of the unborn child as well as the caregiver's imagined (future) relationship with the child (Siddiqui & Hägglöf, 2000; Vreeswijk et al., 2014). Importantly, prenatal paternal sensitivity, measured during the third trimester using a life-like infant simulator, has been found to predict postnatal paternal sensitivity 6 weeks after birth (Hechler et al., 2019). Despite these findings, few parenting programs focus on fathers, the perinatal period, or both.

The existing parenting interventions that include (but are not limited to) prenatal sessions are characterised by high numbers of sessions and a broad focus (e.g. self-care, mental health, social networks) with no or little focus on improving parenting quality (e.g. Kitzman et al., 1997; Larson, 1980; Olds et al., 1998). Very few studies have involved fathers in prenatal parenting interventions that focus directly on parent-child interaction quality. In one study, it was found that three prenatal 'Growing as a Couple and Family' (GCF) sessions led to favourable, albeit different, outcomes for first-time mothers and fathers (Bryan, 2000). In this study, prenatal GCF classes focused on positive parent-child interactions by showing videotapes of unknown mothers and fathers interacting with an infant, stimulating group discussion on changing roles and identities, and offering information on the physical and behavioural capabilities and needs of a newborn. While mothers in the intervention group were found to be more sensitive to infant cues postnatally, intervention-group fathers provided more affective support in the first two years postpartum (Bryan, 2000). Additionally, a couple-focused perinatal educational program with four sessions prenatally and four within the initial postnatal months has been shown to positively affect first-time fathers' interactional skills with their infants (i.e. observed warmth/emotional support, intrusiveness, positive affect, and dyadic synchrony) as well as their time investment in parenting (Doherty et al., 2006). These results show promise for a brief and interaction-focused intervention for expectant fathers.

Taken together, this research suggests there is a need for an effective, brief, prenatal, interaction-focused parent–child intervention, aimed at improving paternal sensitivity and stimulating paternal involvement. VIPP might be an excellent candidate for this

purpose. Specifically, VIPP is both manualized and individualised: the themes of the sessions are manualized, but it uses individualised dyad-specific footage of the parent–child interaction. This has been shown to be highly valuable in promoting sensitive parenting behaviours that are vital to the optimal development of each specific child. Here, we describe the development of the first prenatal VIPP for first-time expectant fathers using live ultrasound images. In the context of a randomised controlled design, we illustrate the perceived effects of the intervention by comparing the extent to which fathers thought the intervention versus the control condition affected their insights into both their infants and their relationships with their infants. Additionally, we report on the experiences (e.g. satisfaction with content, planning, and number of sessions) of fathers participating in the intervention as well as the sonographers providing the visualisation of the unborn infants during the intervention.

Materials and methods

The VIPP-PRE program

The VIPP-PRE consists of three prenatal sessions in which the intervener discusses the following themes with the expectant father in the respective sessions: 1) attachment and exploration; 2) speaking for the child; and 3) sensitivity chains. (See Supplementary Materials for a more detailed description of the VIPP-PRE protocol per session.) During each session one or two video recordings are made while the father performs interaction-based tasks that are specific to the current session (i.e. reading, touching, singing, talking, free play). These videos are then used at the next appointment to provide feedback based on the interactions specific to each individual father-child dyad. During the recordings, sonographers are asked to create a recognisable live image of the foetus (i.e. profile) using ultrasound images (Philips Lumify 2017, Best, the Netherlands) and to interfere as little as possible. Each father is seated next to the mother's abdomen, where he is close to the child and can see the ultrasound images. The resulting recordings contain both the ultrasound images as well as a frontal view of the father's upper body. During the interactions between the father and his unborn child, the mother is asked to stay aloof and read a magazine. Consequently, both verbal communication and facial expressions of the mother are kept to a minimum during these interactions. To satisfy mothers' wishes to see their unborn children, the sonographers guided both parents during each session in detecting foetal position before and after the intervention activities.

