RISK OF LANGUAGE DELAY IN TODDLERS WITH PROLONGED SCREEN TIME : EVIDENCE BASED CASE REPORT

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ABSTRACT
Background: Language development of children starts early in infantcy and surges in 2 years of life, updated knowledge about association of language delay with its aggravating risk factor, in this case prolong sreening time, is very important to determine the prognosis of language development in children. **Objective:** To investigate the association between increased risk of language delay in toddlers with prolonged screen time. **Methods:** All included studies were collected from Pubmed, Scopus, EBSCO, Clinical Key and Science Direct on February 11th 2020. These articles were then critically appraised using standard Oxford criteria of Evidence Based Medicine prognostic checklist. **Result:** Two eligible retrospective cohort studies from Lin et al (2014) and Byeon and Hong (2015) are included in this EBCR. Both were calculating the risk of language delay in toddlers between 15-35 months and 24-30 months exposed to screen viewing. Toddlers with more than 2 hours of watching television have higher risk of language delay (Odds Ratio: 3.3 (95%CI 1.5-7.3) and 2.74 (95%CI 1.13-6.65) respectively). **Conclusion :** The risk of language delay in toddlers is confirmed to be proportionately increased with the increases of screen duration. Maximum language development may be achieved by giving more two-way communication opportunities other than screen viewing.

Keywords: Language delay, Toddlers, Screen time.

ABSTRAK

Latar belakang : *Perkembangan bahasa anak-anak dimulai sejak kanak-kanak dan melonjak dalam dua tahun awal kehidupan, pengetahuan terbaru tentang hubungan antara keterlambatan bahasa dengan faktor risiko yang memburuk, dalam hal ini memperpanjang waktu menonton televisi sangat penting untuk menentukan prognosis perkembangan bahasa pada anak-anak.* *Tujuan :* *Untuk menyelidiki hubungan antara peningkatan risiko keterlambatan bahasa pada balita dengan waktu menonton televisi yang lama.* *Metode :* *Semua studi literatur yang dimasukkan dan dikumpulkan dari Pubmed, Scopus, EBSCO, Clinical Key dan Science direct pada 11 Februari 2020. Jurnal-jurnal ini kemudian di nilai secara appraisal menggunakan kriteria standar Oxford dalam kaidah laporan kasus berbasis bukti.* *Hasil :* *Dua studi kohort retrospektif yang memenuhi syarat kaidah laporan kasus berbasis bukti / EBCR yaitu Lin et al (2014) dan Byeon dan Hong (2015) dimasukkan dalam EBCR ini. Keduanya melakukan penelitian dan menghitung risiko keterlambatan bahasa pada balita usia antara 15-35 bulan dan 24-30 bulan yang terpapar menonton televisi dalam waktu lama . Balita yang menonton televise lebih dari dua jam sehari memiliki risiko keterlambatan bahasa yang lebih tinggi masing-masing(Odds Ratio: 3.3 (95%CI 1.5-7.3) dan 2.74 (95%CI 1.13-6.65).* *Kesimpulan :* *Risiko keterlambatan bahasa pada balita dipastikan akan meningkat secara proporsional dengan meningkatnya durasi menonton televise. Perkembangan bahasa pada anak lebih maksimal dapat dicapai dengan memberikan lebih banyak waktu untuk berkomunikasi dua arah antara keluarga selain dari menonton televisi.*

Kata Kunci: *Balita, Keterlambatan bahasa, Waktu pemantauan.*

CASE SCENARIO

Patient By Mrs N, 13 months old correction age with language delay came to the outpatient clinic for routine control. Patient could speak "mama", "papa", dan "wawawa" but could not point out specifically. Patient can stand up independently and walk 2 until 3 steps. Patient could put a cube into a glass and playing ball with the examiner. Immunizations received were BCG, Measles, Pentabio III, OPV IV, but had never received IPV. She had adequate nutritional intake with *bubur saring* and still could not chew harder food.

