Effect of Preterm Premature Rupture of Membranes on Neurodevelopmental Outcome of Infants among Preterm Infants Born at Hawassa Comprehensive Specialized Hospital of Sidama Region, Ethiopia, 2022

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Abstract

To verify whether preterm premature rupture of membranes has effect on neurodevelopmental outcome of Infant among preterm infants born at Hawassa Comprehensive Specialized Hospital of Sidama region, Ethiopia, 2022. A prospective cohort study design will be conducted for 2 years and 6 months from March 1/2022 to August 30/2024. A total of 12 Midwives, 6 supervisors and 1 pediatric neurologist or psychiatrist will be involved in the data collection process. All preterm infants will be recruited consecutively from preterm infants admitted to neonatal intensive care unit from March 1/2022 to August 30/2022. The preterm infants will be categorized into Exposed group (preterm infants born after preterm PROM) and non-exposed group (preterm infants born after spontaneous preterm labour), and followed until 2 years of age to assess neurodevelopmental outcome of infants. The data will be entered into Epidata software and exported to SPSS software for windows version 23. for analysis. Descriptive statistics will be computed. One-way Anova and post hoc comparisons with Scheffe's procedure will be used. X2 test or Fisher's exact test will be used to compare categorical variables. The study will be conducted from March 1/2022 to August 30/2024.

Key words: preterm premature rupture of membranes; neurodevelopmental outcome of Infant.

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1. **Objective**

To verify whether preterm premature rupture of membranes has effect on neurodevelopmental outcome of infant among preterm infants born at Hawassa Comprehensive Specialized Hospital of Sidama region, Ethiopia, 2022.

2. **Materials and Methods**

2.1 **Study area**

Hawassa Comprehensive Specialized Hospital

2.2 **Study design**

A prospective cohort study design will be conducted for 2 years and 6 months from March 1/2022 to August 30/2024

2.3 **Source population**

All preterm infants born at Hawassa Comprehensive Specialised Hospital of Sidama region.

2.4 **Study population**

All preterm infants born at Hawassa Comprehensive Specialised Hospital and admitted to the neonatal intensive care unit from March 1/2022 to August 30/2022 and meet inclusion criteria

2.5 **Eligibility criteria**

**Inclusion Criteria**

Mother has no medical complications during pregnancy

Fetus born alive

Permanent resident in Sidama Region

**Exclusion Criteria**

Severe malformation

Children with genetic disorders

2.6 **Sample size determination**
Given the observational nature of the study, no data from the previous study about the proportion of neurodevelopmental disability among preterm infants born from preterm premature rupture of membrane and to obtain sufficient exposed group the is preterm infants born from preterm premature rupture of membrane in a reasonable period of time, we did not calculate a sample size.

2.7 Sampling techniques

All preterm infants will be recruited consecutively from preterm infants admitted to neonatal intensive care unit from March 1/2022 to August 30/2022. The preterm infants will be categorized into Exposed group (preterm infants born after preterm PROM) and non-exposed group (preterm infants born after spontaneous preterm labour), and followed until 2 years of age to assess neurodevelopmental outcome of infants

2.8 Study variables

Dependent variable: neurodevelopmental outcome of infants

Independent variable

- Socio-demographic factors
- Birth weight
- Gestational Age
- Previous low birth weight
- Previous abortions

2.9 Operational definitions

Preterm PROM was diagnosed when membrane rupture occurred in the absence of regular uterine contractions and the time from membrane rupture to delivery was greater than 12 h;

Spontaneous preterm labour was defined as the presence of regular, painful contractions (more than four in 30 min) with intact membranes or, if membrane rupture had preceded the onset of regular uterine contractions, the time from rupture to delivery was 12 h or less [1]

2.10 Data collection procedure

Maternal sociodemographic. Clinical and obstetrics variables will be collected using a structured questionnaire. The diagnosis of PROM will be based on clinical assessment, and ultrasonography findings

Neurodevelopmental examination of the infants will be done by a child neuro psychiatrist or neurologist not involved in the intensive care of the infants and unaware of maternal and neonatal history.