During the recordings of fathers' interactions with their unborn children, interveners provide live feedback in line with the current theme being discussed, during which an effort is made not to disrupt ongoing interactions but subtly support the father to read the child's signals. Given the limitations in visualising the child's signals, interveners are careful in interpreting the images. For example, instead of '*she is listening to what you are saying*,' a more typical VIPP-PRE comment would be '*Your baby stopped moving when you started talking, Maybe she is listening. At this age she is certainly capable of hearing and recognising your voice*.' Additional effort is put into encouraging fathers to let the babies lead the interactions; teach father is encouraged to act according to his child's current behaviour (e.g. playing when the child is active, but softly supporting the child when he/she is resting). After the recordings, the father is invited to review the recordings of the previous

session together with the intervener and is provided with feedback on these recordings as prepared by the intervener in the period between the sessions. Throughout the intervention, the intervener not only shows empathy for the child (e.g. '*It's very tiring to grow so fast, so no wonder that he/she sleeps very often!*'), but also for the parent (e.g. '*Some behaviours of your child might be a bit difficult to see or interpret now, but that will get easier once he/she is born*.'). Fathers were also encouraged to interact with their unborn children outside of the intervention during fathers' own time for at least 5–10 minutes per day.

Upon request of the relevant ethics committee, sessions were scheduled at a prenatal screening facility and only took place at participants' homes when no other options were available. The VIPP-PRE only took place in case of uncomplicated singleton pregnancies where no abnormalities were discovered on standard 20-week scans. Ideally, the VIPP-PRE sessions were scheduled between 20 and 30 weeks' gestation when foetal behaviour can be easily visualised by use of ultrasound, with 1 to 2 weeks in between sessions.

Control condition

In order to examine expectant fathers' experiences with the VIPP-PRE, all expectant fathers described here were randomly assigned to either the VIPP-PRE intervention or a control condition (as is typically done in VIPP intervention trials, e.g. Juffer et al., 2008). The control condition consisted of three phone conversations during which the pregnancy and upcoming fatherhood were discussed; any interaction-related information and encouragement were excluded. See Supplementary Materials for a more detailed description of the control condition.

Intervener criteria and training

All VIPP-PRE interveners (i.e. first and second author and one research assistant named in the acknowledgements) were behavioural scientists trained as interveners in a Video-feedback Intervention to promote Positive Parenting and Sensitive Discipline (VIPP-SD) training. After successful completion of the VIPP-SD training, they were trained in the VIPP-PRE by the first and last authors of this paper. Frequent supervision was used to provide ongoing support and quality control.

Sonographers

The sonographers were employees of the partnering prenatal clinic *Verloskundig Centrum De Poort* in Leiden, the Netherlands. Most, but not all, sonographers were also midwives. They were asked to indicate foetal position to the parents, and remain silent throughout the remainder of the session. The sonographers did not answer any questions regarding the wellbeing of the mother or child, unless they noticed something clinically relevant on the images, in which case the parents were instructed to contact their midwife. This happened in none of the cases.

Current study

First-time expectant fathers were assessed for eligibility after responding to recruitment invitations distributed via midwives and (online) advertisements. Fathers had to cohabitate with first-time expectant partners and speak Dutch; they were excluded if they self-reported current psychiatric symptoms or medication. Partners had to have an uncomplicated pregnancy of a singleton with a pregnancy duration of 18–31 weeks at the time of inclusion. Fathers were excluded when their partners used alcohol, tobacco, or illicit drugs during the pregnancy or had a BMI over 30 kg/m^2 before pregnancy. Additionally, participants were excluded when abnormalities were found during the 20-week ultrasound examination or in case of known birth defects in the families of either parent that caused excessive worry for the current pregnancy. Included fathers (N = 73) were randomly assigned to the intervention or control group based on their study identification number. Ninety-six percent of fathers were born in the Netherlands. The average duration of education was 8.79 (SD = 1.44) years past primary education. Ninety-five percent of couples had planned this pregnancy, and 89% conceived naturally. Seventy-four percent of couples had not experienced a previous abortion or miscarriage.

After completion of the intervention all expectant fathers were asked to fill out an online questionnaire, with questions regarding an evaluation of their experiences (i.e. VIPP-PRE or dummy program) and the perceived effects of the intervention. VIPP-PRE fathers were given additional questions assessing their experiences with the VIPP-PRE. Additionally, sonographers were presented with a questionnaire pertaining to their experiences with the VIPP-PRE intervention. All questions were designed for the current study; existing VIPP evaluation questionnaires were not suitable for the prenatal period. Where possible, t-tests are used for testing differences between groups with regard to their evaluation of the intervention and its effects. Several open-ended questioned were asked to get an impression of the experiences of participants (included in online questionnaires) and sonographers (provided with a paper-based questionnaire after completion of all interventions). Answers to these questions were grouped into themes. All themes and the corresponding percentages of participants or sonographers that reported on this theme, are discussed below. Effects of the intervention on parenting sensitivity and involvement will be reported elsewhere. The study in which the VIPP-PRE was embedded was approved by the Ethics Committee of the Leiden University Medical Centre and the Department of Education and Child Studies at Leiden University. All participants gave informed consent.