Patient was diagnosed with delayed gross motor screened by Denver II 5 months prior to recent visit. 4 months prior to recent visit, patient came for developmental control and diagnosed with speech delay screened by Denver II. One-week later patient was consulted to ENT department for BERA test and the result was negative for hearing problem. 2 months prior recent visit patient also came for routine control without any additional complain.

Patient was born in 33rd week, with C-Section in RSCM because of early membrane rupture 21 hours before admission. Pregnancy history is G5P3A2. Mother has oligohydroamnion and other mother's risk factor for

35

infection is negative. Birth weight: 1385 gram, Birth length: 32 cm. Patient has a history of respiratory distress at birth, Apgar score 6/8, received CPAP for 2 hours. Received first line antibiotics. Patient was icteric but not pale or cyanotic. Patient was hospitalized for 21 days. Patient was screened by ROP for retinopathy of prematurity and the result was negative. Patient had OAE and BERA test for hearing abnormality screening and the result was also negative.

Patient has good nutritional status with BB/U =10,2/8,8 = -2 < z < 2 = enough weight, TB/U = 76,5/73 = -2 < z < 2 = normal stature, BB/TB = 10,2/76,5 = -2 < z < 2 = well-nourished. Patient was screened using Denver II. Social-personal and Fine motor skill still in normal limit, patient was diagnosed with gross motor delay at 8 months old correction age, expressive speech delay since 9 months old correction age.

INTRODUCTION

Language delay should be differenciate between speech delay for its disturbed normal feature. Language delay is an expressive ability which is composed from several components, such as phonological, semantics and syntax, and also pragmatics.[1] Normally, during 4th-6th week of age, cooing noises are established. By 4 months of age, infants begin to make bilabial sounds, and monosyllables the following month. Laughing is noticeable during this period. For the next 5-6 months, babbling is shortened into specific words like "mama" or "papa" for their parents. Over the next several months, infants learn 1 or 2 words for common objects and begin to imitate the words they hear from adult. When they reach 18-20 months of age, toddlers should use a minimum of 20 words and produce simple jargon with 50-100 words in their lexicon.[2] Linebarger and Walker even mention that there is word-learning explosion phenomenon during second year of life, which play a big role language development milestones.[3] On the beginning of their third year, sentence length increases rapidly and the following year children should be able to carry on conversations using adult-like grammatical forms. [2]

Screen time is the time when a child is exposed to digital media exposure from television, video games, or other technologies that use digital screens.[4] Several studies have been conducted to see the relationship between these two situations. There are lots of study regarding effect of prolong television viewing to children's developmental skills delay accompanied by other health problems such as obesity because of sedentary behavior.[5,6] Another research conducted in a South East Asia country found no association between watching TV and language development in 2-year-olds. [7] However, a research was conducted 10 years ago in another country found that 56 out of 110 children had delayed language development due to TV-watching habits.[8]

36

However, these studies have been limited for its small size and usage of telephone survey on general children.

The American Academy of Pediatrics (AAP) recommends limiting screen time for children at around 2 years old or older for no longer than 2 hours per day. In addition, children under 2 years old should not be exposed to media at all. [7] The *Indonesian Pediatric Society* (*Ikatan Dokter Anak Indonesia*) stated that 5-8% of preschool children have speech and language delays.[9] Due to the language development of children happens way before 5 years old and surges in 2 years of life, updated knowledge about association of language delay in toddlers with its aggravating risk factor, in this case prolong sreening time, is very important to determine the prognosis of language development in children.

CLINICAL QUESTION

Is the risk of language delay in toddlers proportionately increased with the increase in screen time?