Examinations will be done at discharge from hospital and at 3 month, 6 month, 12 month and 24 months of corrected age.
Neurological evaluation of the newborns will be based on the methods of Amiel-Tison neurological assessment [2]

The Bayley scales of infant development will be used to assess cognitive development (Mental Developmental Index (MDI)) [3]

Infants will be grouped into three categories of outcome according to their final examination:

An overall level of impairment was defined based on the worst outcome from the 5 domains

Instead of classifying impairments into ‘none’, ‘mild- moderate’ and ‘severe’ impairment, we classify as none, mild, Moderate –severe impairment

Participants who receive a positive response to the following questions into the ‘moderate-severe’ category: with spastic diplegia or hemiplegia or spastic tetraplegia according to neurological examination

- D2 Is the child’s development between 6-12 months behind corrected age?
- RC1 Does this child have difficulty with understanding outside of familiar context?
- EC2 Does this child have difficulty with speech (<10 words/signs)?
- FM2 Does this child have difficulty with the use of both hands?
- GM2 Is this child’s gait non-fluent or abnormal reducing mobility
- GM4 Is this child unstable or needs to be supported when sitting?

Participants who received a positive response to any of the other questions are classified as having mild impairment with abnormalities of tone or reflexes according to neurological examination

A total of 12 Midwives, 6 supervisors and 1 pediatric neurologist or psychiatrist will be involved in the data collection process.

2.11 Data quality control

Three day intensive training will be given on how to assess the cognitive development (Mental Developmental Index (MDI)) and on interviewing techniques using standard checklist and structured questionnaire. Supervision will be conducted. Double data entry will be done and the questionnaire will be pretested on 5% of total sample size at Dila referral Hospital During data collection, continuous supervision will be done by the supervisors and principal investigator.

2.12 Data processing and analysis
The data will be entered into Epidata software and exported to SPSS software for windows version 23. for analysis. Descriptive statistics will be computed

One-way Anova and post hoc comparisons with Scheffe’s procedure will be used

X2 test or Fisher’s exact test will be used to compare categorical variables

2.13 Ethical consideration

Prior to data collection appropriate ethical clearance and supportive letter will be obtained from the Ethical Review Committee of Hawassa College of Health Science. Written permission will be obtained to undertake the study from Hawassa Referal Hospital. Participation in the study will be based on voluntary base and the participants will be informed about the right to withdraw at any time from the study. Confidentiality will be assured by using anonymity.

During the period of the study it will be the responsibility of Hawassa referral hospital to manage PROM as well as pre term infants. Preterm infants with neurodevelopment impairment will be linked to appropriate intervention service.

Written consent will be requested from mothers/care givers during data collection time after explaining the objectives of the study. For this purpose, a one page consent letter was attached to the cover page of each questionnaire stating about the general objective of the study and issues of confidentiality which was discussed by the data collectors before proceeding with the interview.

References

[1]. Caughey AB, Robinson JN, Norwitz ER. Contemporary diagnosis and management of preterm premature rupture of membranes. Rev Obstet Gynecol. 2008;1(1):11-22.

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[3]. Balasundaram P, Avulakunta ID. Bayley Scales Of Infant and Toddler Development. [Updated 2020 Dec 24]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK567715/
Questionnaire on Neurodevelopmental outcomes of preterm infants

Questions

Development (Cognitive)

D1 Is the child’s development between 3-6 months behind corrected age?

D2 Is the child’s development between 6-12 months behind corrected age?

D3 Is the child’s development more than 12 months behind corrected age?

Receptive communication

RC1 Does this child have difficulty with understanding outside of familiar context?

RC2 Is this child unable to understand words or signs?

Expressive communication

EC1 Does this child have any difficulty with communication?

EC2 Does this child have difficulty with speech (<10 words/signs)?

EC3 Does the child have <5 meaningful words, vocalisation or signs?

Fine motor

FM1 Does this child have any difficulty with the use of one hand?

FM2 Does this child have difficulty with the use of both hands?

FM3 Is this child unable to use hands (i.e. to feed)?

Gross motor

GM1 Does this child have any difficulty walking?

GM2 Is this child’s gait non-fluent or abnormal reducing mobility?

GM3 Is this child unable to walk without assistance?

GM4 Is this child unstable or needs to be supported when sitting?
GM5  Is this child unable to sit?

A positive response to any of the questions implied the presence of impairment. Questions D3, RC2, EC3, FM3, GM3 and GM5 denote the criteria for severe impairment.