Results

Results are presented in three sections. First, we provide a brief description of the sample of expectant fathers. Then we list their evaluations of the intervention's perceived effects, feasibility, and experiences, followed by the evaluations of the sonographers.

Description of the sample

Of the 73 expectant fathers, 39 were randomly assigned to the VIPP-PRE (M_{Age} = 32.60, SD = 2.91) and 34 to the control condition (M_{Age} = 32.73, SD = 3.76). Randomisation was

performed before the start of the study using a computer-generated randomisation sequence. Due to logistical problems we had to stop the inclusion of participants earlier than expected. Keeping the random assignment, this led to somewhat unequal numbers in the experimental and control group. In the VIPP-PRE group, 12 fathers were expecting boys, 18 fathers were expecting girls, and 9 fathers did not know the gender of their unborn children. In the control group, 11 fathers were expecting boys, 18 fathers were expecting girls, and 5 fathers did not know the gender of their unborn child. Attrition overall was small and similar in both groups. Two participants (1 VIPP-PRE, 1 control) dropped out of the study due to pregnancy complications. One VIPP-PRE participant participated in the intervention but did not fill out questionnaires. During the first intervention session, the gestational age for fathers ranged between 22 and 33 weeks in the VIPP-PRE condition and between 21 and 32 weeks in the control condition. Fifty percent of fathers were in the second trimester (i.e. <28 weeks) at the start of the intervention for the VIPP-PRE group compared to 68% for fathers in the control group. See Figure 1 for an overview of the timeline of the intervention.

Fathers' evaluation of the intervention

Participants in both groups were asked about the perceived effects of the intervention by indicating whether the intervention gave them more insight into 1) their relationship with the babies, 2) their understanding of the babies, 3) their communication with the babies, and 4) their understanding of the feelings of the babies. All items were rated on a scale ranging from 1 = 'not at all' to 5 = 'very much.' VIPP-PRE fathers thought the intervention

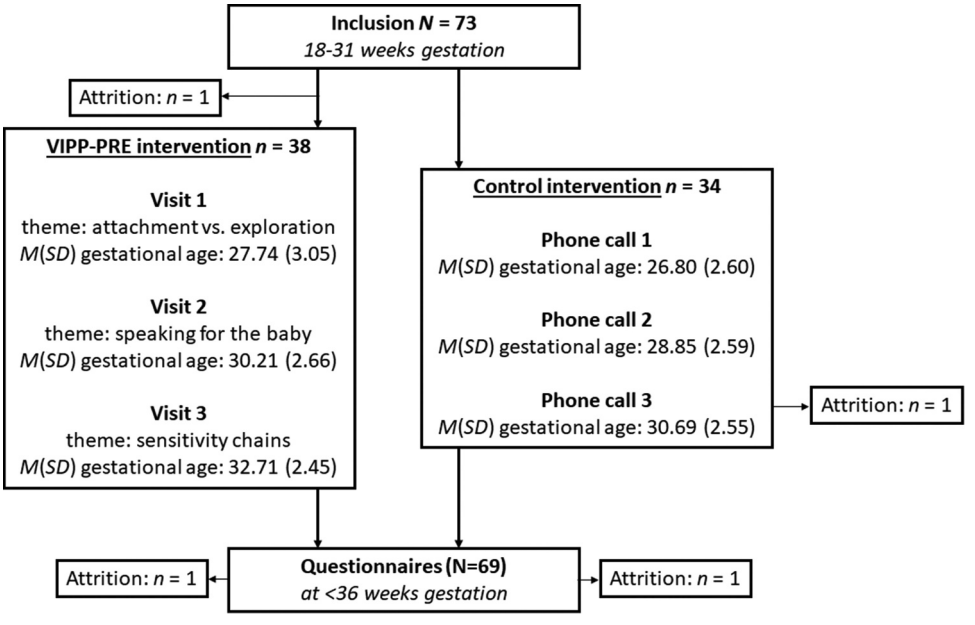

Figure 1. Timeline for the VIPP-PRE intervention as well as the feasibility data collected through a questionnaire. The mean gestational age of the unborn child is reported for all intervention appointments. Participants were randomly assigned to one of the groups.

Table 1. Expectant fathers' perceived effects of the VIPP-PRE intervention and the control condition.