> P: toddlers
> I: long screen time
> C: limited screen time
> O: language delay

METHODS

Article searches were conducted on five web database journals namely Pubmed®, Scopus® , EBSCO®, Clinical Key® and Science Direct® on February 11th 2020. Keywords used are several synonyms from "toddler", "screen time", and "language delay" that are combined each with boolean "OR". Each of the keywords together with the synonyms are combined using boolean "AND". Here are the results of the search, the flow, along with the inclusion and exclusion criteria.
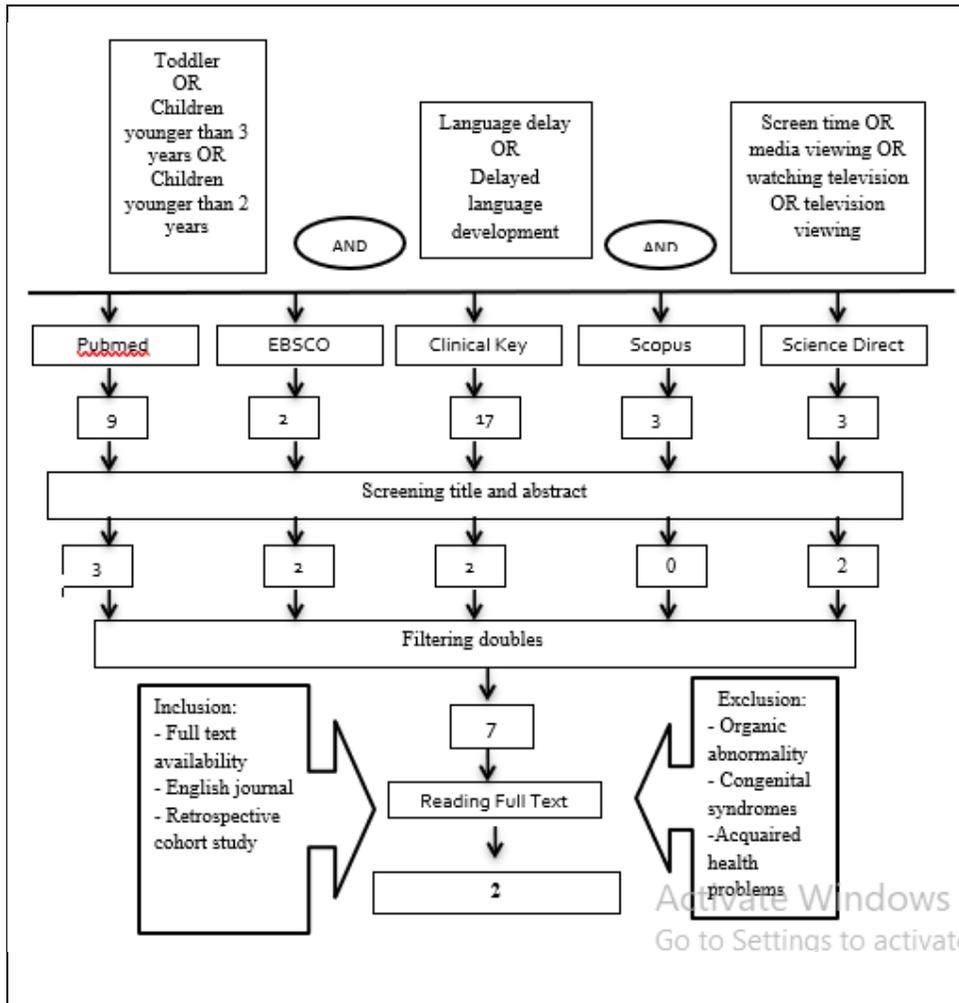
Table 1. Search Strategy

Database	Search Strategy	Hits	Selection Articles
Pubmed	(((Toddler[Title/Abstract]) OR (Children younger than 3 years old[Title/Abstract]) OR (Children younger than 2 years old[Title/Abstract])) AND ((Screen time[Title/Abstract]) OR (Media viewing[Title/Abstract]) OR (watching television[Title/Abstract]) OR (television viewing[Title/Abstract])) AND	9	3

	((Language delay[Title/Abstract]) OR(Delayed language development[Title/Abstract])))		
EBSCO	("Toddler*" OR "Children younger than 3 years old" OR "Children younger than 2 years old") AND ("Screen time" OR "Media viewing" OR "Watching television" OR "Television viewing") AND ("Language delay" OR "Delayed language development")	2	2
Clinical Key	Screen time or watch television in toddlers with language delay	17	2
Scopus	(Title-Abs-Key(Children AND below AND 2 AND years) OR (Title-Abs-Key (toddler*) OR (Title-Abs-Key(Children AND below AND 3 AND years)) AND (Title-Abs-Key(language)) AND ((Title-Abs-Key(delay) OR (Title-Abs-Key(Delay AND language AND 3 AND development)) AND ((Title-Abs-Key(screen AND time)) OR Title-Abs-Key)watch* AND television)) OR Title-Abs-Key(television AND view*)))	3	0
Science Direct	("Toddler*" OR "Children* younger than 3 years old" OR "Children* younger than 2 years old") AND ("Screen time" OR "Media viewing" OR "Watching television" OR "Television viewing") AND ("Language delay" OR "Delayed language development")AND LIMIT-TO(contenttype, "1,2","Journal")	3	2