Additional information on whether the child was diagnosed with cerebral palsy, were also entered

In addition  gestation at birth, birth weight, sex, ethnicity, singleton or multiple pregnancy, mode of delivery, days of mechanical ventilation, oxygen therapy at 36 weeks’ corrected gestational age, maternal ag

A missing response does not count as a ‘no’; therefore complete data entry is required to assign participants as having no impairmen

An overall level of impairment was defined based on the worst outcome from the 5 domains

Instead of classifying impairments into ‘none’, ‘mild- moderate’ and ‘severe’ impairment, we classify as none, mild, Moderate –severe impairment

Participants who receive a positive response to the following questions into the ‘moderate-severe’ category:

D2  Is the child’s development between 6-12 months behind corrected age?

RC1  Does this child have difficulty with understanding outside of familiar context?

EC2  Does this child have difficulty with speech (<10 words/signs)?

FM2  Does this child have difficulty with the use of both hands?

GM2  Is this child’s gait non-fluent or abnormal reducing mobility?

GM4  Is this child unstable or needs to be supported when sitting

Participants who received a positive response to any of the other questions are classified as having mild impairment.
Section A: General information

Table 1

| Study Number: |
|---------------|
| Gender: Male ☐ Female ☐ |

| Gestational age at birth: |
|---------------------------|

| Years | Months | Days |
|-------|--------|------|
| Date of assessment: | | |
| EDD: | | |
| Adjusted age: | | |
| (in months and days) | | |

Consultant Paediatrician:

Permission to forward results to Paediatrician: ☐

General Practitioner:

Permission to forward results to GP: ☐

What is (are) the main language(s) spoken at home?

Child accompanied by: Mother ☐ Father ☐ Others ☐

please specify: ______________________

Site: ___
### Section b: neurosensory information

#### Visual or eye problem

| Question                                                                 | Left eye | Right eye |
|-------------------------------------------------------------------------|----------|-----------|
| Is there a visual or eye defect of any type present?                    | Yes ☐    | Yes ☐     |
|                                                                         | No ☐     | No ☐      |
| Does the child wear glasses?                                            | Yes ☐    | No ☐      |
| Usual vision (with glasses with worn)                                   |          |           |
| Normal or near normal ☐ Impaired but appears to have useful vision ☐ Sees light or gross movement only ☐ |
| No useful vision (blind) ☐                                               |          |           |
| Is there a squint present?                                              | Left ☐   | Right ☐   | No ☐     |
| Are there abnormal eye movement present                                 | Left ☐   | Right ☐   | No ☐     |
| Has the child had any ophthalmic assessment or intervention?            | Left ☐   | Right ☐   | No ☐     |

If yes, please describe

Details of ophthalmic specialist (if applicable):

Other comments: (including any parental concerns regarding the child’s vision)
Hearing problem

|                          | Left ear | Right ear |
|--------------------------|----------|-----------|
| **Is there a hearing impairment of any type present?** | Yes ☐    | Yes ☐     |
|                          | No ☐     | No ☐      |

Does the child normally wear aids?  Left ☐  Right ☐  No ☐

Usual hearing (with aids if worn)

Normal or near normal ☐

Hearing loss corrected with aids ☐

Some hearing but loss not corrected by aids ☐

No useful hearing even with aids ☐

Has the child had any hearing assessment or intervention?  Left ☐  Right ☐  No ☐

*If yes, please describe*

Details of hearing specialist

*(if applicable):*

Other comments: *(including any parental concerns regarding the child’s hearing)*

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Section c: neurological examination

Scores

Table 2

| Cranial Nerves (Max 15) | Posture (Max 18) | Movements (Max 6) | Tone (Max 24) | Reflexes (Max 15) | Total (Max 78) |
|------------------------|-----------------|------------------|--------------|------------------|---------------|
| R                      | R               | R                | R            |                  |               |
| L                      | L               | L                | L            |                  |               |

Overall comments:

Cranial nerve function

Table 3

| Score 3 | Score 2 | Score 1 | Score 0 | Score |
|---------|---------|---------|---------|-------|
| Facial appearance (at rest and when crying or stimulated) | smiles or reacts to stimuli by closing eyes and grimacing | closes eyes but not tightly, poor facial expression | expressionless, does not react to stimuli | expressionless, does not react to stimuli |
| Eye appearance | normal conjugated eye movements | Intermittent deviation of eyes or abnormal movements | continuous deviation of eyes or abnormal movements |
| Auditory response | reacts to stimuli on both sides | doubtful reaction to stimuli or asymmetrical movements | does not react to stimuli |
| Visual response | follows the object for a complete arc | follows the object for an incomplete arc or asymmetry | does not follow the object |
| Sucking/swallowing | good suck and swallowing | poor suck and/or swallowing | no sucking reflex no swallowing |
Figure 1
# TONE

|                  | Score 3 | Score 2 | Score 1 | Score 0 | Score |
|------------------|---------|---------|---------|---------|-------|
| **Scarf sign**   | ![Image](image1) | ![Image](image2) | ![Image](image3) | ![Image](image4) | ![Image](image5) |
| Take the infant's hand and pull the arm across the chest until there is resistance. Note the position of the elbow. |
| **Passive shoulder elevation** | ![Image](image6) | ![Image](image7) | ![Image](image8) | ![Image](image9) | ![Image](image10) |
| Lift arm next to the infant's head. Note resistance at shoulder and elbow. |
| **Pronation/supination** | ![Image](image11) | ![Image](image12) | ![Image](image13) | ![Image](image14) | ![Image](image15) |
| Steady upper arm while pronating and supinating forearm, note resistance |
| **Adductors**    | ![Image](image16) | ![Image](image17) | ![Image](image18) | ![Image](image19) | ![Image](image20) |
| With the infant's legs extended, open them as far as possible. The angle formed by the legs is noted. |
| **Popliteal angle** | ![Image](image21) | ![Image](image22) | ![Image](image23) | ![Image](image24) | ![Image](image25) |
| Legs are flexed at the hip simultaneously on to the side of the abdomen, then extended at the knee until there is resistance. Note angle between lower and upper leg. |
| **Ankle dorsiflexion** | ![Image](image26) | ![Image](image27) | ![Image](image28) | ![Image](image29) | ![Image](image30) |
| With knee extended, dorsiflex ankle. Note the angle between foot and leg. |
| **Pulled to sit** | ![Image](image31) | ![Image](image32) | ![Image](image33) | ![Image](image34) | ![Image](image35) |
| Pull infant to sit by wrists |
| **Ventral suspension** | ![Image](image36) | ![Image](image37) | ![Image](image38) | ![Image](image39) | ![Image](image40) |
| Hold infant in ventral suspension; note position of back, limbs and head |

*Figure 2*
Reflexes and reactions

Table 4

|                      | Score | Score | Score | Score | Score |
|----------------------|-------|-------|-------|-------|-------|
| **Tendon reflexes**  | 3     | 2     | 1     | 0     |       |
| easily elicitable    | mild brisk | Brisk | clonus or absent |
| **Arm protection**   |       |       |       |       |       |
| Pull the infant by one arm from the supine position and note the reaction of the opposite side. |
| R arm & L arm extended | R arm & L arm semi-flexed | R arm & L arm fully flexed |
| **Vertical suspension** |       |       |       |       |       |
| hold infant under axilla, make sure legs do not touch any surface |
| R arm | L arm | R arm | L arm |
| kicks symmetrically | no kicking even if stimulated, or scissoring |
| **Lateral tilting** (describe side up). Infant held vertically tilt quickly to horizontal. Note spine, limbs and head |
| R L | R L | R L | R L |
| **Forward parachute** |       |       |       |       |       |
| Infant held vertically and suddenly tilted forward. Note reaction of the arms. |
| as asymmetrical partial | as asymmetrical partial | as asymmetrical partial |


Section d: assessment of cerebral palsy

Cerebral palsy algorithm

![Cerebral palsy algorithm diagram]

Figure 3

**Classification of cerebral palsy**

- Spastic bilateral
  - 2 limb involvement/ Diparesis
  - 3 limb involvement/ Asymmetric quadripareisis
  - 4 limb involvement/ Quadripareisis

