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Concurrent validity, discriminatory power, and feasibility of the Instrument for identification of Parents At Risk for child Abuse and Neglect (IPARAN)

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Abstract

Objectives To determine the feasibility, concurrent validity and discriminatory power of the IPARAN among Dutch parents with a newborn child.

Setting Community pediatrics.

Participants Data from a controlled trial was used. In total, 2,659 Dutch parents with a newborn child were invited to participate. Of the 2,659 parents, 759 parents filled in the consent form and participated in the study.

Primary and secondary outcome measures Concurrent validity was determined by calculating correlations – using the Pearson correlation (r) – between the IPARAN score and related constructs from the following instruments: the Empowerment Questionnaire 2.0 (EMPO 2.0), the Family Functioning Questionnaire and the Parenting Stress Questionnaire. Discriminatory power was determined by calculating ROC curves between high-risk and low-risk mothers according to their scores on the related constructs. Feasibility was determined by examining the percentage of missing answers.

Results In terms of concurrent validity, we found that three out of 12 correlations between IPARAN score and related constructs were strong (i.e. $r > 0.50$) and four out of 12 were medium (i.e. $r = 0.30$-0.49). In terms of discriminatory power, mothers with a score in the borderline/clinical range or P10 range of the related constructs (high-risk mothers) had a higher IPARAN score than mothers with a score in the normal range or P90 range of the related constructs (low-risk mothers). Effect sizes varied from d=0.37 to d=1.93, and the area under the ROC curve varied from AUC=0.62 to AUC=0.93. Regarding feasibility, the part of the IPARAN filled in by the mother had on average 0.7% missing answers, whereas the part of the IPARAN filled in by the father had on average 1.7% missing answers.

Conclusion The results of this study support the concurrent validity, discriminatory power, and feasibility of the IPARAN among a population of Dutch parents with a newborn child.

Strengths and limitations of the study

- First study to validate the risk assessment tool 'IPARAN' to identify parents at-risk of parenting stress.
- Various reference scales of risk factors for parenting stress were used for validation.
- High response rate among difficult to reach sample.
- A convenient sampling method was used.
- Not all risk factors of parenting stress could be validated.

Introduction

Raising a child can be challenging for parents. Research has shown that parents/caregivers (further mentioned parents) have many concerns, especially when their child is still young. Concerns are about parenting in general, developmental delay or behavior of their child. Almost 60% of parents with children around 14 months of age indicated to have some parental concerns for which they felt they needed assistance or advice from someone outside the family, and 11.4% indicated to have frequent concerns (1). Circumstances in parents' life may cause parenting to become more challenging and stressful (2), and lead to parenting stress. Previous research has identified circumstances that may increase the risk of parenting stress: lack of social support (3, 4), single parenthood (5), young parenthood (3-6), ambivalent feelings about parenthood (4, 7), depressive feelings (3, 4, 6), spousal violence (3, 4, 8-10), alcohol/drug abuse (3, 4, 11), negative childhood experiences (3, 4, 6-8, 12, 13), negative sexual experiences (6, 7, 13), tendency to become upset and angry (losing temper) (3), believe in physical punishment (4, 8), low birthweight of the child (14), and birth term of the child (14).

Parenting stress is conceptualized by Östberg (15) as a perceived discrepancy between situational demands and personal resources in parenthood. Parenting stress is associated with severe parenting practices such as child abuse and neglect (16). Child abuse and neglect

again, is associated with adverse physical, cognitive and psychosocial outcomes for children in the short and long term (17-19).

It is important to provide help and support to parents that experience parenting stress. However, it remains a challenge to identify parents at-risk of parenting stress timely, in order to provide preventive interventions. The Instrument for identification of Parents At Risk for child Abuse and neglect (IPARAN) (20) was developed to identify parents with a newborn child who are likely to experience parenting stress that may be associated with child abuse or neglect, in order to provide them with a preventive intervention, such as the Supportive Parenting Intervention (21). By identifying those parents at-risk of parenting stress early on in a child's life, by screening parents with a newborn child, we will be better able to support these parents. This helps to prevent the long-term potential harmful effects of parenting stress and the associated negative parenting practices such as child abuse and neglect.

The IPARAN focuses on the aforementioned circumstances that increase the risk of parenting stress, such as a problematic childhood of one or both parents, poor social support, and depressive feelings by one or both parents.

The IPARAN is currently used by 51% of Youth Health Care (YHC) centers in the Netherlands to support professionals in their assessment of risk of parenting stress (22, 23). Although some research has been conducted regarding non-response (24), there is no study yet available examining the concurrent validity, discriminative power, and feasibility of the IPARAN. The objective of this study was therefore to evaluate the concurrent validity, discriminative power, and feasibility of the IPARAN in a population of Dutch parents with a newborn child. Our research question was as follows: Is the IPARAN a valid and feasible tool for assessing risk factors for parenting stress in this population? To answer this question, we calculated correlations between parents' scores on the IPARAN and those for related constructs (concurrent validity). Based on the direction of the questions asked, we expected negative correlations for all related constructs, except for the related construct 'depressive symptoms'.

Additionally to explore the discriminatory power of the IPARAN differences in IPARAN score between mothers within the borderline/clinical range or P10 range of the related constructs (high-risk mothers) and mothers within the normal range or P90 range of the related constructs (low-risk mothers) were examined, and ROC curves were calculated. We expected higher IPARAN scores for the high-risk mothers. The feasibility of the IPARAN was determined by examining the percentage of missing answers.

Methods

Data collection and participants

This study used data from the Supportive Parenting study, a controlled trial described in detail elsewhere (25). The IPARAN was previously named 'Supportive Parenting Questionnaire' (25) (Trial registration: www.trialregister.nl; Netherlands Trial Register: NTR 5307; 16 July 2015).

In short, all parents with a child born between January and September 2014, living in a suburban area of the western part of the Netherlands were invited to participate. In order to participate, parents were required to have at least basic Dutch language skills and provide written informed consent.

In the Netherlands, a Youth Health Care nurse (YHC-nurse) visits all parents with a newborn child at home 5-14 days after childbirth. This is known as the 'well-child visit'. During this visit the YHC-nurse informed the parents about the study and provided parents with an information leaflet, informed consent form and baseline questionnaire. This baseline questionnaire included the IPARAN and three other questionnaires that assess related constructs, namely the Empowerment Questionnaire 2.0 (EMPO 2.0) (26), the Family Functioning Questionnaire (27), and the Parenting Stress Questionnaire (28). Parents were

invited to provide written informed consent for participation in the study and to return the baseline questionnaire to the researchers in a pre-paid envelope.

In total, 2,659 parents received information about the study and were invited to participate. Of these, 759 parents completed the written informed consent form and baseline questionnaire (28.5%). However, for 32 families (4.2%), an IPARAN score could not be calculated for the father. Only the mothers completed their part and not both parents, despite the mother indicating that she lived together with her husband or partner, leaving a population for analysis of 727 parents.

Ethics statement

Methods were carried out in accordance with the STROBE statement (29). Parents received written information about the study and were free to refuse participation. Parents willing to participate provided written informed consent. Only anonymous data were used for analysis. This study was approved by the Medical Ethics Committee of Erasmus Medical Center Rotterdam (MEC-2013-568).

Measurements

The IPARAN

The IPARAN aims to identify risk factors related to the development of parenting stress (30). These risk factors were selected by Bouwmeester-Landweer et al. (31) based on previous research (3-14) and can be divided into three domains (31) based on the ecological model of Belsky (32-34), and the concept of parental awareness of Newberger (35), elaborated on by

Baartman (36). These three domains are as follows: child and family characteristics; parental developmental history and personality (including parental awareness); and characteristics of the social context.

The IPARAN is a three-page self-report form with a general part (filled in by both parents), a part for the mother, and a part for the father/other parent (see Supporting Information S1 table). The general part consists of five items relating to risk factors in the first domain: birthweight of the child, duration of pregnancy, age of mother at delivery, age of father at delivery, and family structure. The part filled in by the mother and the part filled in by the father/other parent each consists of sixteen items. These items relate to risk factors in the first, second and third domain. The item within the first domain is 'quarrels with partner ever become physical'. Items within the second domain are 'worried about raising your child', 'unhappy during pregnancy about becoming a mother/father', 'parents or carers had loving relationship', 'being hit as a child', 'ever felt unhappy in past 3 years', 'losing temper', ' negative sexual experience', 'drug/alcohol abuse', and 'hitting should be part of upbringing'. Items within the third domain are 'finding it difficult to ask for help', 'feeling comfortable in neighborhood', 'maintain close relations with family', 'receiving support from network of family, neighbors, friends', and 'receiving support from partner'. The items are accompanied by either a 4-point response scale (always, often, sometimes, never) or a yes/no option.

Each item is assigned a score between 0 and 2 (see Supporting Information S1 table). In order to categorize parents as either being at-risk or not-at-risk for parenting stress, a summation score is calculated for each parent by adding the total score of the parent to the total score of the general part of the instrument. If either parent has a summation score of ≥3, the family is considered to be at-risk of parenting stress.

Demographic characteristics

Data was collected on age, gender, and country of birth of both parents and child. Educational level of both parents and net family income per month were also included. Educational level was classified as low (primary education, lower secondary education), middle (higher secondary education, vocational education) or high (higher vocational education, university). Net family income was classified as low (<€1800,- per month) or high (≥€1800,- per month). Nationality of the child, father, and mother was classified as Dutch or non-Dutch, according to definitions used by Statistics Netherlands (37).

Related constructs of parenting stress

Competences as a person and parent, childhood experiences, depressive symptoms, social network and partner support were assessed by subscales based on the existing instruments, EMPO 2.0, Family Functioning Questionnaire (FFQ), and Parent Stress Questionnaire (PSQ) (26-28). These questionnaires formed part of the baseline questionnaire. No data was obtained on four risk factors for parenting stress assessed by the IPARAN (i.e. negative sexual experience, believe in physical punishment, spousal violence and alcohol/drug abuse).

Competences as a person and parent

Competences as a person and parent were assessed by two subscales of the EMPO 2.0, a questionnaire that assesses parental empowerment. Competence as a person refers to parents' feelings about whether they are in control of their own lives and capable of dealing with problems as they occur. This construct is assessed by eight items. An example of an item is 'I can handle problems easily'. Competence as a parent is about parents' feelings whether they are in control of their child and know their strengths and limitations as a parent. This construct is assessed by seven items. An example of an item is 'I have great confidence in my parenting

skills'. Both subscales have a 5-point response scale ranging from 1=strongly disagree to 5=strongly agree.

For both subscales raw scores are converted to a score between 1 (indicating a low level of competence) and 10 (indicating a high level of competence). Depending on the amount of items belonging to a subscale (e.g. competence as a person consists of 8 items), a minimum score, 8, and maximum score, 40, can be calculated. The maximum score minus the minimum score of a subscale (40–8=32) is distributed evenly over the maximum converted score of 10 (10/32=0.3125). To calculate a parent's converted score, the minimum score of the subscale is subtracted from his/her summation score, e.g. 32 ((32-8)*0.3125=7.5). Parents within the first 10% (P10) of both subscales were seen as high-risk parents. The subscales competence as a person and competence as a parent have a Cronbach's alpha of 0.81 and 0.82 respectively (26).

Parental developmental history

Parental developmental history is assessed by the subscale childhood experience, also derived from the FFQ. Childhood experience is about a parent's own childhood and whether he/she has pleasant memories of his/her own childhood . The subscale is assessed by four items on a 4-point response scale ranging from 1=not true to 4=very true. A summation score is calculated and also converted into a category (normal, borderline, clinical) according to the guideline (27). An example of an item is 'you feel your own parents treated you well'. This subscale has a Cronbach's alpha of 0.85 (27).

Partner support

Partner support is assessed by the subscale partner relationship, also derived from the FFQ and is about the perception of a person's relationship with his/her partner and the extent to

which he/she feels supported by his/her partner. Partner relationship is assessed by five items on a 4-point response scale ranging from 1=not true to 4=very true. A summation score is calculated and also converted into a category (normal, borderline, clinical) according to the guideline (27). An example of an item is 'you feel your partner supports you in raising the children'. This subscale has a Cronbach's alpha of 0.89 (27).

Social network

Social network is assessed by the subscale social contacts from the Family Functioning Questionnaire (FFQ), a questionnaire that assesses problems parents encounter within their family. The subscale social contacts refers to the extent to which a parent has contact with neighbors, family and friends, and is assessed by five items on a 4-point scale ranging from 1=not true to 4=very true. A summation score is calculated and also converted into a category (normal, borderline, clinical) according to the guideline (27). An example of an item is 'your family has regular contact with other local residents'. This subscale has a Cronbach's alpha of 0.72 (27). The FFQ provides norm referenced standard scores for children between 0-3 year, 4-11 year and 12-18 year.

Depressive symptoms

Symptoms of depression was assessed with the subscale depressive symptoms, derived from the Parenting Stress Questionnaire (PSQ), a questionnaire that assesses the level of stress parents experience in their role as a parent. This subscale refers to the extent to which a parent is happy with him/herself and his/her circumstances and is assessed by seven items on a 4-point response scale ranging from 1=not true to 4=very true. A summation score is calculated and also converted into a category (normal, borderline, clinical) according to the guideline (28). An example of an item is 'sometimes I do not see the point of living'. This subscale has a

Cronbach's alpha of 0.87 (28). The PSQ provides norm referenced standard scores for children between 0-3 year, 4-11 year and 12-18 year.

Statistical analyses

Concurrent validity

Concurrent validity was assessed by comparing the IPARAN score with those obtained for the related constructs of the EMPO 2.0 (26), the FFQ (27) and the PSQ (28) and calculating Pearson's correlation coefficients (r). The IPARAN score of the mother was only compared with the scores obtained for the related constructs, filled in by the mother. The IPARAN score of the father was only compared with the scores obtained for the related constructs, filled in by the father. We used the criteria suggested by Cohen for judging the size of the correlations thus obtained: r <0.30 for minor, r = 0.30-0.49 for medium, and r ≥0.50 for strong correlations (38).

Discriminatory power

An independent t-test was used to compare the IPARAN score of mothers with a borderline/clinical range or P10 range of the related constructs (high-risk mothers) with those for mothers with a score in the normal range or P90 range of the related constructs (low-risk mothers). In order to relate the difference in mean scores to the distribution of the scores, effect size estimations (*d*) were calculated by dividing the difference between the mean scores by the standard deviation. We used the criteria suggested by Cohen for judging the effect sizes thus obtained: *d*=0.20 for small, *d*=0.50 for moderate and *d*=0.80 for large effect sizes (38). Additionally, receiver operating characteristic (ROC) curves were plotted and the area under the curve (AUC) was calculated. The greater the AUC, the greater the discriminatory power of the IPARAN for discriminating between high-risk and low-risk mothers. An AUC<0.50 indicated

chance level; 0.50≤AUC<0.70 indicated low discriminatory power; 0.70≤AUC<0.90 indicated moderate discriminative power; and an AUC≥0.90 indicated high discriminatory power (39).