	VIPP-PRE (n = 37)	Control (n = 31)	Independent sample t-test				
	M (*SD*)	*M* (*SD*)	*t*	*df*	*p*	*95% CI*[a]	Hedges's g_s
Relation with the baby	3.16 (1.14)	1.84 (0.86)	5.44 [c]	65.31	< .001	[0.84, 1.81]	1.28
Understanding of the baby	3.11 (1.17)[b]	2.00 (0.97)	4.21	65	< .001	[0.58, 1.64]	1.01
Communication with the baby	3.41 (1.14)	1.94 (0.81)	6.18 [c]	64.46	< .001	[0.99, 1.95]	1.45
Understanding of the feelings of the baby	2.81 (1.28)[b]	2.00 (1.03)	2.80	65	< .01	[0.23, 1.38]	0.68
Helpfulness	3.36 (1.17)[b]	2.13 (0.86)[d]	4.89 [c]	63.04	< .001	[0.73, 1.17]	1.17

Note. Participants indicated to what extend (i.e. ranging from 1 = 'not at all' to 5 = 'very much') they thought the intervention affected their insight into their relationship with, understanding of, and communication with the baby. Also, participants indicated on the same scale to what extent they thought the VIPP-PRE session or phone conversations were helpful.

[a]Confidence interval of the difference between means.

[b]Data available for 36 participants.

[c]Unequal variances according to the Levene's test.

[d]Data available for 30 participants.

Table 2. Expectant fathers' evaluation of the feasibility and experiences of the VIPP-PRE or control condition sessions.

		VIPP-PRE (n = 37)	Control condition (n = 31)
How difficult was it to plan the sessions?			
	Very difficult	5.4%	0%
	A bit difficult	37.8%	12.9%
	Neutral	13.5%	0%
	Easy	29.7%	19.4%
	Very easy	13.5%	67.7%
What did you think of the time between sessions?			
	Too long	0%	0%
	Just enough	94.6%	96.8%
	Too short	5.4%	3.2%
What did you think of the number of sessions?			
	Too few	2.7%	6.5%
	Just enough	89.2%	93.5%
	Too many	8.1%	0%
How did you experience the interaction with the researcher?			
	Very unpleasant	0%	0%
	A bit unpleasant	0%	0%
	Neutral	5.4%	3.2%
	A bit pleasant	24.3%	9.7%
	Very pleasant	70.3%	87.1%
Did the ultrasound images make performing the tasks (e.g. reading, talking to the baby) easier or more difficult?			
	A lot harder	0%	
	A bit harder	13.5%	
	Made no difference	32.4%	
	A bit easier	29.7%	
	A lot easier	24.3%	
Did the presence of your partner make performing the tasks more difficult or easier?			
	A lot harder	2.8%	
	A bit harder	2.8%	
	No difference	77.8%	
	A bit easier	11.1%	
	A lot easier	5.6%	
Did you miss any specific information before onset of the intervention?			
	No	81.1%	
	Yes	18.9%	

improved their insights into their babies more than fathers in the control condition; see Table 1. Also, fathers were asked to rate whether or not they found the intervention helpful on a 5-point rating scale (ranging from 1 = 'not at all' to 5 = 'very much'). Fathers in the VIPP-PRE group found the appointments more helpful (t[63.04] = 4.89, p < .001); see Table 1.

Additionally, participants in both groups reported on the intervention by evaluating their experiences with the planning and number of sessions as well as interaction with the intervener; see Table 2. Not surprisingly, control-condition fathers receiving phone conversations (M = 4.42, SD = 1.03) experienced less difficulties planning the appointments compared to the VIPP-PRE fathers attending sessions at the prenatal clinic (M = 3.08, SD = 1.21), t[66] = 4.86, p < .001, 95% CI [0.79, 1.89], Hedges' g = 1.17. Expectant fathers in

both groups reported overall positive experiences with the intervener. Most fathers found the number of sessions and the time in between sessions 'just right.'

Fathers in the VIPP-PRE group were asked some additional questions regarding their experiences with the intervention; see Table 2 for answers to the multiple choice questions and this paragraph for their responses to open-ended questions. (Open-ended questions are listed in the Supplemental Materials.) Some fathers indicated that they would have liked to know in advance when they would be asked to sing for their babies. Likewise, when asked about what they liked least about the VIPP-PRE, 18% of expectant fathers reported having to sing. Other least favourite aspects of the intervention were logistic difficulties with the appointments at the prenatal clinic due to limited available time slots, heavy traffic or the amount of time invested, the instructions for the video recordings in general, the quality of the ultrasound images, and the mother not being allowed to join the reviewing of the ultrasound images. When asked about the most positive elements of the VIPP-PRE, 82% of expectant fathers said they particularly liked seeing and/or interacting with their unborn children. Other elements perceived as positive were: the feedback provided by the intervener, the instructions for the video recordings, and receiving information about their children's development and capabilities. Surprisingly, some fathers found that the presence of ultrasound images made the interactive activities such as reading or touching more difficult. Two fathers in the VIPP-PRE group reported that the presence of their partners made carrying out the instructions for the videos somewhat or a lot more difficult.