- Hemiplegia
  - Right-sided
  - Left-sided

- Other: Dyskinetic

Comments:
**Gross motor function classification scale (GMFCS)**

**Level of gross motor ability**

**Table 5**

| 24 months corrected age |  |
|-------------------------|--|
| **Level 1** | Infants move in and out of sitting and floor sit with both hands free to manipulate objects. Infants crawl on hands and knees, pull to stand and take steps holding on to furniture. Infants walk between 18 months and 2 years of age without the need for any assistive mobility device. |
| **Level 2** | Infants maintain floor sitting but may need to use their hands for support to maintain balance. Infants creep on their stomach or crawl on hands and knees. Infants may pull to stand and take steps holding on to furniture. |
| **Level 3** | Infants maintain floor sitting when the low back is supported. Infants roll and creep forward on their stomachs. |
| **Level 4** | Infants have head control but trunk support is required for floor sitting. Infants can roll to supine and may roll to prone. |
| **Level 5** | Physical impairments limit voluntary control of movement. Infants are unable to maintain antigravity head and trunk postures in prone and sitting. Infants require adult assistance to roll. |

| 24 months corrected age |  |
|-------------------------|--|
| **Level 1** | Children floor sit with both hands free to manipulate objects. Movements in and out of floor sitting and standing are performed without adult assistance. Children walk as the preferred method of mobility without the need for any assistive mobility device. |
| **Level 2** | Children floor sit but may have difficulty with balance when both hands are free to manipulate objects. Movements in and out of sitting are performed without adult assistance. Children pull to stand on stable surface. Children crawl on hands and knees with a reciprocal pattern, cruise holding onto furniture and walk using an assistive mobility device as preferred methods of mobility. |
| **Level 3** | Children maintain floor sitting often by “W-sitting” and may require adult assistance to assume sitting. Children creep on their stomach or crawl on hands and knees (often without reciprocal leg movements) as their primary methods of self mobility. Children may pull to stand on a stable surface and cruise short distances. Children may walk short distances indoors using an assistive mobility device and adult assistance for steering and turning. |
| **Level 4** | Children floor sit when placed, but are unable to maintain alignment and balance without use of their hands for support. Children frequently require adaptive equipment for sitting and standing. Self mobility for short distances is achieved through rolling, creeping on stomach, or crawling on hands and knees without reciprocal leg movement. |
| **Level 5** | Physical impairments restrict voluntary control of movement and the ability to maintain antigravity head and trunk postures. All areas of motor function are limited. Functional limitations in sitting and standing are not fully compensated for through the use of adaptive equipment and assistive technology. Children |
have no means of independent mobility and are transported.

**Manual abilities classification system (MACS)**

**Level of manual ability**

**Table 6**

| Level  | Description |
|--------|-------------|
| Level 1 | Handles objects easily and successfully: At most limitations in the ease of performing manual tasks requiring speed and accuracy; however, any limitations in manual activities do not restrict independence in daily activities. |
| Level 2 | Handles most objects but with somewhat reduced quality and/or speed of achievement: certain activities may be avoided or be achieved with some difficulty; alternative ways of performance might be used but manual abilities do not usually restrict independence in daily activities. |
| Level 3 | Handles objects with difficulty, needs help to prepare and/or modify activities: the performance is slow and achieved with limited success regarding quality and quantity; activities are performed independently if they have been set up or anticipated. |
| Level 4 | Handles a limited selection of easily managed objects in adapted situations: performs part of activities with effort and limited success; requires continuous support and/or adapted equipment for even partial achievement of activity. |
| Level 5 | Does not handle objects and has severely limited ability to perform even simple actions: requires total assistance. |
SECTION E: behaviour observation record

Examiner rating

|   | Observed most of the time | Observed some of the time | Never or rarely observed |
|---|---------------------------|---------------------------|-------------------------|
| 1. Positive affect (smiles and laughs) |   |   |   |
| 2. Shows enthusiasm or excitement |   |   |   |
| 3. Explores objects in the environment |   |   |   |
| 4. Readily takes part in activities |   |   |   |
| 5. Cooperates with requests |   |   |   |
| 6. Alertness (quiet and attentive, not drowsy) |   |   |   |
| 7. Appropriate muscle tone (not overly stiff, floppy or with tremor) |   |   |   |
| 8. Adapts easily to changes in stimulation or routines |   |   |   |
| 9. Works without being overly active or fidgety |   |   |   |
| 10. Distracted easily, interfering with performance on items |   |   |   |
| 11. Overly sensitive to touch or textures |   |   |   |
| 12. Approaches new tasks with apprehension |   |   |   |
| 13. Negative affect (cries, frown, whines or complains) |   |   |   |