Feasibility

To determine feasibility percentages of missing answers at the item level of the IPARAN were calculated. Percentages of respondents for whom it was not possible to calculate a total IPARAN score due to missing items were also calculated.

Furthermore, descriptive statistics were used to describe the study sample. Only complete cases were used for all analyses. All analyses were performed using SPSS21 (40).

Results

Sample characteristics

The baseline questionnaire, containing the IPARAN and the questionnaires assessing the related constructs, was completed by 727 parents. Average age of the mother at baseline was 30.0 years (SD=4.5). Only 0.3% was ≤18 years. The majority of the mothers (92.8%) had middle to high educational level and 96.8% were of Dutch ethnicity. Fathers had an average age of 32.5 years (SD=5.2) at baseline. Of the fathers, 86.2% had a middle to high educational level and 97.6% were of Dutch ethnicity. In total, 1.7% of the respondents were single parents and 10.9% had a net monthly income below €1800,-. The mean age of the child at baseline was 5.2 months (SD=3.5) and 52.4% of the children were boys. The IPARAN has to be filled in by both the mother and father/other parent (with the exception of single parents). The remaining part of the baseline questionnaire (containing questions for the related constructs from the EMPO 2.0,

the FFQ and the PSQ) has to be filled in by one of the parents. For 93.2% of the baseline questionnaires, the remaining part was filled in by the mothers (Table 1).

Parents at-risk of parenting stress are more often single parent, more often of non-Dutch ethnicity, have a lower educational level, shorter duration of pregnancy and the child had a lower birthweight.

Table 1. Demographic characteristics of the study sample.

Subject	Characteristics	Total (n=727)	Parents at-risk (n=177)	Parents not at-risk (n=550)	p-value
Mother	Mean age (SD), y	30.0 (4.5)	30.7 (5.3)	29.8 (4.2)	**.048**
	<19 years (%)	0.3	1.1	0.0	**.003**
	Nationality (Dutch, %)	96.7	93.2	97.8	**.003**
	Educational level (Low, %)	7.4	13.2	5.5	**.002**
	IPARAN score	1.35 (1.94)	3.73 (2.46)	0.59 (0.80)	**.000**
Father	Mean age (SD), y	32.5 (5.2)	32.6 (6.0)	32.4 (4.9)	.671
	<19 years (%)	0.0	0.0	0.0	-
	Nationality (Dutch, %)	97.6	94.7	98.5	**.004**
	Educational level (Low, %)	13.6	13.1	13.8	.962
	IPARAN score	1.02 (1.33)	2.51 (1.63)	0.58 (0.81)	**.000**
Child	Gender child (boy, %)	52.2	59.3	49.9	**.029**
	Mean age child, months (SD)	5.2 (3.5)	5.1 (2.8)	5.2 (3.7)	.806
	Duration of pregnancy (<38 weeks, %)	8.9	15.3	6.9	**.001**
	Birth weight (<2500 grams, %)	5.2	11.3	3.3	**.000**
Household	Family composition (single parent, %)	1.7	5.1	0.5	**.000**
	Net monthly family income (<€1800,- %)	10.9	15.5	9.4	**.024**
Other	Gender parent[a] (female, %)	93.0	92.7	93.1	.844

[a] Gender of the parent who completed the remaining part of the baseline questionnaire

Concurrent validity

Table 2 shows the correlations between the related constructs and the IPARAN score, separately for mothers and fathers.

The correlations of the IPARAN score of the mother varied from *r*= -0.10 to *r*= -0.58 and *r* = 0.50 (depending on the related construct with which the total IPARAN score was being compared). Of the six pairs of scores analyzed, one third of the correlations (33.3%) had values

of *r* smaller than -0.30; two pairs (33.3%) had values between *r*=0.30 and *r*=0.49. And two pairs (33.3%) had values of *r*>0.49, for both negative and positive correlations. The strongest correlations were found between the IPARAN score and the related constructs 'childhood experience' (*r*= -0.58), and 'depressive symptoms'(*r*=0.50) (Table 2).

Table 2 Concurrent validity: correlations between parents' scores (mothers n=676; fathers n=51) on the IPARAN and those on the related constructs.

IPARAN[a]	**Related constructs**	**Missings**	**Correlation mother's part**		**Correlation father's part**	
		n	***r***	***p***	***r***	***p***
Total score**	Competence as a person[b*]	4	**-.24**	**.000**	**-.40**	**.004**
	Competence as a parent[b*]	3	**-.10**	**.007**	-.06	.691
	Childhood experience[c*]	2	**-.58**	**.000**	**-.59**	**.000**
	Partner relationship[c*]	18	**-.36**	**.000**	-.17	.236
	Social contacts[c*]	1	**-.39**	**.000**	-.22	.117
	Depressive symptoms[d**]	4	**.50**	**.000**	**.48**	**.000**

a Correlations between total score on the IPARAN in the first column and the related constructs in the second column were calculated using Pearson's correlation coefficient (r). The IPARAN score of the mother was correlated to related constructs filled in by the mother. The IPARAN score of the father was correlated to related constructs filled in by the father.

b Derived from the EMPO 2.0 (26)

c Derived from the Family Functioning Questionnaire(27)

d Derived from the Parenting Stress Questionnaire (28)

* A low score indicates problems

** A high scores indicates problems

Bold numbers indicate a significant correlation between the item on the IPARAN and the related construct (p<0.008) as tested with Pearson's correlation and correct for multiple testing with a Bonferroni correction (0.05/6).

Of the six correlations between the IPARAN score of the father and the related constructs, half of the correlations were not significant (p>0.05.) Of the three remaining significant correlations, two had an *r* between 0.30-0.49, for both positive and negative correlations, and one correlation had an *r* of -0.59. The strongest correlation was found between the IPARAN score and the related construct 'childhood experience' (*r*= -.59) (Table 2).

Discriminatory power

Table 3 shows the IPARAN score, the Cohen's *d* and the AUC for mothers within the borderline/clinical range or P10 range of the related constructs (high-risk mothers) and mothers within the normal range or P90 range of the related constructs (low-risk mothers). On all related

constructs, high-risk mothers had a significantly higher IPARAN score than low-risk mothers ($p<0.05$). Half of the effect sizes were large ($d>0.80$) and one third was moderate ($0.50<d<0.80$). The ROC curves show that the IPARAN has moderate discriminatory power (≤0.70AUC<0.90) for the related constructs 'depressive symptoms', 'social contacts', and 'partner relationship' and has high discriminatory power (AUC>0.90) for the related construct 'childhood experience'. For the related constructs ‘competence as a person’, and ‘competence as a parent’ the IPARAN had low discriminatory power (0.50≤AUC<0.70) (39).

Table 3. Discriminatory power of the mothers’ IPARAN score, relative to the scores on the related constructs in the borderline/clinical or P10 range filled in by the mothers.

Related constructs	*n*	Mean score on IPARAN[a] (SD)	Cohen’s *d*	AUC (95% CI)
Competence as a person[b]				
High risk	65	**2.70 (2.63)**	0.58	.68 (.60; .75)
Low risk	607	1.17 (1.73)		
Competence as a parent[b]				
High risk	84	**2.01 (2.15)**	0.37	.62 (.56; .69)
Low risk	589	1.22 (1.83)		
Childhood experience[c]				
High risk	27	**5.04 (2.00)**	1.93	.93 (.91; .96)
Low risk	647	1.18 (1.74)		
Partner relationship[c]				
High risk	14	**3.61 (3.22)**	0.75	.74 (.59; .90)
Low risk	644	1.19 (1.70)		
Social contacts[c]				
High risk	47	**3.71 (3.09)**	0.83	.76 (.68; .84)
Low risk	628	1.15 (1.66)		
Depressive symptoms[d]				
High risk	58	**4.11 (3.21)**	0.95	.81 (.74; .87)
Low risk	610	1.07 (1.48)		

[a] The mean score represents the summation score of the mother.
[b] Derived from the EMPO 2.0 (26)
[c] Derived from the Family Functioning Questionnaire (27)
[d] Derived from the Parenting Stress Questionnaire (28)
Bold numbers indicate a significant difference between the high-risk and low-risk group ($p<0.05$) as tested with an independent T-test.

Feasibility

The mother's part of the IPARAN had on average 0.7% missing answers, whereas the father's part of the IPARAN had on average 1.7% missing answers. The highest percentage of missing

answers, for both mothers and fathers, was for the item 'Quarrels with partner ever become physical' (respectively 1.7% and 2.3% missing answers). Also, for 32 families (4.2%) it was not possible to calculate an IPARAN score for the father/other parent. Only the mothers completed their part and not both parents, despite the mother indicating that she lived together with her husband or partner.

Discussion

The results of our study suggest that the Instrument for identification of Parents At Risk for child Abuse and Neglect (IPARAN) is a valid and feasible tool for assessing risk factors for parenting stress in Dutch parents with a newborn child. The results in terms of feasibility partly confirm the results of earlier study (20).

The correlations found between the IPARAN score and those obtained on the related constructs of the EMPO 2.0 (26), Family Functioning Questionnaire (27) and Parenting Stress Questionnaire (28) support the instrument's concurrent validity. Various minor to strong correlations were found between the IPARAN score and the related constructs, filled in by the mother. All directions of the correlations were in line with our expectations. The strongest correlations were found between the IPARAN and the constructs 'childhood experience' and 'depressive symptoms'. The related constructs 'competence as a parent' and 'competence as a person' filled in by the mother showed minor correlations with the IPARAN. A possible explanation for this minor correlation is that the related construct that we chose does not measure exactly the same concept as the IPARAN score with which it is being compared. The items in the IPARAN that are related to competences as a parent focuses on worries during pregnancy about becoming a mother/father, and whether you feel capable of becoming a

parent, while the related construct focuses more on parenting practices in general. It is likely that the correlation is low due to this conceptual difference.

The correlations for the fathers raise some concern, since half of the correlations were not significant. The related constructs ‘competence as a parent’, ‘social contacts’ and ‘partner relationship’ filled in by the father showed no significant correlation with the IPARAN score of the father. Since our sample size of the fathers was low (n=51), the fact that half the correlations were not significant could be due to this low sample size. We therefore suggest that future research should focus more on the part of the father.

The fact that the IPARAN was able to distinguish between high-risk and low-risk mothers for most related constructs of parenting stress, shows that it has moderate to high discriminatory power. However, it should be noted that the discriminatory power of the IPARAN was low for the related constructs 'competence as a person and 'competence as a parent', findings that were supported by the mean scores and effect sizes. As mentioned above for the concurrent validity, it could be reasoned that the related constructs chosen here do not measure exactly the same concept as measured by the IPARAN. This could explain the low discriminatory power for these particular constructs. In future research, using a different questionnaire for measuring empowerment may help to improve the discriminatory power of the IPARAN.

The IPARAN is a short questionnaire with easily asked questions. The relatively low percentage of missing answers (≤2.0% for 16 items for both mothers and fathers) supports the feasibility. However, it should be mentioned that for 4.2% of the families (*n*=32) in our study it was not possible to calculate an IPARAN score due to the fact that the fathers/other parents did not fill in their part of the IPARAN, while the mother did and had also indicated that she was living together with her partner.

The questionnaire is a good addition to the data collected by default (such as parental age, birth term and birthweight of the child, which are already risk factors of parenting stress and child abuse and neglect (41). This questionnaire adds more information of risk factors of

parenting stress and child abuse and neglect to these demographic data such as social network and developmental history of the parents. The concurrent validity, discriminative power, and feasibility show that the questionnaire is easy to use in daily practice of YHC to detect parents at risk of parenting stress. By detecting parents at risk in time, interventions, such as the Supportive Parenting Intervention, can be offered, that can prevent severe outcomes of parenting stress.

Strengths and limitations of the study

Two limitations of the current study should be mentioned. Firstly, we have no data on the large non-response group (71.5%). It is possible that parents did not respond because they are afraid of possible interventions by the YHC center. Since characteristics of non-respondents are unknown, this selection bias might have influenced the study results. Secondly, we were limited in the instruments that we could administer. Therefore we could not evaluate concurrent validity for the items 'negative sexual experience', 'spousal violence', 'drug/alcohol abuse' and 'belief in physical punishment', as no related constructs were measured in the baseline questionnaire. Since this study was originally set up for measuring empowerment, these constructs were not included. However, these constructs are strong measurements of severe outcomes of parenting stress, such as child abuse and neglect. Therefore we propose that future studies include measurements of related constructs for these items. We also propose that additional psychometric properties (such as test-retest reliability) of the IPARAN be determined.

Although response rate was not very high, strength of this study is that the sample was nevertheless sufficiently large to allow us to determine the validity and feasibility of the IPARAN. In addition, we used several references (The Family Functioning Questionnaire, The EMPO 2.0 and the Parenting Stress Questionnaire).

Conclusion

Our findings that the IPARAN is feasible and shows good concurrent validity and discriminative power support the use of this instrument. The IPARAN can continue to be used by health practitioners in the Netherlands to evaluate whether parents with a newborn child are at risk of parenting stress. The timeliness of offering preventive help to these parents is vital in order to prevent these families from severe outcomes of parenting stress, such as child abuse and neglect and the long-term harmful effects of child abuse and neglect.

Contributorship statement HR, SB and EH-G originated the idea for the study and were responsible for acquiring the grant for the study. MB-L invented the intervention. All authors contributed to further develop the study concept and design. AG and EH are responsible for data collection, study coordination and reporting study results. EH was responsible for drafting and revising the manuscript. CM, RB, SB, EH-G and MB-L contributed to critical revision of the manuscript for important intellectual content. HR is responsible for study supervision and reporting of study results. All authors have read and approved the final manuscript.

Competing interests The authors declare that they have no competing interests.