Upon searching in accordance with the above keywords, obtained some articles in accordance with the proposed clinical question. Of the many articles, only those in english and with full text available are selected. The types of studies included in this case report is retrospective cohort studies. Article related to organic abnormalities and congenital syndromes affecting language

development are also included in the exclusion category. Following completion of thorough reading for each of the relevant article, 3 articles remained for further analysis. Critical appraisal was done using several aspect based on Center of Evidence-Based Medicine, University of Oxford for prognostic study.

Picture 1. Literature Searching Flowchart

RESULTS

Critical appraisal was done for both of the relevant articles by Lin et al (2014) and Byeoan and Hong (2015). Both of them are retrospective cohort study with the level of evidence II for prognostic study.

39

Lin et al (2014) performed a retrospective cohort study by gathering data from 75 patients from Pediatric Clinics at Southern Taiwan University Medical Center between the age of 15 until 35 months old that were exposed to television both frequently to investigate its effect on several developmental skills such as cognitive, language, and motor developmental skills. The study only focused with children that have not been diagnosed with any health problems that can interfere any developmental skills. Control group used in this study consisted of similar number of respondent with one-to-one exact matching with no significant differences in each of the characteristics resulted in 150 respondents in total. Characteristics that were considered are age, sex, number of siblings, care provider, parents level of education and occupation, average number of children per family, and double income family. Language development was assessed using Chinese version BSID-II with good reliability demonstration in Taiwan that provides mental developmental index (MDI) to interpret cognitive, language, and personal social ability.

Exposed group had average watching television duration of 137.2 min per day while the control group spent only 16.3 minutes per day. Exposed group with more than 8 times longer duration of screens viewing had higher risk of language delay by 3.3 (95% CI: 1.5–7.3). Maternal education and type of care provider also found to have significant relationship with longer screen viewing duration per day and was proven to be subsequent with increase risk of language delay. Limitation of this study was it could not to determine the long-term effects of television exposure on developmental skills of young children. Another limitation is the sample size use in this study that was considered to be low because of hospital-based setting.[11]

Byeon and Hong (2015) gathered data of 1,778 healthy young children without any acquired or congenital abnormalities and abnormal growth between 24 until 30 months old from Panel Study on Korean Children (PSKC) conducted in 2010. Screen of speech delay in the children was done using Korean-Ages and Stages Questionnaire (K-ASQ). Score less than -2 SD was defined as language development delay. They investigated the average period of television viewing in general which were 1.21 hours and 32.6% of those toddlers watched television for more than 2 hours. The result was adjusted by several confounding factors and were divided into 4 groups of model. Environmental factors are categorized in Model 1, which was consisted of main care giver, family income, and size of city. Model 2 and 3 are maternal and paternal related which were consisted of education level, economic activities, marriage satisfaction, and communication pattern with children. All confounding factors with individual characteristics were adjusted in Model 4.

Prevalence of language delay in toddlers with average daily screen time 2-3 hours was 8% and toddlers with less than 1 hour screen time was

3.2%. Children with 2-3 hours of screen time have 2.7 times higher risk (CI= 1.13-6.65) and even increases until 3 times (CI= 1.13-8.21) after adjusted by all confounding factors such as in Model 4. Proportional increase between watching time and risk of language delay positively confirmed using Cochran-Armitage trend test (p=0.004). This is a strong study because of the national-scale scope. However, both of the studies did not consider the types of TV programs watched by the toddlers where some of the programs were intentionally aimed for education. Each of the study were using questionnaires that relied on history taking hence the possibility of recall bias is possible just like another retrospective cohort study.