Sonographers' evaluation of the intervention

The sonographers involved with the VIPP-PRE who filled out an evaluation form ($N = 5$) reported that they had received sufficient information about the intervention beforehand. Also, they reported that achieving a recognisable image of the foetus was somewhat or very doable (on a 3-point scale ranging from not doable to very doable). In order to create recognisable images some sonographers would have preferred using their own equipment (n = 3) or to see all participants exclusively before 30 weeks' gestation ($n = 1$). On a 5-point scale (i.e. ranging from 1 = 'not good at all' to 5 = 'very good'), they indicated that they were positive about fathers having a central position in the intervention ($M = 4.60$, $SD = 0.55$).

Sonographers' opinions on interactions between fathers and their unborn children in general did not change. Three out of five of the sonographers would not opt to include father–foetus interaction in standard medical practice. The sonographers who were open to include father-foetus interaction in standard medical practice (if given enough time to do so), indicated that the results of an RCT testing the effects of the intervention would be crucial in determining whether this would be appropriate. Two sonographers, including one who was slightly less positive about fathers' playing a central role in the intervention, indicated they would not opt for including this interaction into standard practice, saying that fathers might have sometimes felt uncomfortable during the intervention and that a home setting could aid in improving parent–child interactions. Three out of five sonographers indicated that they thought that fathers would likely be more involved in parenting after the VIPP-PRE. Some indicated that the fathers participating in this study were likely already very involved and therefore might not benefit from the intervention.

Lastly, sonographers reported that their interaction with the intervener was pleasant, as was based on a 5-point scale ranging from very unpleasant (i.e. 1) to very pleasant (i.e. 5), ($M = 4.80$, $SD = 0.45$).

Discussion

In this paper, we described the Prenatal Video-feedback Intervention to promote Positive Parenting (VIPP-PRE), aimed at improving parenting quality and stimulating involvement in expectant fathers. Based on reports of participating fathers and sonographers, we conclude that the VIPP-PRE is feasible and positively evaluated.

Expectant fathers receiving the VIPP-PRE reported that they particularly liked seeing and interacting with their unborn children as well as receiving feedback on these interactions. The number of appointments, as well as the time in between appointments, was deemed 'just right'. Being able to see their children through live ultrasound images was helpful to most fathers in the intervention. Importantly, expectant fathers receiving the VIPP-PRE reported more insight into their relationship with the babies, better understanding of the babies and the babies' feelings, and more insight into their communication with the babies than fathers in the control condition. Fathers' gaining more insight in their relationship and better understanding of the babies' feelings during the VIPP-PRE might be considered a preparation for an important precursor of the quality of the attachment relationship in infancy, namely parental mentalisation as the ability to see the world from the perspective of the child. VIPP-PRE might stimulate the three components of mentalisation: parental mind-mindedness, parental insightfulness, and parental reflective functioning (Zeegers et al., 2017) through the guided interactions with the ultrasound images which are a prelude of the new-born person the fathers might expect after birth.

Sonographers also reported overall positive experiences with the VIPP-PRE. Providing live and recognisable images of the foetuses was feasible. Interactions with the interveners were rated as pleasant, and sonographers felt they had received sufficient information on the intervention beforehand. They suggested that if the VIPP-PRE improves expectant fathers' parenting sensitivity and/or involvement, then it could be considered to offer these sessions, perhaps in a more private and home-based environment where fathers feel more at ease. They also suggested to start the sessions preferably before 30 weeks of gestation due to difficulties with imaging near the end of pregnancy. Even though the sonographers' opinions on the role of father-foetus interactions did not change after the intervention, they were very positive about the fact that fathers played a central role. Some sonographers indicated that using more high-grade equipment would have resulted in more recognisable images.

Previously, prenatal parenting interventions have predominantly focused on achieving positive health and psychosocial outcomes in high-risk samples. Such interventions are scarce, and they do not make clear which element(s) contributed to these positive outcomes. For example, Bryan (2000) evaluated a broad intervention that included videotaped examples of unknown fathers and mothers interacting with a child, group discussions about parental roles, and parenting education. This compound of potentially effective components leaves open the question of the specific part of the intervention

which brought about the change. In contrast, the VIPP-PRE is a brief and focused intervention aimed at supporting interactions between the father and his own baby.