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Data sharing statement No additional data are available

References

1. Reijneveld SA, de Meer G, Wiefferink CH, Crone MR. Parents' concerns about children are highly prevalent but often not confirmed by child doctors and nurses. BMC Public Health. 2008;8:124.
2. Belsky J. The determinants of parenting: A process model. Child Dev. 1984;55:83-96.
3. Schumacher JA, Smith Slep AM, Heyman RE. Risk factors for child neglect. Agression and Violent Behaviour. 2001;6:231-54.
4. Black DA, Heyman RE, Slep AM. Risk factors for child physical abuse. Agression and Violent Behaviour. 2001;6:121-88.
5. Brown J, Cohen P, Johnson JG, Salzinger S. A longitudinal analysis of risk factors for child maltreatment: findings of a 17-year prospective study of officially recorded and self-reported child abuse and neglect. Child Abuse Negl. 1998;22:1065-78.
6. Sidebotham P, Golding J. Child maltreatment in the "children of the nineties" a longitudinal study of parental risk factors. . Child Abuse Negl. 2001;25:1177-200.
7. Black DA, Heyman RE, Slep AM. Risk factors for child sexual abuse. . Aggression and Violent Behaviour. 2001;6:203-29.
8. Black DA, Heyman RE, Slep AM. Risk factors for child psychological abuse. Aggression and Violent Behaviour. 2001;6:189-201.
9. Keuning M, Schulze HJ, Stams GJ, Groenewegen I, Schuengel C. Marital conflict strategies predict child abuse potential in Dutch families from low socioeconomic backgrounds. Zeitschrift für Familienforschung. 2002;14:153-66.
10. Tajima EA. The relative importance of wife abuse as a risk factor for violence against children. Child Abuse Negl. 2000;24:1383-98.
11. Kotch JB, Browne DC, Dufort V, Winsor J. Predicting child maltreatment in the first 4 years of life from characteristics assessed in the neonatal period. Child Abuse Negl. 1999;23:1025-37.
12. Ertem IO, Leventhal JM, Dobbs S. Intergenerational continuity of child physical abuse: how good is the evidence? Lancet. 2000;356:814-9.
13. Hall LA, Sachs B, Rayens MK. Mothers' potential for child abuse: the roles of childhood abuse and social resources. Nurs Res. 1998;47:87-95.
14. Sidebotham P, Heron J. Child maltreatment in the "children of the nineties": the role of the child. Child Abuse Negl. 2003;27:337-52.
15. Östberg M. Parenting stress. Conceptual and methodological issues. Uppsala: Acta Universitatis Upsaliensis; 1999.
16. Lavee Y, Sharlin S, Katz R. The effect of parenting stress on marital quality. An integrated mother-father model. Journal of Family Issues. 1996;17:114-35.
17. Mills R, Alati R, O'Callaghan M, Najman JM, Williams GM, Bor W, et al. Child abuse and neglect and cognitive function at 14 years of age: findings from a birth cohort. Pediatrics. 2011;127(1):4-10.
18. Norman RE, Byambaa M, De R, Butchart A, Scott J, Vos T. The long-term health consequences of child physical abuse, emotional abuse, and neglect: a systematic review and meta-analysis. PLoS Med. 2012;9(11):e1001349.
19. Widom CS, Czaja SJ, Bentley T, Johnson MS. A prospective investigation of physical health outcomes in abused and neglected children: new findings from a 30-year follow-up. Am J Public Health. 2012;102(6):1135-44.
20. Bouwmeester-Landweer MBR. Early home visitation in families at risk for child maltreatment [Doctoral thesis]. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.

21. Bouwmeester-Landweer MBR, Kousemaker NPJ, Dekker FW, Landsmeer-Beker EA, Baartman HEM, Wit JM. Home visitation in families at risk for child maltreatment: process-evaluation. Early home visitation in families at risk for child maltreatment. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
22. Stevig Ouderschap: Stevig Ouderschap; [Available from: https://www.stevigouderschap.nl/voor-professionals/vereniging.
23. GGD GHOR Kennisnet: GGD GHOR Kennisnet; [Available from: http://www.ggdghorkennisnet.nl/?file=23239&m=1433926283&action=file.download.
24. Landsmeer-Beker EA, Bouwmeester-Landweer MBR, Korbee-Haverhoek HD, Kousemaker NPJ, Baartman HEM, Wit JM, et al. Differences between respondents and non-respondents on a postal questionnaire addressing risk factors for child maltreatment. In: Bouwmeester-Landweer MBR, editor. Early home visitation in families at risk for child maltreatment. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
25. Horrevorts EM, van Grieken A, Broeren SM, Bannink R, Bouwmeester-Landweer MB, Hafkamp-de Groen E, et al. Design of a controlled trial to evaluate the effectiveness of Supportive Parenting ('Stevig Ouderschap'): an intervention to empower parents at increased risk of parenting problems by providing early home visits. BMC Psychol. 2015;3(1):47.
26. Damen HR, Veerman JW. EMPO Ouders - Versie 2.0. Nijmegen: Praktikon; 2011.
27. Veerman JW, Janssen J, Kroes G, de Meyer R, Ngyen L, Vermulst A. Vragenlijst Gezinsfunctioneren - versie voor ouders van jeugdigen van 0 t/m 18 jaar. Nijmegen: Praktikon; 2011.
28. Vermulst A, Kroes G, de Meyer R, Ngyen L, Veerman JW. Opvoedingsbelasting vragenlijst - versie voor ouders van jeugdigen van 0 t/m 18 jaar. Nijmegen: Praktikon; 2011.
29. von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007;370(9596):1453-7.
30. Bouwmeester-Landweer MBR. Risk factors for child maltreatment. Early home visitation in families at risk for child maltreatment. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
31. Bouwmeester-Landweer MBR, Dekker FW, Landsmeer-Beker EA, Kousemaker NPJ, Baartman HEM, Wit JM. Prevalence of risk factors for child maltreatment in the Netherlands. Early home visitations in families at risk for child maltreatment. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
32. Belsky J. Child maltreatment: an ecological integration. Am Psychol. 1980;35(4):320-35.
33. Belsky J. Etiology of child maltreatment: a developmental-ecological analysis. Psychol Bull. 1993;114(3):413-34.
34. Belsky J, Vondra J. Lessons from child abuse: the determinants of parenting. In: V CDC, editor. Child maltreatment, theory and research on the causes and consequences of child abuse and neglect. Cambridge: Cambridge University Press; 1989.
35. Newberger CM. The cognitive structure of parenthood; the development of a descriptive measure. In: R SRY, editor. Clinical-developmental psychology New directions of child development: clinical development research. 7. San Francisco: Jossey-Bass; 1980.
36. Baartman HEM. Opvoeden kan zeer doen. Over oorzaken van kindermishandeling, hulpverlening en preventie. Utrecht: SWP; 1996.
37. CBS [Available from: http://www.cbs.nl/nl-NL/menu/methoden/begrippen/default.htm?ConceptID=37.

38. Cohen J. Statistical power analysis for the behavioral sciences. New Jersey: Lawrence Erlbaum Associates; 1988.
39. Swets JA. Measuring the accuracy of diagnostic systems. Science. 1988;240(4857):1285-93.
40. IBM Corp. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp; Released 2012.
41. Wu SS, Ma C-X, Carter RL, Ariet M, Feaver EA, Resnick MB, et al. Risk factors for infant maltreatment: a population-based study. Child Abuse Negl. 2004;28:1253-64.

Supporting Information

S1 Table. Score assigned if parent meets criterion for risk factor on the IPARAN.

General risk factors	**Score**	
Birth weight, *(<2500 grams)*	1.0	
Duration of pregnancy, *(<38 weeks)*	0.5	
Family composition, *(single parent,)*	2.0	
Age mother, *(<19 years)*	0.5 (18 years) or 1.0 (<18 years)	
Age father, *(<19 years)*	0.5 (18 years) or 1.0 (<18 years)	
Father and mother part	**Score of the Father**	**Score of the Mother**
Worried about raising your child *(always-often)*	1.0	2.0
Unhappy during pregnancy about becoming a mother/father *(always-often)*	1.0	1.0
Parents (or carers) had loving relationship *(sometimes-never)*	1.0	1.0
Felt safe with parents (or carers) as a child *(sometimes-never)*	1.0	1.0
Being hit as a child *(always-often-sometimes)*	1.0	1.0
Hitting should be part of upbringing *(yes)*	1.0	1.5
Should use less alcohol or drugs *(yes)*	0.5	0.5
Ever had a negative sexual experience *(yes)*	1.0	1.5
Ever felt unhappy in past 3 years *(always-often)*	1.0	2.0
Losing temper *(always-often)*	1.0	1.0
Finding it difficult to ask for help *(always-often)*	-	1.0
Quarrels with partner ever become physical *(always-often-sometimes)*	2.0	1.0
Feeling comfortable in neighborhood *(sometimes-never)*	-	0.5
Maintain close relations with family *(sometimes-never)*	-	0.5
Receiving support from network of family, neighbors, friends *(sometimes-never)*	-	0.5
Receiving support from partner *(sometimes-never)*	0.5	1.5

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	n.a.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-10
Bias	9	Describe any efforts to address potential sources of bias	n.a.
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	11-12
		(*b*) Describe any methods used to examine subgroups and interactions	n.a.
		(*c*) Explain how missing data were addressed	12
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n.a.
		(*e*) Describe any sensitivity analyses	n.a.
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	n.a.
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13
		(b) Indicate number of participants with missing data for each variable of interest	14-15
Outcome data	15*	Report numbers of outcome events or summary measures	14-15
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	n.a.
		(*b*) Report category boundaries when continuous variables were categorized	9-11
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n.a.
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n.a.
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19
Generalisability	21	Discuss the generalisability (external validity) of the study results	n.a.
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	20

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Concurrent validity, discriminatory power, and feasibility of the Instrument for identification of Parents At Risk for child Abuse and Neglect (IPARAN)

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Concurrent validity, discriminatory power, and feasibility of the Instrument for identification of Parents At Risk for child Abuse and Neglect (IPARAN)

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Abstract

Objectives To determine the feasibility, concurrent validity and discriminatory power of the IPARAN among Dutch parents with a newborn child.

Setting Community pediatrics.

Participants Data from a controlled trial were used. In total, 2,659 Dutch parents with a newborn child were invited to participate. Of the 2,659 parents, 759 parents filled in the consent form and participated in the study.

Primary and secondary outcome measures Concurrent validity was determined by calculating correlations – using the Pearson correlation (r) – between the IPARAN score and related constructs from the following instruments: the Empowerment Questionnaire 2.0 (EMPO 2.0), the Family Functioning Questionnaire and the Parenting Stress Questionnaire. Discriminatory power was determined by calculating ROC curves between high-risk and low-risk mothers according to their scores on the related constructs. Feasibility was determined by examining the percentage of missing answers.

Results In terms of concurrent validity, we found that three out of 12 correlations between IPARAN score and related constructs were strong (i.e. $r > 0.50$) and four out of 12 were medium (i.e. $r = 0.30$-0.49). In terms of discriminatory power, mothers with a score in the borderline/clinical range or P10 range of the related constructs (high-risk mothers) had a higher IPARAN score than mothers with a score in the normal range or P90 range of the related constructs (low-risk mothers). Effect sizes varied from $d=0.37$ to $d=1.93$, and the area under the ROC curve varied from AUC=0.62 to AUC=0.93. Regarding feasibility, the part of the IPARAN filled in by the mother had on average 0.7% missing answers, whereas the part of the IPARAN filled in by the father had on average 1.7% missing answers.

Conclusion The results of this study support the concurrent validity, discriminatory power, and feasibility of the IPARAN among a population of Dutch parents with a newborn child.

Strengths and limitations of the study

- First study to validate the risk assessment tool 'IPARAN' to identify parents at-risk of parenting stress.
- Various reference scales of risk factors for parenting stress were used for validation.
- A convenient sampling method was used.
- Not all risk factors of parenting stress could be validated.
- The sample consisted of highly educated respondents.

Introduction

Research has shown that parents/caregivers (further mentioned parents) have many concerns about parenting in general, developmental delay or behavior of their child, especially when their child is still young. Almost 60% of parents with children around 14 months of age indicated to have some parental concerns for which they felt they needed assistance or advice from someone outside the family, and 11.4% indicated to have frequent concerns (1). Circumstances in parents' life may cause parenting to become more challenging and stressful (2), and lead to parenting stress. Parenting stress is conceptualized by Östberg (3) as a perceived discrepancy between situational demands and personal resources in parenthood. Previous research has identified circumstances that predict the risk of parenting stress. These predictors can be categorized into different categories: *competence as a person/parent* (e.g. ambivalent feelings about parenthood, the tendency to become upset and angry, believing in physical punishment, and spousal violence (4-9)), *parental developmental history* (e.g. alcohol/drug abuse, negative childhood experiences, and negative sexual experiences (4-7, 10-13)), *partner support* (e.g. being a single parent (14)), *social network* (e.g. the lack of social support (4, 6)), *depressive symptoms* (e.g. depressive feelings (4, 6, 11)), and *demographic factors* (e.g. young parenthood, low birthweight of the child, and gestational age (4, 6, 11, 14, 15)).

Parenting stress is associated with negative parenting practices such as child abuse and neglect (16). Child abuse and neglect in turn, is associated with adverse physical, cognitive and psychosocial outcomes for children in the short and long term (17-19). Research of Mills et al. (17) showed that child abuse and neglect of children was independently associated with impaired cognition and academic functioning in adolescence. Child maltreatment was also related to a range of mental disorders, drug use, suicide, and risky sexual behavior (18), and also associated to negative physical outcomes such as risk for diabetes, lung disease, malnutrition and vision problems (19).

It is important to provide help and support to parents that experience parenting stress. However, it remains a challenge to identify parents at-risk of parenting stress timely, in order to provide preventive interventions. The Instrument for identification of Parents At Risk for child Abuse and neglect (IPARAN) (20) was developed to identify parents with a newborn child who are likely to experience parenting stress that may be associated with child abuse or neglect, in order to provide them with a preventive intervention, such as the Supportive Parenting Intervention (21). By identifying those parents at-risk of parenting stress early on in a child's life, by screening parents with a newborn child, we may be better able to support these parents. This helps to prevent the long-term potential harmful effects of parenting stress and the associated negative parenting practices such as child abuse and neglect.

The IPARAN focuses on the aforementioned predictors that increase the risk of parenting stress, such as the parental developmental history, social network, and depressive symptoms. The IPARAN is currently used by 51% of Youth Health Care (YHC) centers in the Netherlands to support professionals in their assessment of risk of parenting stress (22, 23). Although some research has been conducted regarding non-response (24), there is no study yet available examining the concurrent validity, discriminatory power, and feasibility of the IPARAN. Information on the validity and feasibility of the IPARAN can support Youth Health Care and local policy to make a careful decision in the methodologies that are used in daily

practice to detect at-risk families. The use of a valid and feasible instrument supports detection of at-risk families in a timely manner, and thus the possibility to offer these families suitable interventions. The IPARAN focuses on predictors of parenting stress. In this study we investigated whether a) the items/constructs of the IPARAN are in accordance with other validated instruments aimed at predictors of parenting stress (i.e. concurrent validity), b) the IPARAN distinguished between parents at-risk and parents not at-risk of parenting stress, (i.e. discriminatory power), and c) the IPARAN was easy to use (feasibility).

The objective of this study was therefore to evaluate the concurrent validity, discriminatory power, and feasibility of the IPARAN in a population of Dutch parents with a newborn child. Our research question was as follows: Is the IPARAN a valid and feasible tool for assessing risk factors for parenting stress in this population? To answer this question, we calculated correlations between parents' scores on the IPARAN and those on related constructs (concurrent validity). Based on the direction of the questions asked, we expected negative correlations for all related constructs, except for the related construct 'depressive symptoms'. Additionally to explore the discriminatory power of the IPARAN differences in IPARAN score between mothers within the borderline/clinical range or P10 range of the related constructs (high-risk mothers) and mothers within the normal range or P90 range of the related constructs (low-risk mothers) were examined, and ROC curves were calculated. We expected higher IPARAN scores for the high-risk mothers. The feasibility of the IPARAN was determined by examining the percentage of missing answers.