Table 2. Critical appraisal based on Centre of Evidence-Based Medicine, University of Oxford, 2010

Validity		Lin et al (2014)	Byeon and Hong (2015)
Was a defined, representative sample of patients assembled at a common (usually early) point in the course of their disease?		✓	✓
Was patient follow up sufficiently long and complete?		✓	✓
Were objective outcome criteria applied in a "blind" fashion?		Not applied	Not applied
If subgroups with different prognosis are identified, was there adjustment for important prognostic factors?		✓	✓
Importance	Proportion of Poor Outcome	Lin et al (2014)	Byeon and Hong (2015)
How likely are the outcomes over time?	Overall poor outcome	50%	5.2%
	Longer duration	49.3%	8%
	Shorter duration	24%	3.2%
	Risk Difference	25.3%	4.8%

		OR	3.3	2.74
How precise are the estimate?	95% CI	1.5-7.3	1.13-6.65
Applicability		Lin et al (2014)	Byeon and Hong (2015)
Were the study patients similar to your own?		X	X
Will this evidence make a clinically important impact on your conclusions about what to offer or tell your patient?		✓	✓

DISCUSSION

Several studies have evaluated the effects of long exposure of television use on language development in toddlers and most of them asserted higher risk of expressive language delays in.[3,8] Although those studies do not have high level of evidence, the result was consistent with two articles with good strengeth and reliability appraised in this evidence-based case report. It is confirmed that language development has a negative relationship with the duration of exposure to television on toddlers.

However, some attributing internal and external factors should be taken into consideration. There are conditions where the rate of screen time is high, in which positively correlated with risk of language delay. Those conditions are low educational level of the mother, dual income in the family, and caregiver substitution.[11] The biological mechanism is still unclear, however, parental factors may be one of the proposed explanation, especially in maternal side as proven by Lin et al. One of the possibility is that highly educated mothers allowed their children less time to engage in screen activities than mothers who possessed low levels of education. Highly educated parents are less likely to engage in screen activities if they aware these activities may disturb children development.

Actually there are several studies stating that media helps the language development of children have their children with language delays watch TV for longer times.[3,12,13] on the other hand, parents might not consider the type of program designed special for educational purpose. Educational media differ from general TV programs in terms of content and packaging. They are composed of simple narrative structures and contain pauses for children to respond, which are good for stimulating language skills.[13]

Without any doubt, parents or caregivers are critical in determining the television-viewing times of children. However, language acquisitions can only be achieved with two-way interaction that stimulates the expressive

component of speech that is absent in prolonged screen time. Background television can be distracting and interfering as the child tries to engage in expressive stimulating activities. This can be one of the explanations why television viewing gives negative impact on the process of developing language milestones in children. Human interaction, especially parents, like playing or book reading are some the example of good stimulation for children.

On the other hand, It is reported that watching television has a harmful effect on such cognitive abilities as attention and reading [5,14] and it has a significant relationship with language delay.[15] Long duration of screen time not only affect language development but also motoric skill and cognitive behavior. This activity also highly correlated with sedentary lifestyle that leads to other comorbidities.[10] Unfortunately, in South Korea 1 out of 3 toddlers exceeds the recommendation of screen time period by AAP (32.6%). [12]

This finding should encourage healthcare professionals to explain the relationship between television viewing time and development to every parents and caregivers. They should be assured to develop positive activities for young children in the home. Health worker can give regimen recommendations of physical activities that can be done at home to limit sedentary activities of their children therefore can reduce screen time. Several play strategies or toy equipment that can be proposed to promote active lifestyle and stimulate social skill.

As both of the tudies were retrospective cohort, there are several limitations of this paper. Both of them did not use standardized measures to determine other important variables such as behavioral problems, interactive activity and engagement with parents or caregiver. These contributing factors were collected only through parent interview only hence recall bias may exist.[8]

CONCLUSION

In conclusion, risk of language delay in toddlers is confirmed to proportionately increase with the increases of screen duration. As there were some limitations in both of the studies, high quality prospective cohort study with adequate power or systematic review of these studies is required as they are level I of evidence for prognostic studies. Medical professionals should provide this information regarding the relationship between television exposure and delay language development to the parents and caregivers of young children. For maximum language development, caregivers must give more two-way communication opportunities other than screen viewing.