SECTION F: socio-demographic information

Maternal age at child’s birth: _________________________________

Maternal status
Number of children in household: 

Educational status

Occupational status

Child care arrangements

Age of child when mother returned to work: or N/A

Alternative childcare:

| Regularly | Sometimes |
|-----------|-----------|
| Partner/husband/wife |   |   |
| Grandparent(s) |   |   |
| Other relatives |   |   |
| Friends |   |   |
| Nursery |   |   |
| Child minder |   |   |

Other: 

Does the child regularly attend:

Yes | No
---|---
Playgroup |   |

If yes, number of half day sessions per week: 

| Nursery |
|---------|
|   |

If yes, number of half day sessions per week: 

Bayley-III Social-Emotional questionnaires

An important part of your child’s evaluation is to learn how he or she interacts with you. Because you
understand your child so well, you are the best person to provide this information. We will use this information to help us understand how premature children learn social skills.

Please complete all the questions in this booklet as accurately as possible.

Please bring the completed booklet to the research appointment and give it to the doctor.

PART ONE

For each question, circle the number in the column that best describes how often you observe the behaviour in your child. Circle only one number for each question.

| Behaviour Frequency                          | Can’t | None | Some | Half | Most | All |
|---------------------------------------------|-------|------|------|------|------|-----|
| Told of the time                             | 0     | 1    | 2    | 3    | 4    | 5   |
| Time of the time                             | 0     | 1    | 2    | 3    | 4    | 5   |
| Time of the time                             | 0     | 1    | 2    | 3    | 4    | 5   |
| Time of the time                             | 0     | 1    | 2    | 3    | 4    | 5   |
| Time of the time                             | 0     | 1    | 2    | 3    | 4    | 5   |

1. Takes a calm and enjoyable interest in most sounds. 0 1 2 3 4 5
2. You can easily get your child’s attention without having to be very dramatic. 0 1 2 3 4 5
3. Takes a calm and enjoyable interest in most sights, including colourful or bright things. 0 1 2 3 4 5
4. You can easily get your child to look at things without them being very bright or colourful. 0 1 2 3 4 5
5. Calmly enjoys touching or being touched by different things. 0 1 2 3 4 5
6. You can easily get your child to respond to your touch without having to touch your child firmly to get his or her attention. 0 1 2 3 4 5
7. Likes to be swung around, danced with while in your arms, or quickly lifted up in the air. 0 1 2 3 4 5
8. You can easily get your child’s attention by approaching him or her, or moving him or her around slowly. 0 1 2 3 4 5
9. You can help your child to calm down. 0 1 2 3 4 5
10. Looks at interesting sights, such as your face or a toy. 0 1 2 3 4 5
11. Looks at or turns toward interesting sounds.  

| Behaviour Frequency | Can't Tell | None | Some of the Time | Half of the Time | Most of the Time | All of the Time |
|---------------------|------------|------|------------------|------------------|------------------|----------------|
|                     | 0          | 1    | 2                | 3                | 4                | 5              |

12. Seems happy or pleased when he or she sees a favourite person (e.g. looks or smiles, makes sounds, or moves arms in a way that expresses joy or delight).  

| Behaviour Frequency | Can't Tell | None | Some of the Time | Half of the Time | Most of the Time | All of the Time |
|---------------------|------------|------|------------------|------------------|------------------|----------------|
|                     | 0          | 1    | 2                | 3                | 4                | 5              |

13. Responds to people talking or playing with him or her by making sounds or faces (e.g. happy sounds or a curious or annoyed look).  

| Behaviour Frequency | Can't Tell | None | Some of the Time | Half of the Time | Most of the Time | All of the Time |
|---------------------|------------|------|------------------|------------------|------------------|----------------|
|                     | 0          | 1    | 2                | 3                | 4                | 5              |

14. Reaches for or points at things, or makes distinct sounds to show you what he or she wants (e.g. reaches out to be picked up or points at a toy).  