Methods

Data collection and participants

This study used data from the Supportive Parenting study, a controlled trial described in detail elsewhere (25). The IPARAN was previously named 'Supportive Parenting Questionnaire' (25) (Trial registration: www.trialregister.nl; Netherlands Trial Register: NTR 5307; 16 July 2015).

In short, all parents with a child born between January and September 2014, living in a suburban area of the western part of the Netherlands were invited to participate. In order to participate, parents were required to have at least basic Dutch language skills and provide written informed consent.

In the Netherlands, a Youth Health Care nurse (YHC-nurse) visits all parents with a newborn child at home 5-14 days after childbirth. This is known as the 'well-child visit'. During this visit the YHC-nurse informed the parents about the study and provided parents with an information leaflet, informed consent form and baseline questionnaire. This baseline questionnaire included the IPARAN and three other questionnaires that assess related constructs, namely the Empowerment Questionnaire 2.0 (EMPO 2.0) (26), the Family Functioning Questionnaire (27), and the Parenting Stress Questionnaire (28). Parents were invited to provide written informed consent for participation in the study and to return the baseline questionnaire to the researchers in a pre-paid envelope.

In total, 2,659 parents received information about the study and were invited to participate. Of these, 759 parents completed the written informed consent form and baseline questionnaire (28.5%). However, for 32 families (4.2%), an IPARAN score could not be calculated for the father. Only the mothers completed their part and not both parents, despite the mother indicating that she lived together with her husband or partner, leaving a population for analysis of 727 parents.

Sample characteristics

Table 1 shows the demographic characteristics of the sample. In the subgroup parents at-risk, mothers were on average older, were more often of non-Dutch ethnicity, and had a lower educational level compared to mothers in the subgroup parents not at-risk. Fathers in the subgroup parents at-risk were more often of non-Dutch ethnicity compared to fathers in the subgroup parents not at-risk. Children in the subgroup parents at-risk were more often a boy, were on average of lower gestational age, and had a lower birthweight, compared to children in the subgroup parents not at-risk. The household in the subgroup parents at-risk consisted more often a single parent, and had a lower net monthly income, compared to the household in the subgroup of parents not at-risk

Table 1. Demographic characteristics of the study sample.

Subject	Characteristics	Total (n=727)	Parents at-risk (n=177)	Parents not at-risk (n=550)	p-value
Mother	Mean age (SD), y	30.0 (4.5)	30.7 (5.3)	29.8 (4.2)	**.048**
	<19 years (%)	0.3	1.1	0.0	**.003**
	Nationality (Dutch, %)	96.7	93.2	97.8	**.003**
	Educational level (Low, %)	7.4	13.2	5.5	**.002**
	IPARAN score	1.35 (1.94)	3.73 (2.46)	0.59 (0.80)	**.000**
Father	Mean age (SD), y	32.5 (5.2)	32.6 (6.0)	32.4 (4.9)	.671
	<19 years (%)	0.0	0.0	0.0	-
	Nationality (Dutch, %)	97.6	94.7	98.5	**.004**
	Educational level (Low, %)	13.6	13.1	13.8	.962
	IPARAN score	1.02 (1.33)	2.51 (1.63)	0.58 (0.81)	**.000**
Child	Gender child (boy, %)	52.2	59.3	49.9	**.029**
	Mean age child, months (SD)	5.2 (3.5)	5.1 (2.8)	5.2 (3.7)	.806
	Duration of pregnancy (<38 weeks, %)	8.9	15.3	6.9	**.001**
	Birth weight (<2500 grams, %)	5.2	11.3	3.3	**.000**
Household	Family composition (single parent, %)	1.7	5.1	0.5	**.000**
	Net monthly family income (<€1800,- %)	10.9	15.5	9.4	**.024**
Other	Gender parent[a] (female, %)	93.0	92.7	93.1	.844

[a] Gender of the parent who completed the remaining part of the baseline questionnaire

Ethics statement

Methods were carried out in accordance with the STROBE statement (29). Parents received written information about the study and were free to refuse participation. Parents willing to participate provided written informed consent. Only anonymous data were used for analysis. This study was approved by the Medical Ethics Committee of Erasmus Medical Center Rotterdam (MEC-2013-568).

Measurements

The IPARAN

The IPARAN aims to identify risk factors related to the development of parenting stress (30). These risk factors were selected by Bouwmeester-Landweer et al. (31) based on previous research (4-15) and can be divided into three domains (31) based on the ecological model of Belsky (32-34), and the concept of parental awareness of Newberger (35), elaborated on by Baartman (36). These three domains are as follows: child and family characteristics; parental developmental history and personality (including parental awareness); and characteristics of the social context.

The IPARAN is a three-page self-report form with a general part (filled in by both parents), a part for the mother, and a part for the father/other parent (see online supplementary table S1). The general part consists of five items relating to risk factors in the first domain: birthweight of the child, duration of pregnancy, age of mother at delivery, age of father at delivery, and family structure. The part filled in by the mother and the part filled in by the father/other parent each consists of sixteen items. These items relate to risk factors in all three domains. The item within the domain of child and family characteristics is ‘quarrels with partner

ever become physical'. Items within the domain of parental developmental history and personality (including parental awareness) are 'worried about raising your child', 'unhappy during pregnancy about becoming a mother/father', 'parents or carers had loving relationship', 'being hit as a child', 'ever felt unhappy in past 3 years', 'losing temper', ' negative sexual experience', 'drug/alcohol abuse', and 'hitting should be part of upbringing'. Items within the domain of characteristics of the social context are 'finding it difficult to ask for help', 'feeling comfortable in neighborhood', 'maintain close relations with family', 'receiving support from network of family, neighbors, friends', and 'receiving support from partner'. The items are accompanied by either a 4-point response scale (always, often, sometimes, never) or a yes/no option.

Each item is assigned a score between 0 and 2 (see online supplementary table S1). In order to categorize parents as either being at-risk or not-at-risk for parenting stress, a summation score is calculated for each parent by adding the total score of the parent to the total score of the general part of the instrument. If either parent has a summation score of ≥3, the family is considered to be at-risk of parenting stress. The cut-off score of ≥3 is based on previous research (31), and minimizes the chances of overestimation and underestimation of parents at-risk of parenting stress.

Supplementary table S1

Demographic characteristics

Data was collected on age, gender, and country of birth of both parents and child. Educational level of both parents and net family income per month were also included. Educational level was classified as low (primary education, lower secondary education), middle (higher secondary education, vocational education) or high (higher vocational education, university). Net family

income was classified as low (<€1800,- per month) or high (≥€1800,- per month). Nationality of the child, father, and mother was classified as Dutch or non-Dutch, according to definitions used by Statistics Netherlands (37).

Competences as a person and parent

Competences as a person and parent were assessed by two subscales of the EMPO 2.0 (26), a questionnaire that assesses parental empowerment. Competence as a person refers to parents' feelings about whether they are in control of their own lives and capable of dealing with problems as they occur. This construct is assessed by eight items. An example of an item is 'I can handle problems easily'. Competence as a parent is about parents' feelings whether they are in control of their child and know their strengths and limitations as a parent. This construct is assessed by seven items. An example of an item is 'I have great confidence in my parenting skills'. Both subscales have a 5-point response scale ranging from 1=strongly disagree to 5=strongly agree.

For both subscales raw scores are converted to a score between 1 (indicating a low level of competence) and 10 (indicating a high level of competence). Depending on the amount of items belonging to a subscale (e.g. competence as a person consists of 8 items), a minimum score, 8, and maximum score, 40, can be calculated. The maximum score minus the minimum score of a subscale (40–8=32) is distributed evenly over the maximum converted score of 10 (10/32=0.3125). To calculate a parent's converted score, the minimum score of the subscale is subtracted from his/her summation score, e.g. 32 ((32-8)*0.3125=7.5). Parents within the first 10% (P10) of both subscales were seen as high-risk parents. The subscales competence as a person and competence as a parent have a Cronbach's alpha of 0.81 and 0.82 respectively (26).

Parental developmental history

Parental developmental history is assessed by the subscale childhood experience, derived from the Family Functioning Questionnaire (FFQ) (27), a questionnaire that assesses problems parents encounter within their family. Childhood experience is about a parent's own childhood and whether he/she has pleasant memories of his/her own childhood . The subscale is assessed by four items on a 4-point response scale ranging from 1=not true to 4=very true. A summation score is calculated and also converted into a category (normal, borderline, clinical) according to the guideline (27). An example of an item is 'you feel your own parents treated you well'. This subscale has a Cronbach's alpha of 0.85 (27). The FFQ provides norm referenced standard scores for children between 0-3 year, 4-11 year and 12-18 year.

Partner support

Partner support is assessed by the subscale partner relationship, also derived from the FFQ (27) and is about the perception of a person's relationship with his/her partner and the extent to which he/she feels supported by his/her partner. Partner relationship is assessed by five items on a 4-point response scale ranging from 1=not true to 4=very true. A summation score is calculated and also converted into a category (normal, borderline, clinical) according to the guideline (27). An example of an item is 'you feel your partner supports you in raising the children'. This subscale has a Cronbach's alpha of 0.89 (27).

Social network

Social network is assessed by the subscale social contacts, also derived from the FFQ (27).The subscale social contacts refers to the extent to which a parent has contact with neighbors, family and friends, and is assessed by five items on a 4-point scale ranging from 1=not true to 4=very true. A summation score is calculated and also converted into a category (normal,

borderline, clinical) according to the guideline (27). An example of an item is 'your family has regular contact with other local residents'. This subscale has a Cronbach's alpha of 0.72 (27).

Depressive symptoms

Symptoms of depression was assessed with the subscale depressive symptoms, derived from the Parenting Stress Questionnaire (PSQ) (28), a questionnaire that assesses the level of stress parents experience in their role as a parent. This subscale refers to the extent to which a parent is happy with him/herself and his/her circumstances and is assessed by seven items on a 4-point response scale ranging from 1=not true to 4=very true. A summation score is calculated and also converted into a category (normal, borderline, clinical) according to the guideline (28). An example of an item is 'sometimes I do not see the point of living'. This subscale has a Cronbach's alpha of 0.87 (28). The PSQ provides norm referenced standard scores for children between 0-3 year, 4-11 year and 12-18 year.

Statistical analyses

Concurrent validity

Concurrent validity was assessed by comparing the IPARAN score with those obtained for the related constructs of the EMPO 2.0 (26), the FFQ (27) and the PSQ (28) and calculating Pearson's correlation coefficients (r). The IPARAN score of the mother was only compared with the scores obtained for the related constructs, filled in by the mother. The IPARAN score of the father was only compared with the scores obtained for the related constructs, filled in by the father. We used the criteria suggested by Cohen for judging the size of the correlations thus obtained: r <0.30 for minor, r = 0.30-0.49 for medium, and r ≥0.50 for strong correlations (38).

Discriminatory power

An independent t-test was used to compare the IPARAN score of mothers with a borderline/clinical range or P10 range of the related constructs (high-risk mothers) with those for mothers with a score in the normal range or P90 range of the related constructs (low-risk mothers). In order to relate the difference in mean scores to the distribution of the scores, effect size estimations (*d*) were calculated by dividing the difference between the mean scores by the standard deviation. We used the criteria suggested by Cohen for judging the effect sizes thus obtained: *d*=0.20 for small, *d*=0.50 for moderate and *d*=0.80 for large effect sizes (38). Additionally, receiver operating characteristic (ROC) curves were plotted and the area under the curve (AUC) was calculated. The greater the AUC, the greater the discriminatory power of the IPARAN for discriminating between high-risk and low-risk mothers. An AUC<0.50 indicated chance level; 0.50≤AUC<0.70 indicated low discriminatory power; 0.70≤AUC<0.90 indicated moderate discriminatory power; and an AUC≥0.90 indicated high discriminatory power (39).

Feasibility

To determine feasibility percentages of missing answers at the item level of the IPARAN were calculated. Percentages of respondents for whom it was not possible to calculate a total IPARAN score due to missing items were also calculated.

Furthermore, descriptive statistics were used to describe the study sample. Only complete cases were used for all analyses. All analyses were performed using SPSS21 (40). To correct for multiple comparisons, a Bonferroni correction was used. The results in table 2 and table 3 are presented with correction for multiple comparisons.

Results

Concurrent validity

Table 2 shows the correlations between the related constructs and the IPARAN score, separately for mothers and fathers.

The correlations of the IPARAN score of the mother with the related constructs varied from *r*= -0.10 to *r*= -0.58 and *r* = 0.50. Of the six pairs analyzed, the pairs IPARAN-Competence as a person, and IPARAN-Competence as a parent had values of *r* smaller than -0.30; the pairs IPARAN-Partner relationship, and IPARAN-Social contacts had values between *r*= -0.30 and *r*= -0.49. And the pairs IPARAN-Childhood experience, and IPARAN-Depressive symptoms had values of *r*>0.49, for both negative and positive correlations. The strongest correlations were found between the IPARAN and the related constructs 'childhood experience' (*r*= -0.58), and 'depressive symptoms'(*r*=0.50) (Table 2).

Table 2 Concurrent validity: correlations between parents' scores (mothers n=676; fathers n=51) on the IPARAN and those on the related constructs.

IPARAN[a]	**Related constructs**	**Missings**	**Correlation mother's part**		**Correlation father's part**	
		n	***r***	***p***	***r***	***p***
Total score**	Competence as a person[b*]	4	**-.24**	**.000**	**-.40**	**.004**
	Competence as a parent[b*]	3	**-.10**	**.007**	-.06	.691
	Childhood experience[c*]	2	**-.58**	**.000**	**-.59**	**.000**
	Partner relationship[c*]	18	**-.36**	**.000**	-.17	.236
	Social contacts[c*]	1	**-.39**	**.000**	-.22	.117
	Depressive symptoms[d**]	4	**.50**	**.000**	**.48**	**.000**

[a] Correlations between total score on the IPARAN in the first column and the related constructs in the second column were calculated using Pearson's correlation coefficient (r). The IPARAN score of the mother was correlated to related constructs filled in by the mother. The IPARAN score of the father was correlated to related constructs filled in by the father.

[b] Derived from the EMPO 2.0 (26)

[c] Derived from the Family Functioning Questionnaire(27)

[d] Derived from the Parenting Stress Questionnaire (28)

[*] A low score indicates problems

[**] A high scores indicates problems

Bold numbers indicate a significant correlation between the item on the IPARAN and the related construct (p<0.008) as tested with Pearson's correlation and correct for multiple testing with a Bonferroni correction (0.05/6).