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Appendix I

CASE ILLUSTRATION

1.1   IDENTITY
Name   : By. Mrs. N
Birth date   : 31 August 2018
Age   : 1 year 3 months (Correction: 1 year 1 month)
Sex   : Female
Address   : Jl. Delta Serdang No 30 RT 004/007, Kemayoran
Medical record : 4156636
Admission date   : 9 November 2019 11.30

1.2   ANAMNESIS
Data gathered from medical record at 26 February 2020.
1.2.1   Chief Complain
Patient with language delay comes to the outpatient clinic for routine control. Patient can speak "mama", "papa", dan "wawawa" but still cannot point out specifically. Patient can stand up independently and walk 2 until 3 steps. Patient can put a cube into a glass and playing ball with the examiner. Immunizations received are BCG, Measles, Pentabio III, OPV IV, but never received IPV. Adequate nutritional intake with *bubur saring* and still cannot chew harder food.
1.2.2   History of present disease
Patient was diagnosed with delayed gross motor screened by Denver II 5 months prior to recent admission. 4 months prior to recent admission, patient came for developmental control and diagnosed with delay speech screened by Denver II. One-week later patient was consulted to ENT department for BERA test and the result was negative for hearing problem. 2 months ago patient also came for routine control without any additional complain.
1.2.3   History of previous disease
Patient was born pre term (33 weeks) because of early membrane rupture 21 hours prior to admission and received first line antibiotic for unproven sepsis.
1.2.4   Family history
Mother has asthma and frequently consumes salbutamol and has a history of pre eclampsia.
1.2.5   Pregnancy history
G5P3A2. Mother has oligohydroamnion with 21 hours early membrane rupture. Other mother's risk factor for infection is negative.
1.2.6   Birth history
Patient was born in 33rd week, with C-Section in RSCM. Birth weight: 1385 gram, Birth length: 32 cm. Patient has a history of respiratory distress at birth, Apgar score 6/8, received CPAP for 2 hours. Received first line antibiotics.

Patient was icteric but not pale or cyanotic. Patient was hospitalized for 21 days. Patient was screened for Retinopathy of Prematurity (ROP) and the result is negative. Patients was screened for OAE and BERA for hearing abnormality in preterm baby and the result is negative.

1.2.7 Feeding history
ASI + Low birth weight formula milk + *bubur saring*

1.2.8 Immunization
BCG 1x, Pentabio 3x, OPV4x, Measles 1x,
Patient has not received IPV

1.2.9 Development history
Patient was screened using Denver II. Social-personal and Fine motor skill still in normal limit, patient was diagnosed with gross motor delay at 8 months old correction age, expressive speech delay since 9 months old correction age.