| Behaviour Frequency | Can't Tell | None | Some of the Time | Half of the Time | Most of the Time | All of the Time |
|---------------------|------------|------|------------------|------------------|------------------|----------------|
|                     | 0          | 1    | 2                | 3                | 4                | 5              |

15. Exchanges two or more smiles, other looks, sounds, or actions (e.g. reaching, giving or taking) with a favourite person.  

| Behaviour Frequency | Can't Tell | None | Some of the Time | Half of the Time | Most of the Time | All of the Time |
|---------------------|------------|------|------------------|------------------|------------------|----------------|
|                     | 0          | 1    | 2                | 3                | 4                | 5              |

16. Shows you that he or she understands your actions or gestures by making an appropriate gesture in return (e.g. makes a funny face back at you, looks at something you point to, stops doing something when you shake your head and use a firm voice to say “No!” or smiles and does more of something when you nod with a big smile and say “Yes!”).  

| Behaviour Frequency | Can't Tell | None | Some of the Time | Half of the Time | Most of the Time | All of the Time |
|---------------------|------------|------|------------------|------------------|------------------|----------------|
|                     | 0          | 1    | 2                | 3                | 4                | 5              |

17. Uses many consecutive actions in a back-and-forth way to show you what he or she wants or to have fun with you (e.g. smiles, reaches out for a hug, and, when you hug, takes your hat, puts it on his or her head, and smiles proudly OR takes your hand, leads you to the refrigerator, tugs on the handle, and, after you open it, points to something he or she likes, such as food, a bottle of juice, or milk).  

| Behaviour Frequency | Can't Tell | None | Some of the Time | Half of the Time | Most of the Time | All of the Time |
|---------------------|------------|------|------------------|------------------|------------------|----------------|
|                     | 0          | 1    | 2                | 3                | 4                | 5              |

18. Copies or imitates many of your sounds, words, or actions while playing with you (e.g. if you make funny faces and sounds, he or she copies them).  

| Behaviour Frequency | Can't Tell | None | Some of the Time | Half of the Time | Most of the Time | All of the Time |
|---------------------|------------|------|------------------|------------------|------------------|----------------|
|                     | 0          | 1    | 2                | 3                | 4                | 5              |

19. Searches for something he or she wants by looking or getting you to look for it.  

| Behaviour Frequency | Can't Tell | None | Some of the Time | Half of the Time | Most of the Time | All of the Time |
|---------------------|------------|------|------------------|------------------|------------------|----------------|
|                     | 0          | 1    | 2                | 3                | 4                | 5              |

20. Shows you what he or she wants or needs by using a few actions in a row (e.g. leads you by the hand to open a door and then touches or bangs on the door).  

| Behaviour Frequency | Can't Tell | None | Some of the Time | Half of the Time | Most of the Time | All of the Time |
|---------------------|------------|------|------------------|------------------|------------------|----------------|
|                     | 0          | 1    | 2                | 3                | 4                | 5              |

21. Uses words or tries to use words when people talk with or play with him or her.  

| Behaviour Frequency | Can't Tell | None | Some of the Time | Half of the Time | Most of the Time | All of the Time |
|---------------------|------------|------|------------------|------------------|------------------|----------------|
|                     | 0          | 1    | 2                | 3                | 4                | 5              |
| 22. Copies or imitates familiar make-believe play (e.g. feeds or hugs a doll). | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 23. Tells you what he or she wants with one or a few words (e.g. “juice”, “open” or “kiss”). | 0 | 1 | 2 | 3 | 4 | 5 |
| 24. Shows you he or she understands your simple verbal wish (e.g. “Please show me your toy”). | 0 | 1 | 2 | 3 | 4 | 5 |
| 25. Plays make-believe (e.g. feeds a doll, plays house, or pretends to be a TV or movie character) with you or others. | 0 | 1 | 2 | 3 | 4 | 5 |
| 26. Uses words or pictures to tell you what he or she is interested in (e.g. “See truck!”). | 0 | 1 | 2 | 3 | 4 | 5 |
| 27. Uses words with one or more peers. | 0 | 1 | 2 | 3 | 4 | 5 |
| 28. Uses words or pictures to show what he or she likes or dislikes (e.g. “Want that” or “No want” | 0 | 1 | 2 | 3 | 4 | 5 |

Thank you for completing this questionnaire

Your help is greatly appreciate