Of the six pairs made between the IPARAN score of the father and the related constructs, half of the correlations were not significant (p>0.05.): IPARAN-Competence as a parent, IPARAN-Partner relationship, and IPARAN-Social contacts. Of the three remaining significant correlations, the pairs IPARAN-Competence as a person, and IPARAN-Depressive symptoms had an *r* between 0.30-0.49, for both positive and negative correlations. The pair IPARAN-Childhood experience had an *r* of -0.59, which was also the strongest correlation found (Table 2).

Discriminatory power

Table 3 shows the IPARAN score, the Cohen's *d* and the AUC for mothers within the borderline/clinical range or P10 range of the related constructs (high-risk mothers) and mothers within the normal range or P90 range of the related constructs (low-risk mothers). On all related constructs, high-risk mothers had a significantly higher IPARAN score than low-risk mothers ($p<0.05$). Half of the effect sizes were large ($d>0.80$) and one third was moderate ($0.50<d<0.80$). The ROC curves show that the IPARAN has moderate discriminatory power (≤0.70AUC<0.90) for the related constructs 'depressive symptoms', 'social contacts', and 'partner relationship' and has high discriminatory power (AUC>0.90) for the related construct 'childhood experience'. For the related constructs 'competence as a person', and 'competence as a parent' the IPARAN had low discriminatory power (0.50≤AUC<0.70) (39).

Table 3. Discriminatory power of the mothers' IPARAN score, relative to the scores on the related constructs in the borderline/clinical or P10 range filled in by the mothers.

Related constructs	*n*	Mean score on IPARAN[a] (SD)	Cohen's *d*	AUC (95% CI)
Competence as a person[b]				
High risk	65	**2.70 (2.63)**	0.58	.68 (.60; .75)
Low risk	607	1.17 (1.73)		
Competence as a parent[b]				
High risk	84	**2.01 (2.15)**	0.37	.62 (.56; .69)
Low risk	589	1.22 (1.83)		
Childhood experience[c]				
High risk	27	**5.04 (2.00)**	1.93	.93 (.91; .96)
Low risk	647	1.18 (1.74)		
Partner relationship[c]				
High risk	14	**3.61 (3.22)**	0.75	.74 (.59; .90)
Low risk	644	1.19 (1.70)		
Social contacts[c]				
High risk	47	**3.71 (3.09)**	0.83	.76 (.68; .84)
Low risk	628	1.15 (1.66)		
Depressive symptoms[d]				
High risk	58	**4.11 (3.21)**	0.95	.81 (.74; .87)
Low risk	610	1.07 (1.48)		

[a] The mean score represents the summation score of the mother.
[b] Derived from the EMPO 2.0 (26)
[c] Derived from the Family Functioning Questionnaire (27)
[d] Derived from the Parenting Stress Questionnaire (28)
Bold numbers indicate a significant difference between the high-risk and low-risk group ($p<0.008$) as tested with a Mann-Whitney U Test, and corrected for multiple testing with a Bonferroni correction (0.05/6).

Feasibility

The mother's part of the IPARAN had on average 0.7% missing answers, whereas the father's part of the IPARAN had on average 1.7% missing answers. The highest percentage of missing answers, for both mothers and fathers, was for the item 'Quarrels with partner ever become physical' (respectively 1.7% and 2.3% missing answers). Also, for 32 families (4.2%) it was not possible to calculate an IPARAN score for the father/other parent. Only the mothers completed their part and not both parents, despite the mother indicating that she lived together with her husband or partner.

Discussion

The results of our study suggest that the Instrument for identification of Parents At Risk for child Abuse and Neglect (IPARAN) is a valid and feasible tool for assessing risk factors for parenting stress in Dutch parents with a newborn child. The results in terms of feasibility partly confirm the results of an earlier study (20).

The correlations found between the IPARAN score and those obtained on the related constructs of the EMPO 2.0 (26), Family Functioning Questionnaire (27) and Parenting Stress Questionnaire (28) support the instrument's concurrent validity. Various minor to strong correlations were found between the IPARAN score and the related constructs, filled in by the mother. All directions of the correlations were in line with our expectations. The strongest correlations were found between the IPARAN and the constructs 'childhood experience' and 'depressive symptoms'. The related constructs 'competence as a parent' and 'competence as a person' filled in by the mother showed minor correlations with the IPARAN. A possible explanation for this minor correlation is that the related construct that we chose does not measure exactly the same concept as the IPARAN score with which it is being compared. The items in the IPARAN that are related to competences as a parent focuses on worries during pregnancy about becoming a mother/father, and whether you feel qualified to become a parent, while the related construct focuses more on parenting practices in general. It is likely that the correlation is low due to this conceptual difference.

The correlations for the fathers raise some concern, since half of the correlations were not significant. The related constructs 'competence as a parent', 'social contacts' and 'partner relationship' filled in by the father showed no significant correlation with the IPARAN score of the father. Since our sample size of the fathers was low (n=51), the fact that half the correlations were not significant could be due to this low sample size. We therefore suggest that future research should focus more on the part of the father.

The fact that the IPARAN was able to distinguish between high-risk and low-risk mothers for most related constructs of parenting stress, shows that it has moderate to high discriminatory power. However, it should be noted that the discriminatory power of the IPARAN was low for the related constructs 'competence as a person and 'competence as a parent', findings that were supported by the mean scores and effect sizes. As mentioned above for the concurrent validity, it could be reasoned that the related constructs chosen here do not measure exactly the same concept as measured by the IPARAN. This could explain the low discriminatory power for these particular constructs. In future research, using a different questionnaire for measuring empowerment may help to improve the discriminatory power of the IPARAN.

The IPARAN is a short questionnaire with easily asked and clear questions. The relatively low percentage of missing answers (≤2.0% for 16 items for both mothers and fathers) supports the feasibility. However, it should be mentioned that for 4.2% of the families (*n*=32) in our study it was not possible to calculate an IPARAN score due to the fact that the fathers/other parents did not fill in their part of the IPARAN, while the mother did and had also indicated that she was living together with her partner. This was also seen in a previous study of Bouwmeester-Landweer (31). Hypothetically, even though it is written above the pages, it may not have been clear for every parent that both parents had to complete a part of the questionnaire. In addition, mothers may have felt uncomfortable having to ask the father to complete their part of the questionnaire. Since these are only hypotheses, we recommend future qualitative research using interviews with fathers and mothers to gain insight in barriers and opportunities they experienced in completing the questionnaire.

The questionnaire is a valuable addition to the default data collected by the Youth Health Care centers, which mainly consists of demographic and basic information like parental age, birth term and birthweight of the child (41). With the IPARAN more information is collected on potential risk factors in the family that have been proven to be related to parenting stress, such as the social network of the family (4, 6) and the developmental history of the parents (4, 6, 10).

The concurrent validity, discriminatory power, and feasibility show that the questionnaire is easy to use in daily practice of YHC to detect parents at risk of parenting stress. By detecting parents at risk in time, interventions, such as the Supportive Parenting Intervention, can be offered. Which in turn may prevent consequences of parenting stress on both parent and child health.

Strengths and limitations of the study

First of all, no data was available on the parents in the large non-response group. Parents were invited directly by professionals working in two Youth Health Care centers during the home-visit within two weeks after child birth (25). Parents who did not want to participate in the study did not complete a questionnaire. We have no insight in reasons for not participating in the study. Secondly, our sample was largely Dutch with middle to high education. This means that the results of our study can only be generalized to this Dutch, highly educated group. Future research should therefore try to include more non-Dutch and lower educated respondents to evaluate the psychometric properties of the IPARAN among these subgroups. Furthermore, we were limited in the instruments that we could administer. Therefore we could not evaluate concurrent validity for the items 'negative sexual experience', 'spousal violence', 'drug/alcohol abuse' and 'belief in physical punishment', as no related constructs were measured in the baseline questionnaire. Since this study was originally set up for measuring empowerment, these constructs were not included. However, these constructs are strong measurements of severe outcomes of parenting stress, such as child abuse and neglect. Therefore we propose that future studies include measurements of related constructs for these items. We also propose that additional psychometric properties (such as test-retest reliability) of the IPARAN be determined in future research. Lastly, we recommend longitudinal research to evaluate the associations between parenting stress (as measured by the IPARAN) and child health and parenting outcomes over time.

Although response rate was not very high, strength of this study is that the sample was nevertheless sufficiently large to allow us to determine the validity and feasibility of the IPARAN. In addition, we used several references (The Family Functioning Questionnaire, The EMPO 2.0 and the Parenting Stress Questionnaire).

Conclusion

Our findings that the IPARAN is feasible and shows good concurrent validity and discriminatory power support the use of this instrument. The IPARAN can continue to be used by health practitioners in the Netherlands to evaluate whether parents with a newborn child are at risk of parenting stress. The timeliness of offering preventive help to these parents is vital in order to prevent severe outcomes of parenting stress, such as child abuse and neglect and the long-term harmful effects of child abuse and neglect in these families.

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Competing interests The authors declare that they have no competing interests.

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References

1. Reijneveld SA, de Meer G, Wiefferink CH, Crone MR. Parents' concerns about children are highly prevalent but often not confirmed by child doctors and nurses. BMC Public Health. 2008;8:124.
2. Belsky J. The determinants of parenting: A process model. Child Dev. 1984;55:83-96.
3. Östberg M. Parenting stress. Conceptual and methodological issues. Uppsala: Acta Universitatis Upsaliensis; 1999.
4. Black DA, Heyman RE, Slep AM. Risk factors for child physical abuse. Agression and Violent Behaviour. 2001;6:121-88.
5. Black DA, Heyman RE, Slep AM. Risk factors for child sexual abuse. . Aggression and Violent Behaviour. 2001;6:203-29.
6. Schumacher JA, Smith Slep AM, Heyman RE. Risk factors for child neglect. Agression and Violent Behaviour. 2001;6:231-54.
7. Black DA, Heyman RE, Slep AM. Risk factors for child psychological abuse. Aggression and Violent Behaviour. 2001;6:189-201.
8. Keuning M, Schulze HJ, Stams GJ, Groenewegen I, Schuengel C. Marital conflict strategies predict child abuse potential in Dutch families from low socioeconomic backgrounds. Zeitschrift für Familienforschung. 2002;14:153-66.
9. Tajima EA. The relative importance of wife abuse as a risk factor for violence against children. Child Abuse Negl. 2000;24:1383-98.
10. Kotch JB, Browne DC, Dufort V, Winsor J. Predicting child maltreatment in the first 4 years of life from characteristics assessed in the neonatal period. Child Abuse Negl. 1999;23:1025-37.
11. Sidebotham P, Golding J. Child maltreatment in the "children of the nineties" a longitudinal study of parental risk factors. . Child Abuse Negl. 2001;25:1177-200.
12. Ertem IO, Leventhal JM, Dobbs S. Intergenerational continuity of child physical abuse: how good is the evidence? Lancet. 2000;356:814-9.
13. Hall LA, Sachs B, Rayens MK. Mothers' potential for child abuse: the roles of childhood abuse and social resources. Nurs Res. 1998;47:87-95.
14. Brown J, Cohen P, Johnson JG, Salzinger S. A longitudinal analysis of risk factors for child maltreatment: findings of a 17-year prospective study of officially recorded and self-reported child abuse and neglect. Child Abuse Negl. 1998;22:1065-78.
15. Sidebotham P, Heron J. Child maltreatment in the "children of the nineties": the role of the child. Child Abuse Negl. 2003;27:337-52.
16. Lavee Y, Sharlin S, Katz R. The effect of parenting stress on marital quality. An integrated mother-father model. Journal of Family Issues. 1996;17:114-35.
17. Mills R, Alati R, O'Callaghan M, Najman JM, Williams GM, Bor W, et al. Child abuse and neglect and cognitive function at 14 years of age: findings from a birth cohort. Pediatrics. 2011;127(1):4-10.
18. Norman RE, Byambaa M, De R, Butchart A, Scott J, Vos T. The long-term health consequences of child physical abuse, emotional abuse, and neglect: a systematic review and meta-analysis. PLoS Med. 2012;9(11):e1001349.
19. Widom CS, Czaja SJ, Bentley T, Johnson MS. A prospective investigation of physical health outcomes in abused and neglected children: new findings from a 30-year follow-up. Am J Public Health. 2012;102(6):1135-44.
20. Bouwmeester-Landweer MBR. Early home visitation in families at risk for child maltreatment [Doctoral thesis]. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
21. Bouwmeester-Landweer MBR, Kousemaker NPJ, Dekker FW, Landsmeer-Beker EA, Baartman HEM, Wit JM. Home visitation in families at risk for child maltreatment: process-evaluation. Early home

visitation in families at risk for child maltreatment. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
22. Stevig Ouderschap: Stevig Ouderschap; [Available from: https://www.stevigouderschap.nl/voor-professionals/vereniging.
23. GGD GHOR Kennisnet: GGD GHOR Kennisnet; [Available from: http://www.ggdghorkennisnet.nl/?file=23239&m=1433926283&action=file.download.
24. Landsmeer-Beker EA, Bouwmeester-Landweer MBR, Korbee-Haverhoek HD, Kousemaker NPJ, Baartman HEM, Wit JM, et al. Differences between respondents and non-respondents on a postal questionnaire addressing risk factors for child maltreatment. In: Bouwmeester-Landweer MBR, editor. Early home visitation in families at risk for child maltreatment. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
25. Horrevorts EM, van Grieken A, Broeren SM, Bannink R, Bouwmeester-Landweer MB, Hafkamp-de Groen E, et al. Design of a controlled trial to evaluate the effectiveness of Supportive Parenting ('Stevig Ouderschap'): an intervention to empower parents at increased risk of parenting problems by providing early home visits. BMC Psychol. 2015;3(1):47.
26. Damen HR, Veerman JW. EMPO Ouders - Versie 2.0. Nijmegen: Praktikon; 2011.
27. Veerman JW, Janssen J, Kroes G, de Meyer R, Ngyen L, Vermulst A. Vragenlijst Gezinsfunctioneren - versie voor ouders van jeugdigen van 0 t/m 18 jaar. Nijmegen: Praktikon; 2011.
28. Vermulst A, Kroes G, de Meyer R, Ngyen L, Veerman JW. Opvoedingsbelasting vragenlijst - versie voor ouders van jeugdigen van 0 t/m 18 jaar. Nijmegen: Praktikon; 2011.
29. von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007;370(9596):1453-7.
30. Bouwmeester-Landweer MBR. Risk factors for child maltreatment. Early home visitation in families at risk for child maltreatment. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
31. Bouwmeester-Landweer MBR, Dekker FW, Landsmeer-Beker EA, Kousemaker NPJ, Baartman HEM, Wit JM. Prevalence of risk factors for child maltreatment in the Netherlands. Early home visitations in families at risk for child maltreatment. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
32. Belsky J. Child maltreatment: an ecological integration. Am Psychol. 1980;35(4):320-35.
33. Belsky J. Etiology of child maltreatment: a developmental-ecological analysis. Psychol Bull. 1993;114(3):413-34.
34. Belsky J, Vondra J. Lessons from child abuse: the determinants of parenting. In: V CDC, editor. Child maltreatment, theory and research on the causes and consequences of child abuse and neglect. Cambridge: Cambridge University Press; 1989.
35. Newberger CM. The cognitive structure of parenthood; the development of a descriptive measure. In: R SRY, editor. Clinical-developmental psychology New directions of child development: clinical development research. 7. San Francisco: Jossey-Bass; 1980.
36. Baartman HEM. Opvoeden kan zeer doen. Over oorzaken van kindermishandeling, hulpverlening en preventie. Utrecht: SWP; 1996.
37. CBS [Available from: http://www.cbs.nl/nl-NL/menu/methoden/begrippen/default.htm?ConceptID=37.
38. Cohen J. Statistical power analysis for the behavioral sciences. New Jersey: Lawrence Erlbaum Associates; 1988.
39. Swets JA. Measuring the accuracy of diagnostic systems. Science. 1988;240(4857):1285-93.
40. IBM Corp. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp; Released 2012.