With the VIPP-PRE we build on the theories of attachment and mentalisation that are the basis for our video-feedback parenting interventions. Because of this theoretical foundation, the intervention focuses on the core elements of the future attachment relationship, namely parental sensitive responsiveness (Ainsworth et al., 1978) and on the enhancement of paternal mentalising capacity (Fonagy et al., 2002). The latter enables fathers to take the perspective of the foetus and the new-born, and to project an emerging mind on the baby that needs his attention and protection. Whereas mothers have been prepared for their mothering role by carrying the foetus and by pregnancy-induced hormonal and neural changes, fathers have had less opportunity to be neurobiologically and behaviourally prepared for the arrival of a new-born (Bakermans-Kranenburg et al., 2003). They might profit from prenatal exposure to the foetus and video feedback around this exposure.

Several potential weaknesses of the intervention arising from the evaluations warrant some discussion. First, a number of expectant fathers receiving the VIPP-PRE seem to have had difficulty with the unannounced proposal to sing to their unborn children in the presence of the mothers, sonographers, and interveners, while being recorded. Therefore, we would suggest replacing this activity with another activity for example, an additional 'free play' situation.

Secondly, several fathers reported that the live ultrasound images made carrying out the activities more difficult. This might be due to the fact that fathers had to multitask during recordings and might have felt like they did not have sufficient time to look at the images closely enough. This might have been especially the case when they were asked to read from a book or when they made eye contact with the intervener. However, the feedback given based on previous recordings in one-to-one conversations with the father was well received. We would therefore suggest to keep reviewing the ultrasound recordings with feedback in the VIPP-PRE and to perhaps put more emphasis on the feedback based on earlier recordings, such as is the case with the other modules of the VIPP. If advances in prenatal imaging allow for making more easily recognisable images of the foetus (e.g. 3D imaging) within the time window needed for this intervention, then this could certainly be considered for the VIPP-PRE.

Lastly, a small percentage of fathers had some difficulty planning the appointments due to limited availability at the prenatal clinic. Considering the limited available spots (e.g. working days only, 8am-4pm), and given that most of our expectant fathers and mothers worked full time, the attrition in the intervention group was surprisingly low. However, if the VIPP-PRE is to be implemented in primary health care, it might be helpful to search for options that circumvent the flexibility shown by our participants. One such solution could be offering home sessions, which might be feasible with portable ultrasound equipment, such as the type used in this study.

The following limitations of the current study should be noted. First, the fathers included in the study do not necessarily represent the general population and are likely relatively involved parents. However, for the purpose of testing feasibility of the intervention this group of fathers was suitable as potential confounding factors, such as the strains and stresses of poverty, were absent. To further test the acceptability and effectiveness of the VIPP-PRE, future studies could include a more diverse group of fathers.

Secondly, the effects of getting extra ultrasound scans are intertwined with the intervention, and it is difficult to disentangle the effects of both components of the intervention. Importantly, the intervention's efficacy needs to be interpreted with this possible confounding in mind, and future studies may be advised to include a control condition with the extra scans but without the interactions and feedback.

The effects of the VIPP-PRE on fathers' quality and quantity of care should guide future efforts on expanding the use of the intervention. Possible mediators, moderators, and secondary outcomes (e.g. fathers' mentalising abilities, neural and hormonal functioning, parents' childhood experiences with maltreatment, postnatal depression) should be considered and might point towards those who would benefit most from the VIPP-PRE.

In summary, both researchers and clinicians have recently started to include partners of pregnant women in perinatal care. The development of a first interaction-based, brief, prenatal interventions aimed directly at improving parenting quality and quantity helps to include family context in perinatal health care.

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Author Contributions (CRediT)

Conceptualization, MJB-K, MHvIJ and KA-vD; Methodology, KA-vD, MHvIJ and MJB-K; Formal analysis, KA-vD and NdW; Investigation, KA-vD and NdW; Data curation, KA-vD and NdW; Writing – original draft, KA-vD; Writing – review & editing, NdW, MHvIJ and MJB-K; Visualization, KA-vD and MJB-K; Supervision, MJB-K and MHvIJ; Project administration. KA-vD and MJB-K; Funding acquisition, MJB-K and MHvIJ .

Disclosure of interest

The authors report no conflicts of interest.

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