1.3 Physical examination
(9 November 2017)

General condition : well and active,
Consciousness : compos mentis
Heart rate : 87x/min
Temperature : 37.1° C (axila)
Respiratory rate : 30x/min
Weight : 10,2 kg   Height : 76.5cm
Nutritional Status :
    BB/U =10,2/8,8 = -2 < z < 2 = enough weight
    TB/U = 76,5/73 = -2 < z < 2 = normal stature
    BB/TB = 10,2/76,5 = -2 < z < 2 = wellnourished
Head : normocephal
Eye : pale conjunctiva (-), icteric sclera (-)
Thorax :Heart sound I,II normal, murmur (-), gallop (-). Lung sound vesicular. Ronchi (-), wheezing (-)
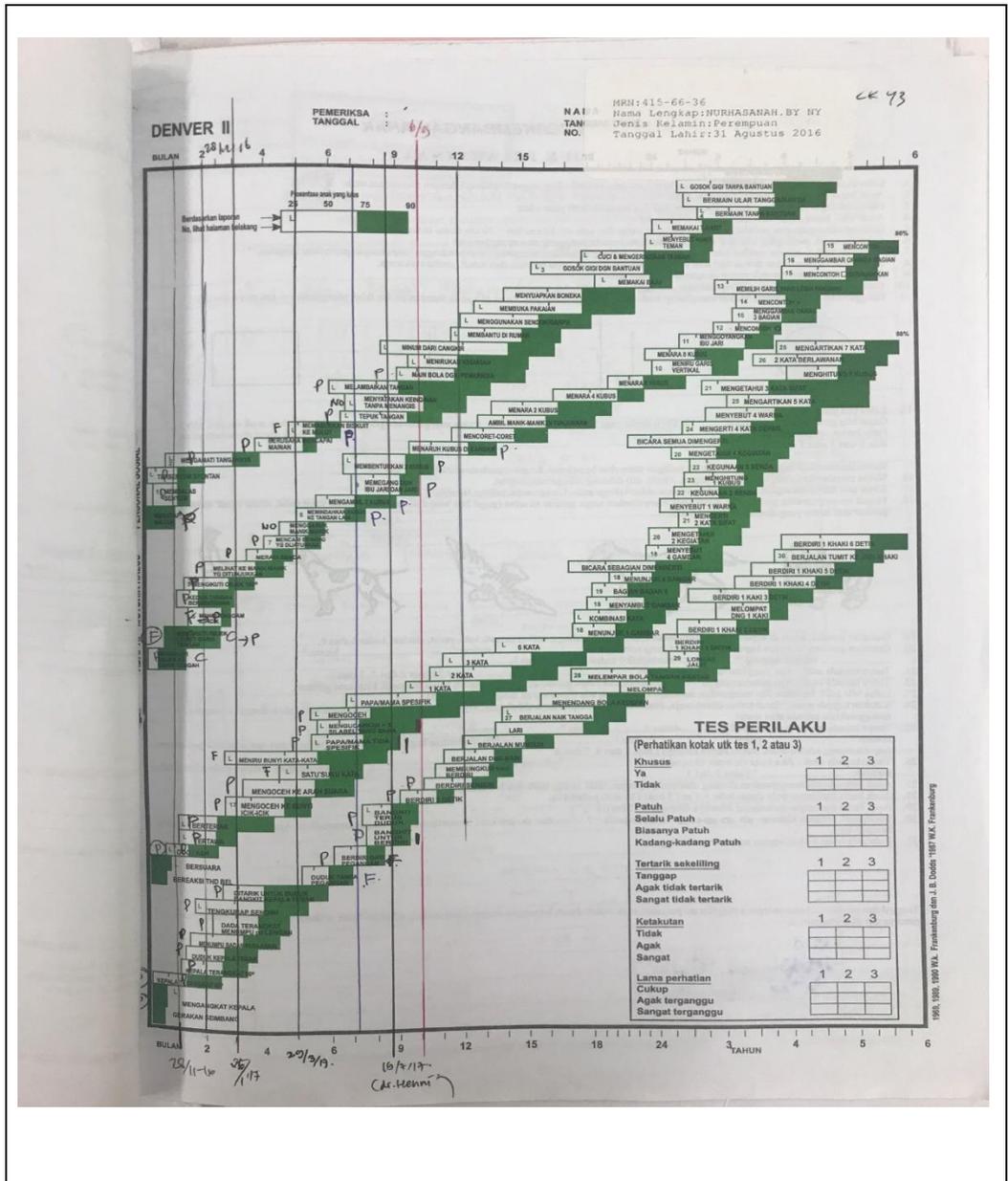Abdomen : flat, supple, bowel sounds (+)
Skin : Mongolian spot in sacrum area

1.5. DIAGNOSIS
- Expressive speech delay
- Incomplete immunization
- High risk baby

1.6. Management

- Physiotherapy
- Educate parents to provide adequate stimulation and limit screen time.
- Continue adequate nutrition
  - 100-120kcal/kgBW/day x 10,2kg = 1020-1224 kcal/day
- Continue immunization at 18 months old: IPV, Pentabio booster, Measles booster.

Appendix II.

Picture 2. Denver II Examination