41. Wu SS, Ma C-X, Carter RL, Ariet M, Feaver EA, Resnick MB, et al. Risk factors for infant maltreatment: a population-based study. Child Abuse Negl. 2004;28:1253-64.

Supplementary Information

Supplementary table S1. Score assigned if parent meets criterion for risk factor on the IPARAN.

General risk factors	**Score**	
Birth weight, *(<2500 grams)*	1.0	
Duration of pregnancy, *(<38 weeks)*	0.5	
Family composition, *(single parent,)*	2.0	
Age mother, *(<19 years)*	0.5 (18 years) or 1.0 (<18 years)	
Age father, *(<19 years)*	0.5 (18 years) or 1.0 (<18 years)	
Father and mother part	**Score of the Father**	**Score of the Mother**
Worried about raising your child *(always-often)*	1.0	2.0
Unhappy during pregnancy about becoming a mother/father *(always-often)*	1.0	1.0
Parents (or carers) had loving relationship *(sometimes-never)*	1.0	1.0
Felt safe with parents (or carers) as a child *(sometimes-never)*	1.0	1.0
Being hit as a child *(always-often-sometimes)*	1.0	1.0
Hitting should be part of upbringing *(yes)*	1.0	1.5
Should use less alcohol or drugs *(yes)*	0.5	0.5
Ever had a negative sexual experience *(yes)*	1.0	1.5
Ever felt unhappy in past 3 years *(always-often)*	1.0	2.0
Losing temper *(always-often)*	1.0	1.0
Finding it difficult to ask for help *(always-often)*	-	1.0
Quarrels with partner ever become physical *(always-often-sometimes)*	2.0	1.0
Feeling comfortable in neighborhood *(sometimes-never)*	-	0.5
Maintain close relations with family *(sometimes-never)*	-	0.5
Receiving support from network of family, neighbors, friends *(sometimes-never)*	-	0.5
Receiving support from partner *(sometimes-never)*	0.5	1.5

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	n.a.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-10
Bias	9	Describe any efforts to address potential sources of bias	n.a.
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	11-12
		(*b*) Describe any methods used to examine subgroups and interactions	n.a.
		(*c*) Explain how missing data were addressed	12
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n.a.
		(*e*) Describe any sensitivity analyses	n.a.
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	n.a.
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13
		(b) Indicate number of participants with missing data for each variable of interest	14-15
Outcome data	15*	Report numbers of outcome events or summary measures	14-15
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	n.a.
		(*b*) Report category boundaries when continuous variables were categorized	9-11
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n.a.
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n.a.
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19
Generalisability	21	Discuss the generalisability (external validity) of the study results	n.a.
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	20

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Concurrent validity, discriminatory power, and feasibility of the Instrument for identification of Parents At Risk for child Abuse and Neglect (IPARAN)

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Concurrent validity, discriminatory power, and feasibility of the Instrument for identification of Parents At Risk for child Abuse and Neglect (IPARAN)

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Abstract

Objectives To determine the feasibility, concurrent validity and discriminatory power of the IPARAN among Dutch parents with a newborn child.

Setting Community pediatrics.

Participants Data from a controlled trial were used. In total, 2,659 Dutch parents with a newborn child were invited to participate. Of the 2,659 parents, 759 parents filled in the consent form and participated in the study.

Primary and secondary outcome measures Concurrent validity was determined by calculating correlations – using the Pearson correlation (r) – between the IPARAN score and related constructs from the following instruments: the Empowerment Questionnaire 2.0 (EMPO 2.0), the Family Functioning Questionnaire and the Parenting Stress Questionnaire. Discriminatory power was determined by calculating ROC curves between high-risk and low-risk mothers according to their scores on the related constructs. Feasibility was determined by examining the percentage of missing answers.

Results In terms of concurrent validity, we found that three out of 12 correlations between the IPARAN score and related constructs were strong (i.e. $r > 0.50$) and four out of 12 were medium (i.e. $r = 0.30$-0.49). In terms of discriminatory power, mothers with a score in the borderline/clinical range or P10 range of the related constructs (high-risk mothers) had a higher IPARAN score than mothers with a score in the normal range or P90 range of the related constructs (low-risk mothers). Effect sizes varied from $d=0.37$ to $d=1.93$, and the area under the ROC curve varied from AUC=0.62 to AUC=0.93. Regarding feasibility, the part of the IPARAN filled in by the mother had on average 0.7% missing answers, whereas the part of the IPARAN filled in by the father had on average 1.7% missing answers.

Conclusion The results of this study support the concurrent validity, discriminatory power, and feasibility of the IPARAN among a population of Dutch parents with a newborn child.

Strengths and limitations of the study

- First study to validate the risk assessment tool 'IPARAN' to identify parents at-risk of parenting stress.
- Various reference scales of risk factors for parenting stress were used for validation.
- A convenient sampling method was used.
- Not all risk factors of parenting stress could be validated.
- The sample consisted of highly educated respondents.

Introduction

Research has shown that parents/caregivers (further mentioned parents) have many concerns about parenting in general, developmental delay or behavior of their child, especially when their child is still young. Almost 60% of parents with children around 14 months of age indicated to have some parental concerns for which they felt they needed assistance or advice from someone outside the family, and 11.4% indicated to have frequent concerns (1). Circumstances in parents' life may cause parenting to become more challenging and stressful (2), and lead to parenting stress. Parenting stress is conceptualized by Östberg (3) as a perceived discrepancy between situational demands and personal resources in parenthood. Previous research has identified circumstances that predict the risk of parenting stress. These predictors can be categorized into different categories: *competence as a person/parent* (e.g. ambivalent feelings about parenthood, the tendency to become upset and angry, believing in physical punishment, and spousal violence (4-9)), *parental developmental history* (e.g. alcohol/drug abuse, negative childhood experiences, and negative sexual experiences (4-7, 10-13)), *partner support* (e.g. being a single parent (14)), *social network* (e.g. the lack of social support (4, 6)), *depressive symptoms* (e.g. depressive feelings (4, 6, 11)), and *demographic factors* (e.g. young parenthood, low birth weight of the child, and gestational age (4, 6, 11, 14, 15)).

Parenting stress is associated with negative parenting practices such as child abuse and neglect (16). Child abuse and neglect in turn, is associated with adverse physical, cognitive and psychosocial outcomes for children in the short and long term (17-19). Research of Mills et al. (17) showed that child abuse and neglect of children was independently associated with impaired cognition and academic functioning in adolescence. Child maltreatment was also related to a range of mental disorders, drug use, suicide, and risky sexual behavior (18), and also associated to negative physical outcomes such as risk for diabetes, lung disease, malnutrition and vision problems (19).

It is important to provide help and support to parents that experience parenting stress. However, it remains a challenge to identify parents at-risk of parenting stress timely, in order to provide preventive interventions. The Instrument for identification of Parents At Risk for child Abuse and neglect (IPARAN) (20) was developed to identify parents with a newborn child who are likely to experience parenting stress that may be associated with child abuse or neglect, in order to provide them with a preventive intervention, such as the Supportive Parenting Intervention (21). By identifying those parents at-risk of parenting stress early on in a child's life, by screening parents with a newborn child, we may be better able to support these parents. This helps to prevent the long-term potential harmful effects of parenting stress and the associated negative parenting practices such as child abuse and neglect.

The IPARAN focuses on the aforementioned predictors that increase the risk of parenting stress, such as the parental developmental history, social network, and depressive symptoms. The IPARAN is currently used by 51% of Youth Health Care (YHC) centers in the Netherlands to support professionals in their assessment of risk of parenting stress (22, 23). Although some research has been conducted regarding non-response (24), there is no study yet available examining the concurrent validity, discriminatory power, and feasibility of the IPARAN. Information on the validity and feasibility of the IPARAN can support Youth Health Care and local policy to make a careful decision in the methodologies that are used in daily

practice to detect at-risk families. The use of a valid and feasible instrument supports detection of at-risk families in a timely manner, and thus the possibility to offer these families suitable interventions. The IPARAN focuses on predictors of parenting stress. In this study we investigated whether a) the items/constructs of the IPARAN are in accordance with other validated instruments aimed at predictors of parenting stress (i.e. concurrent validity), b) the IPARAN distinguished between parents at-risk and parents not at-risk of parenting stress, (i.e. discriminatory power), and c) the IPARAN was easy to use (feasibility).

The objective of this study was therefore to evaluate the concurrent validity, discriminatory power, and feasibility of the IPARAN in a population of Dutch parents with a newborn child. Our research question was as follows: Is the IPARAN a valid and feasible tool for assessing risk factors for parenting stress in this population? To answer this question, we calculated correlations between parents' scores on the IPARAN and those on related constructs (concurrent validity). Based on the direction of the questions asked, we expected negative correlations for all related constructs, except for the related construct 'depressive symptoms'. Additionally, to explore the discriminatory power of the IPARAN, differences in IPARAN score between mothers within the borderline/clinical range or P10 range of the related constructs (high-risk mothers) and mothers within the normal range or P90 range of the related constructs (low-risk mothers) were examined, and ROC curves were calculated. We expected higher IPARAN scores for the high-risk mothers. The feasibility of the IPARAN was determined by examining the percentage of missing answers.

Methods

Data collection and participants

This study used data from the Supportive Parenting study, a controlled trial described in detail elsewhere (25). The IPARAN was previously named 'Supportive Parenting Questionnaire' (25) (Trial registration: www.trialregister.nl; Netherlands Trial Register: NTR 5307; 16 July 2015).

In short, all parents with a child born between January and September 2014, living in a suburban area of the western part of the Netherlands were invited to participate. In order to participate, parents were required to have at least basic Dutch language skills and provide written informed consent.

In the Netherlands, a Youth Health Care nurse (YHC-nurse) visits all parents with a newborn child at home 5-14 days after childbirth. This is known as the 'well-child visit'. During this visit the YHC-nurse informed the parents about the study and provided parents with an information leaflet, informed consent form and baseline questionnaire. This baseline questionnaire included the IPARAN and three other questionnaires that assess related constructs, namely the Empowerment Questionnaire 2.0 (EMPO 2.0) (26), the Family Functioning Questionnaire (27), and the Parenting Stress Questionnaire (28). Parents were invited to provide written informed consent for participation in the study and to return the baseline questionnaire to the researchers in a pre-paid envelope.

In total, 2,659 parents received information about the study and were invited to participate. Of these, 759 parents completed the written informed consent form and baseline questionnaire (28.5%). However, for 32 families (4.2%), an IPARAN score could not be calculated for the father. Only the mothers completed their part and not both parents, despite the mother indicating that she lived together with her husband or partner, leaving a population for analysis of 727 parents.

Sample characteristics

Table 1 shows the demographic characteristics of the sample. The majority of the children in the total sample is a boy (52.2%), and the mean age of the children is 5.2 months. The parents are mainly of Dutch nationality (96.7% of the mothers and 97.6% of the fathers), with a middle to high educational level. The majority of the sample consists of a two-parent family (98.3%), with a net monthly income of €1800,- or more (89.1%).

Table 1. Demographic characteristics of the study sample.

Subject	Characteristics	Total (n=727)	Parents at-risk (n=177)	Parents not at-risk (n=550)	p-value
Mother	Mean age (SD), y	30.0 (4.5)	30.7 (5.3)	29.8 (4.2)	**.048**
	<19 years (%)	0.3	1.1	0.0	**.003**
	Nationality (Dutch, %)	96.7	93.2	97.8	**.003**
	Educational level (Low, %)	7.4	13.2	5.5	**.002**
	IPARAN score	1.35 (1.94)	3.73 (2.46)	0.59 (0.80)	.<**001**
Father	Mean age (SD), y	32.5 (5.2)	32.6 (6.0)	32.4 (4.9)	.671
	<19 years (%)	0.0	0.0	0.0	-
	Nationality (Dutch, %)	97.6	94.7	98.5	**.004**
	Educational level (Low, %)	13.6	13.1	13.8	.962
	IPARAN score	1.02 (1.33)	2.51 (1.63)	0.58 (0.81)	.<**001**
Child	Gender child (boy, %)	52.2	59.3	49.9	**.029**
	Mean age child, months (SD)	5.2 (3.5)	5.1 (2.8)	5.2 (3.7)	.806
	Duration of pregnancy (<38 weeks, %)	8.9	15.3	6.9	**.001**
	Birth weight (<2500 grams, %)	5.2	11.3	3.3	.<**001**
Household	Family composition (single parent, %)	1.7	5.1	0.5	.<**001**
	Net monthly family income (<€1800,- %)	10.9	15.5	9.4	**.024**
Other	Gender parent[a] (female, %)	93.0	92.7	93.1	.844

[a] Gender of the parent who completed the remaining part of the baseline questionnaire

Ethics statement

Methods were carried out in accordance with the STROBE statement (29). Parents received written information about the study and were free to refuse participation. Parents willing to participate provided written informed consent. Only anonymous data were used for analysis.

This study was approved by the Medical Ethics Committee of Erasmus Medical Center Rotterdam (MEC-2013-568).

Measurements

The IPARAN

The IPARAN aims to identify risk factors related to the development of parenting stress (30). These risk factors were selected by Bouwmeester-Landweer et al. (31) based on previous research (4-15) and can be divided into three domains (31) based on the ecological model of Belsky (32-34), and the concept of parental awareness of Newberger (35), elaborated on by Baartman (36). These three domains are as follows: child and family characteristics; parental developmental history and personality (including parental awareness); and characteristics of the social context.

The IPARAN is a three-page self-report form, containing 37 items in total. The IPARAN has a general part (filled in by both parents), a part for the mother, and a part for the father/other parent (see online supplementary table S1). The general part consists of five items relating to risk factors in the first domain: birth weight of the child, duration of pregnancy, age of mother at delivery, age of father at delivery, and family structure. The part filled in by the mother and the part filled in by the father/other parent each consists of sixteen items. These items relate to risk factors in all three domains. The item within the domain of child and family characteristics is 'quarrels with partner ever become physical'. Items within the domain of parental developmental history and personality (including parental awareness) are 'worried about raising your child', 'unhappy during pregnancy about becoming a mother/father', 'parents or carers had loving relationship', 'being hit as a child', 'ever felt unhappy in past 3 years', 'losing temper', ' negative sexual experience', 'drug/alcohol abuse', and 'hitting should be part of upbringing'. Items within

the domain of characteristics of the social context are 'finding it difficult to ask for help', 'feeling comfortable in neighborhood', 'maintain close relations with family', 'receiving support from network of family, neighbors, friends', and 'receiving support from partner'. The items are accompanied by either a 4-point response scale (always, often, sometimes, never) or a yes/no option.

Each item is assigned a score between 0 and 2 (see online supplementary table S1). In order to categorize parents as either being at-risk or not at-risk for parenting stress, a summation score is calculated for each parent by adding the total score of the parent to the total score of the general part of the instrument. If either parent has a summation score of ≥3, the family is considered to be at-risk of parenting stress. The cut-off score of ≥3 is based on previous research (31), and minimizes the chances of overestimation and underestimation of parents at-risk of parenting stress.

Supplementary table S1

Demographic characteristics

Data was collected on age, gender, and country of birth of both parents and child. Educational level of both parents and net family income per month were also included. Educational level was classified as low (primary education, lower secondary education), middle (higher secondary education, vocational education) or high (higher vocational education, university). Net family income was classified as low (<€1800,- per month) or high (≥€1800,- per month). Nationality of the child, father, and mother was classified as Dutch or non-Dutch, according to definitions used by Statistics Netherlands (37).

Competences as a person and parent

Competences as a person and parent were assessed by two subscales of the EMPO 2.0 (26), a questionnaire that assesses parental empowerment. Competence as a person refers to parents' feelings about whether they are in control of their own lives and capable of dealing with problems as they occur. This construct is assessed by eight items. An example of an item is 'I can handle problems easily'. Competence as a parent is about parents' feelings whether they are in control of their child and know their strengths and limitations as a parent. This construct is assessed by seven items. An example of an item is 'I have great confidence in my parenting skills'. Both subscales have a 5-point response scale ranging from 1=strongly disagree to 5=strongly agree.

For both subscales raw scores are converted to a score between 1 (indicating a low level of competence) and 10 (indicating a high level of competence). Depending on the amount of items belonging to a subscale (e.g. competence as a person consists of 8 items), a minimum score, 8, and maximum score, 40, can be calculated. The maximum score minus the minimum score of a subscale (40–8=32) is distributed evenly over the maximum converted score of 10 (10/32=0.3125). To calculate a parent's converted score, the minimum score of the subscale is subtracted from his/her summation score, e.g. 32 ((32-8)*0.3125=7.5). Parents within the first 10% (P10) of both subscales were seen as high-risk parents. The subscales competence as a person and competence as a parent have a Cronbach's alpha of 0.85 and 0.79 respectively (26).

Parental developmental history

Parental developmental history is assessed by the subscale childhood experience, derived from the Family Functioning Questionnaire (FFQ) (27), a questionnaire that assesses problems parents encounter within their family. Childhood experience is about a parent's own childhood

and whether he/she has pleasant memories of his/her own childhood . The subscale is assessed by four items on a 4-point response scale ranging from 1=not true to 4=very true. A summation score is calculated and also converted into a category (normal, borderline, clinical) according to the guideline (27). An example of an item is 'you feel your own parents treated you well'. This subscale has a Cronbach's alpha of 0.85 (27). The FFQ provides norm referenced standard scores for children between 0-3 year, 4-11 year and 12-18 year.

Partner support

Partner support is assessed by the subscale partner relationship, also derived from the FFQ (27) and is about the perception of a person's relationship with his/her partner and the extent to which he/she feels supported by his/her partner. Partner relationship is assessed by five items on a 4-point response scale ranging from 1=not true to 4=very true. A summation score is calculated and also converted into a category (normal, borderline, clinical) according to the guideline (27). An example of an item is 'you feel your partner supports you in raising the children'. This subscale has a Cronbach's alpha of 0.89 (27).

Social network

Social network is assessed by the subscale social contacts, also derived from the FFQ (27).The subscale social contacts refers to the extent to which a parent has contact with neighbors, family and friends, and is assessed by five items on a 4-point scale ranging from 1=not true to 4=very true. A summation score is calculated and also converted into a category (normal, borderline, clinical) according to the guideline (27). An example of an item is 'your family has regular contact with other local residents'. This subscale has a Cronbach's alpha of 0.74 (27).

Depressive symptoms

Symptoms of depression was assessed with the subscale depressive symptoms, derived from the Parenting Stress Questionnaire (PSQ) (28), a questionnaire that assesses the level of stress parents experience in their role as a parent. This subscale refers to the extent to which a parent is happy with him/herself and his/her circumstances and is assessed by seven items on a 4-point response scale ranging from 1=not true to 4=very true. A summation score is calculated and also converted into a category (normal, borderline, clinical) according to the guideline (28). An example of an item is 'sometimes I do not see the point of living'. This subscale has a Cronbach's alpha of 0.86 (28). The PSQ provides norm referenced standard scores for children between 0-3 year, 4-11 year and 12-18 year.

Statistical analyses

Concurrent validity

Concurrent validity was assessed by correlating the IPARAN score with those obtained for the related constructs of the EMPO 2.0 (26), the FFQ (27) and the PSQ (28) and calculating Pearson's correlation coefficients (r). The IPARAN score of the mother was only correlated with the scores obtained for the related constructs, filled in by the mother. The IPARAN score of the father was only correlated with the scores obtained for the related constructs, filled in by the father. We used the criteria suggested by Cohen for judging the size of the correlations thus obtained: r <0.30 for minor, r = 0.30-0.49 for medium, and r ≥0.50 for strong correlations (38).

Discriminatory power

An independent t-test was used to compare the IPARAN score of mothers with a borderline/clinical range or P10 range of the related constructs (high-risk mothers) with those for

mothers with a score in the normal range or P90 range of the related constructs (low-risk mothers). In order to relate the difference in mean scores to the distribution of the scores, effect size estimations (*d*) were calculated by dividing the difference between the mean scores by the standard deviation. We used the criteria suggested by Cohen for judging the effect sizes thus obtained: *d*=0.20 for small, *d*=0.50 for moderate and *d*=0.80 for large effect sizes (38). Additionally, receiver operating characteristic (ROC) curves were plotted and the area under the curve (AUC) was calculated. The greater the AUC, the greater the discriminatory power of the IPARAN for discriminating between high-risk and low-risk mothers. An AUC<0.50 indicated chance level; 0.50≤AUC<0.70 indicated low discriminatory power; 0.70≤AUC<0.90 indicated moderate discriminatory power; and an AUC≥0.90 indicated high discriminatory power (39).

Feasibility

To determine feasibility, percentages of missing answers at the item level of the IPARAN were calculated. Percentages of respondents for whom it was not possible to calculate a total IPARAN score due to missing items were also calculated.

Furthermore, descriptive statistics were used to describe the study sample. Only complete cases were used for all analyses. All analyses were performed using SPSS21 (40). To correct for multiple comparisons, a Bonferroni correction was used. The results in table 2 and table 3 are presented with correction for multiple comparisons.

Results

Comparison of risk and non-risk groups in demographic variables

Table 1 shows the demographic characteristics of parents at-risk and parents not at-risk. n the subgroup parents at-risk, mothers were on average older, were more often of non-Dutch ethnicity, and had a lower educational level compared to mothers in the subgroup parents not at-risk. Fathers in the subgroup parents at-risk were more often of non-Dutch ethnicity compared to fathers in the subgroup parents not at-risk. Children in the subgroup parents at-risk were more often a boy, were on average of lower gestational age, and had a lower birth weight, compared to children in the subgroup parents not at-risk. The subgroup parents at-risk were more often a single parent family, and had a lower net monthly income, compared to the subgroup of parents not at-risk

Concurrent validity

Table 2 shows the correlations between the related constructs and the IPARAN score, separately for mothers and fathers.

The correlations of the IPARAN score of the mother with the related constructs varied from r= -0.10 to r= -0.58 and r=0.50. Of the six pairs analyzed, the pairs IPARAN-Competence as a person, and IPARAN-Competence as a parent had values of r smaller than -0.30; the pairs IPARAN-Partner relationship, and IPARAN-Social contacts had values between r= -0.30 and r= -0.49. And the pairs IPARAN-Childhood experience, and IPARAN-Depressive symptoms had values of r>0.49, for both negative and positive correlations. The strongest correlations were found between the IPARAN and the related constructs 'childhood experience' (r= -0.58), and 'depressive symptoms'(r=0.50) (Table 2).

Table 2 Concurrent validity: correlations between parents' scores (mothers n=676; fathers n=51) on the IPARAN and those on the related constructs.

IPARAN[a]	Related constructs	Missings	Correlation mother's part		Correlation father's part	
		n	*r*	*p*	*r*	*p*
Total score**	Competence as a person[b*]	4	**-.24**	**.<001**	**-.40**	**.004**
	Competence as a parent[b*]	3	**-.10**	**.007**	-.06	.691
	Childhood experience[c*]	2	**-.58**	**.<001**	**-.59**	**.<001**
	Partner relationship[c*]	18	**-.36**	**.<001**	-.17	.236
	Social contacts[c*]	1	**-.39**	**.<001**	-.22	.117
	Depressive symptoms[d**]	4	**.50**	**.<001**	**.48**	**.<001**

[a] Correlations between total score on the IPARAN in the first column and the related constructs in the second column were calculated using Pearson's correlation coefficient (r). The IPARAN score of the mother was correlated to related constructs filled in by the mother. The IPARAN score of the father was correlated to related constructs filled in by the father.

[b] Derived from the EMPO 2.0 (26)

[c] Derived from the Family Functioning Questionnaire(27)

[d] Derived from the Parenting Stress Questionnaire (28)

[*] A low score indicates problems

[**] A high scores indicates problems

Bold numbers indicate a significant correlation between the item on the IPARAN and the related construct (p<0.008) as tested with Pearson's correlation and correct for multiple testing with a Bonferroni correction (0.05/6).

Of the six pairs made between the IPARAN score of the father and the related constructs, half of the correlations were not significant (p>0.05.): IPARAN-Competence as a parent, IPARAN-Partner relationship, and IPARAN-Social contacts. Of the three remaining significant correlations, the pairs IPARAN-Competence as a person, and IPARAN-Depressive symptoms had an *r* between 0.30-0.49, for both positive and negative correlations. The pair IPARAN-Childhood experience had an *r* of -0.59, which was also the strongest correlation found (Table 2).

Discriminatory power

Table 3 shows the IPARAN score, the Cohen's *d* and the AUC for mothers within the borderline/clinical range or P10 range of the related constructs (high-risk mothers) and mothers within the normal range or P90 range of the related constructs (low-risk mothers). On all related constructs, high-risk mothers had a significantly higher IPARAN score than low-risk mothers (p<0.05). Half of the effect sizes were large (*d*>0.80) and one third was moderate

(0.50<*d*<0.80). The ROC curves show that the IPARAN has moderate discriminatory power (≤0.70AUC<0.90) for the related constructs 'depressive symptoms', 'social contacts', and 'partner relationship' and has high discriminatory power (AUC>0.90) for the related construct 'childhood experience'. For the related constructs ‘competence as a person’, and ‘competence as a parent’ the IPARAN had low discriminatory power (0.50≤AUC<0.70) (39).

Table 3. Discriminatory power of the mothers’ IPARAN score, relative to the scores on the related constructs in the borderline/clinical or P10 range filled in by the mothers.

Related constructs	*n*	Mean score on IPARAN[a] (SD)	Cohen’s *d*	AUC (95% CI)
Competence as a person[b]				
High risk	65	**2.70 (2.63)**	0.58	.68 (.60; .75)
Low risk	607	1.17 (1.73)		
Competence as a parent[b]				
High risk	84	**2.01 (2.15)**	0.37	.62 (.56; .69)
Low risk	589	1.22 (1.83)		
Childhood experience[c]				
High risk	27	**5.04 (2.00)**	1.93	.93 (.91; .96)
Low risk	647	1.18 (1.74)		
Partner relationship[c]				
High risk	14	**3.61 (3.22)**	0.75	.74 (.59; .90)
Low risk	644	1.19 (1.70)		
Social contacts[c]				
High risk	47	**3.71 (3.09)**	0.83	.76 (.68; .84)
Low risk	628	1.15 (1.66)		
Depressive symptoms[d]				
High risk	58	**4.11 (3.21)**	0.95	.81 (.74; .87)
Low risk	610	1.07 (1.48)		

[a] The mean score represents the summation score of the mother.
[b] Derived from the EMPO 2.0 (26)
[c] Derived from the Family Functioning Questionnaire (27)
[d] Derived from the Parenting Stress Questionnaire (28)
Bold numbers indicate a significant difference between the high-risk and low-risk group (p<0.008) as tested with a Mann-Whitney U Test, and corrected for multiple testing with a Bonferroni correction (0.05/6).

Feasibility

The mother's part of the IPARAN had on average 0.7% missing answers, whereas the father's part of the IPARAN had on average 1.7% missing answers. The highest percentage of missing answers, for both mothers and fathers, was for the item ‘Quarrels with partner ever become physical’ (respectively 1.7% and 2.3% missing answers). Also, for 32 families (4.2%) it was not

possible to calculate an IPARAN score for the father/other parent. Only the mothers completed their part and not both parents, despite the mother indicating that she lived together with her husband or partner.

Discussion

The results of our study suggest that the Instrument for identification of Parents At Risk for child Abuse and Neglect (IPARAN) is a valid and feasible tool for assessing risk factors for parenting stress in Dutch parents with a newborn child. The results in terms of feasibility partly confirm the results of an earlier study (20).

The correlations found between the IPARAN score and those obtained on the related constructs of the EMPO 2.0 (26), Family Functioning Questionnaire (27) and Parenting Stress Questionnaire (28) support the instrument's concurrent validity. Various minor to strong correlations were found between the IPARAN score and the related constructs, filled in by the mother. All directions of the correlations were in line with our expectations. The strongest correlations were found between the IPARAN and the constructs 'childhood experience' and 'depressive symptoms'. The related constructs 'competence as a parent' and 'competence as a person' filled in by the mother showed minor correlations with the IPARAN. A possible explanation for this minor correlation is that the related construct that we chose does not measure exactly the same concept as the IPARAN score with which it is being compared. The items in the IPARAN that are related to competence as a parent focus on worries during pregnancy, about becoming a mother/father, and whether you feel qualified to become a parent, while the related construct focuses more on parenting practices in general. It is likely that the correlation is low due to this conceptual difference.

The correlations for the fathers raise some concern, since half of the correlations were not significant. The related constructs ‘competence as a parent’, ‘social contacts’ and ‘partner relationship’ filled in by the father showed no significant correlation with the IPARAN score of the father. Since our sample size of the fathers was low (n=51), the fact that half the correlations were not significant could be due to this low sample size. We therefore suggest that future research should focus more on the part of the father.

The fact that the IPARAN was able to distinguish between high-risk and low-risk mothers for most related constructs of parenting stress, shows that it has moderate to high discriminatory power. However, it should be noted that the discriminatory power of the IPARAN was low for the related constructs 'competence as a person’ and 'competence as a parent', findings that were supported by the mean scores and effect sizes. As mentioned above for the concurrent validity, it could be reasoned that the related constructs chosen here do not measure exactly the same concept as measured by the IPARAN. This could explain the low discriminatory power for these particular constructs. In future research, using a different questionnaire for measuring empowerment may help to improve the discriminatory power of the IPARAN.

The IPARAN is a short questionnaire with easily asked and clear questions. The relatively low percentage of missing answers (≤2.0% for 16 items for both mothers and fathers) supports the feasibility. However, it should be mentioned that for 4.2% of the families (*n*=32) in our study it was not possible to calculate an IPARAN score due to the fact that the fathers/other parents did not fill in their part of the IPARAN, while the mother did and had also indicated that she was living together with her partner. This was also seen in a previous study of Bouwmeester-Landweer (31). Hypothetically, even though it is written above the pages, it may not have been clear for every parent that both parents had to complete a part of the questionnaire. In addition, mothers may have felt uncomfortable having to ask the father to complete their part of the questionnaire. Since these are only hypotheses, we recommend

future qualitative research using interviews with fathers and mothers to gain insight into barriers and opportunities they experienced in completing the questionnaire.

The questionnaire is a valuable addition to the default data collected by the Youth Health Care centers, which mainly consists of demographic and basic information like parental age, birth term and birth weight of the child (41). With the IPARAN more information is collected on potential risk factors in the family that have been proven to be related to parenting stress, such as the social network of the family (4, 6) and the developmental history of the parents (4, 6, 10). The concurrent validity, discriminatory power, and feasibility show that the questionnaire is easy to use in daily practice of YHC to detect parents at risk of parenting stress. By detecting parents at-risk in time, interventions, such as the Supportive Parenting Intervention, can be offered. Which in turn may prevent consequences of parenting stress on both parent and child health.

Strengths and limitations of the study

First of all, no data was available on the parents in the large non-response group. Parents were invited directly by professionals working in two Youth Health Care centers during the home-visit within two weeks after child birth (25). Parents who did not want to participate in the study did not complete a questionnaire. We have no insight into reasons for not participating in the study. Secondly, our sample was largely Dutch with a middle to high educational level. This means that the results of our study can only be generalized to this Dutch, highly educated group. Future research should therefore try to include more non-Dutch and lower educated respondents to evaluate the psychometric properties of the IPARAN among these subgroups. Furthermore, we were limited in the instruments that we could administer. Therefore we could not evaluate concurrent validity for the items ‘negative sexual experience’, ‘spousal violence’, ‘drug/alcohol abuse’ and ‘belief in physical punishment’, as no related constructs were measured in the baseline questionnaire. Since this study was originally set up for measuring

empowerment, these constructs were not included. However, these constructs are strong measurements of severe outcomes of parenting stress, such as child abuse and neglect. Therefore we propose that future studies include measurements of related constructs for these items. We also propose that additional psychometric properties (such as test-retest reliability) of the IPARAN be determined in future research. Lastly, we recommend longitudinal research to evaluate the associations between parenting stress (as measured by the IPARAN) and child health and parenting outcomes over time.

Although response rate was not very high, strength of this study is that the sample was nevertheless sufficiently large to allow us to determine the validity and feasibility of the IPARAN. In addition, we used several references (The Family Functioning Questionnaire, The EMPO 2.0 and the Parenting Stress Questionnaire).

Conclusion

Our findings that the IPARAN is feasible and shows good concurrent validity and discriminatory power support the use of this instrument. The IPARAN can continue to be used by health practitioners in the Netherlands to evaluate whether parents with a newborn child are at risk of parenting stress. The timeliness of offering preventive help to these parents is vital in order to prevent severe outcomes of parenting stress, such as child abuse and neglect and the long-term harmful effects of child abuse and neglect in these families.

Contributorship statement HR, SB and EH-G originated the idea for the study and were responsible for acquiring the grant for the study. MB-L invented the intervention. All authors contributed to further develop the study concept and design. AG and EH are responsible for data collection, study coordination and reporting study results. EH was responsible for drafting and revising the manuscript. CM, RB, SB, EH-G and MB-L contributed to critical revision of the

manuscript for important intellectual content. HR is responsible for study supervision and reporting of study results. All authors have read and approved the final manuscript.

Competing interests The authors declare that they have no competing interests.

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References

1. Reijneveld SA, de Meer G, Wiefferink CH, Crone MR. Parents' concerns about children are highly prevalent but often not confirmed by child doctors and nurses. BMC Public Health. 2008;8:124.
2. Belsky J. The determinants of parenting: A process model. Child Dev. 1984;55:83-96.
3. Östberg M. Parenting stress. Conceptual and methodological issues. Uppsala: Acta Universitatis Upsaliensis; 1999.
4. Black DA, Heyman RE, Slep AM. Risk factors for child physical abuse. Agression and Violent Behaviour. 2001;6:121-88.
5. Black DA, Heyman RE, Slep AM. Risk factors for child sexual abuse. . Aggression and Violent Behaviour. 2001;6:203-29.
6. Schumacher JA, Smith Slep AM, Heyman RE. Risk factors for child neglect. Agression and Violent Behaviour. 2001;6:231-54.
7. Black DA, Heyman RE, Slep AM. Risk factors for child psychological abuse. Aggression and Violent Behaviour. 2001;6:189-201.
8. Keuning M, Schulze HJ, Stams GJ, Groenewegen I, Schuengel C. Marital conflict strategies predict child abuse potential in Dutch families from low socioeconomic backgrounds. Zeitschrift für Familienforschung. 2002;14:153-66.
9. Tajima EA. The relative importance of wife abuse as a risk factor for violence against children. Child Abuse Negl. 2000;24:1383-98.
10. Kotch JB, Browne DC, Dufort V, Winsor J. Predicting child maltreatment in the first 4 years of life from characteristics assessed in the neonatal period. Child Abuse Negl. 1999;23:1025-37.
11. Sidebotham P, Golding J. Child maltreatment in the "children of the nineties" a longitudinal study of parental risk factors. . Child Abuse Negl. 2001;25:1177-200.
12. Ertem IO, Leventhal JM, Dobbs S. Intergenerational continuity of child physical abuse: how good is the evidence? Lancet. 2000;356:814-9.
13. Hall LA, Sachs B, Rayens MK. Mothers' potential for child abuse: the roles of childhood abuse and social resources. Nurs Res. 1998;47:87-95.
14. Brown J, Cohen P, Johnson JG, Salzinger S. A longitudinal analysis of risk factors for child maltreatment: findings of a 17-year prospective study of officially recorded and self-reported child abuse and neglect. Child Abuse Negl. 1998;22:1065-78.
15. Sidebotham P, Heron J. Child maltreatment in the "children of the nineties": the role of the child. Child Abuse Negl. 2003;27:337-52.
16. Lavee Y, Sharlin S, Katz R. The effect of parenting stress on marital quality. An integrated mother-father model. Journal of Family Issues. 1996;17:114-35.
17. Mills R, Alati R, O'Callaghan M, Najman JM, Williams GM, Bor W, et al. Child abuse and neglect and cognitive function at 14 years of age: findings from a birth cohort. Pediatrics. 2011;127(1):4-10.
18. Norman RE, Byambaa M, De R, Butchart A, Scott J, Vos T. The long-term health consequences of child physical abuse, emotional abuse, and neglect: a systematic review and meta-analysis. PLoS Med. 2012;9(11):e1001349.
19. Widom CS, Czaja SJ, Bentley T, Johnson MS. A prospective investigation of physical health outcomes in abused and neglected children: new findings from a 30-year follow-up. Am J Public Health. 2012;102(6):1135-44.
20. Bouwmeester-Landweer MBR. Early home visitation in families at risk for child maltreatment [Doctoral thesis]. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
21. Bouwmeester-Landweer MBR, Kousemaker NPJ, Dekker FW, Landsmeer-Beker EA, Baartman HEM, Wit JM. Home visitation in families at risk for child maltreatment: process-evaluation. Early home

visitation in families at risk for child maltreatment. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
22. Stevig Ouderschap: Stevig Ouderschap; [Available from: https://www.stevigouderschap.nl/voor-professionals/vereniging.
23. GGD GHOR Kennisnet: GGD GHOR Kennisnet; [Available from: http://www.ggdghorkennisnet.nl/?file=23239&m=1433926283&action=file.download.
24. Landsmeer-Beker EA, Bouwmeester-Landweer MBR, Korbee-Haverhoek HD, Kousemaker NPJ, Baartman HEM, Wit JM, et al. Differences between respondents and non-respondents on a postal questionnaire addressing risk factors for child maltreatment. In: Bouwmeester-Landweer MBR, editor. Early home visitation in families at risk for child maltreatment. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
25. Horrevorts EM, van Grieken A, Broeren SM, Bannink R, Bouwmeester-Landweer MB, Hafkamp-de Groen E, et al. Design of a controlled trial to evaluate the effectiveness of Supportive Parenting ('Stevig Ouderschap'): an intervention to empower parents at increased risk of parenting problems by providing early home visits. BMC Psychol. 2015;3(1):47.
26. Damen HR, Veerman JW. EMPO Ouders - Versie 2.0. Nijmegen: Praktikon; 2011.
27. Veerman JW, Janssen J, Kroes G, de Meyer R, Ngyen L, Vermulst A. Vragenlijst Gezinsfunctioneren - versie voor ouders van jeugdigen van 0 t/m 18 jaar. Nijmegen: Praktikon; 2011.
28. Vermulst A, Kroes G, de Meyer R, Ngyen L, Veerman JW. Opvoedingsbelasting vragenlijst - versie voor ouders van jeugdigen van 0 t/m 18 jaar. Nijmegen: Praktikon; 2011.
29. von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP, et al. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007;370(9596):1453-7.
30. Bouwmeester-Landweer MBR. Risk factors for child maltreatment. Early home visitation in families at risk for child maltreatment. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
31. Bouwmeester-Landweer MBR, Dekker FW, Landsmeer-Beker EA, Kousemaker NPJ, Baartman HEM, Wit JM. Prevalence of risk factors for child maltreatment in the Netherlands. Early home visitations in families at risk for child maltreatment. Leiden: Leiden University Medical Center (LUMC), Leiden University; 2006.
32. Belsky J. Child maltreatment: an ecological integration. Am Psychol. 1980;35(4):320-35.
33. Belsky J. Etiology of child maltreatment: a developmental-ecological analysis. Psychol Bull. 1993;114(3):413-34.
34. Belsky J, Vondra J. Lessons from child abuse: the determinants of parenting. In: V CDC, editor. Child maltreatment, theory and research on the causes and consequences of child abuse and neglect. Cambridge: Cambridge University Press; 1989.
35. Newberger CM. The cognitive structure of parenthood; the development of a descriptive measure. In: R SRY, editor. Clinical-developmental psychology New directions of child development: clinical development research. 7. San Francisco: Jossey-Bass; 1980.
36. Baartman HEM. Opvoeden kan zeer doen. Over oorzaken van kindermishandeling, hulpverlening en preventie. Utrecht: SWP; 1996.
37. CBS [Available from: http://www.cbs.nl/nl-NL/menu/methoden/begrippen/default.htm?ConceptID=37.
38. Cohen J. Statistical power analysis for the behavioral sciences. New Jersey: Lawrence Erlbaum Associates; 1988.
39. Swets JA. Measuring the accuracy of diagnostic systems. Science. 1988;240(4857):1285-93.
40. IBM Corp. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp; Released 2012.

41. Wu SS, Ma C-X, Carter RL, Ariet M, Feaver EA, Resnick MB, et al. Risk factors for infant maltreatment: a population-based study. Child Abuse Negl. 2004;28:1253-64.

Supplementary Information

Supplementary table S1. Score assigned if parent meets criterion for risk factor on the IPARAN.

General risk factors	**Score**	
Birth weight, *(<2500 grams)*	1.0	
Duration of pregnancy, *(<38 weeks)*	0.5	
Family composition, *(single parent,)*	2.0	
Age mother, *(<19 years)*	0.5 (18 years) or 1.0 (<18 years)	
Age father, *(<19 years)*	0.5 (18 years) or 1.0 (<18 years)	
Father and mother part	**Score of the Father**	**Score of the Mother**
Worried about raising your child *(always-often)*	1.0	2.0
Unhappy during pregnancy about becoming a mother/father *(always-often)*	1.0	1.0
Parents (or carers) had loving relationship *(sometimes-never)*	1.0	1.0
Felt safe with parents (or carers) as a child *(sometimes-never)*	1.0	1.0
Being hit as a child *(always-often-sometimes)*	1.0	1.0
Hitting should be part of upbringing *(yes)*	1.0	1.5
Should use less alcohol or drugs *(yes)*	0.5	0.5
Ever had a negative sexual experience *(yes)*	1.0	1.5
Ever felt unhappy in past 3 years *(always-often)*	1.0	2.0
Losing temper *(always-often)*	1.0	1.0
Finding it difficult to ask for help *(always-often)*	-	1.0
Quarrels with partner ever become physical *(always-often-sometimes)*	2.0	1.0
Feeling comfortable in neighborhood *(sometimes-never)*	-	0.5
Maintain close relations with family *(sometimes-never)*	-	0.5
Receiving support from network of family, neighbors, friends *(sometimes-never)*	-	0.5
Receiving support from partner *(sometimes-never)*	0.5	1.5

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5-6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5-6
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	n.a.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6-10
Bias	9	Describe any efforts to address potential sources of bias	n.a.
Study size	10	Explain how the study size was arrived at	5-6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6-11
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	11-12
		(*b*) Describe any methods used to examine subgroups and interactions	n.a.
		(*c*) Explain how missing data were addressed	12
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n.a.
		(*e*) Describe any sensitivity analyses	n.a.
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6
		(b) Give reasons for non-participation at each stage	6
		(c) Consider use of a flow diagram	n.a.
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13
		(b) Indicate number of participants with missing data for each variable of interest	14-15
Outcome data	15*	Report numbers of outcome events or summary measures	14-15
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	n.a.
		(*b*) Report category boundaries when continuous variables were categorized	9-11
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n.a.
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n.a.
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19
Generalisability	21	Discuss the generalisability (external validity) of the study results	n.a.
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	20

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.