Components of a tool for early detection of development delays in preterm infants: an integrative literature review

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Dissertation submitted in partial fulfilment of the requirements for the degree *Magister Curationis* in Nursing at the Potchefstroom Campus of the North-West University

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November 2015

PREFACE

This study is presented in article format according to the guidelines of the North-West University (NWU, 2013). The *Magister Curationis* (M Cur) student, Ms Zarine Wessels, conducted the research and wrote the manuscript under the supervision of Dr Welma Lubbe and Dr Karin Minnie, the co-authors of the article. Dr Welma Lubbe acted as supervisor, and Dr Karin Minnie as co-supervisor. The researcher wrote the manuscript: "Components of a tool for early detection of developmental delays in preterm infants: an integrative literature review" according to the author guidelines of the *Journal of Perinatal and Neonatal Nursing*, which have been included as Appendix K to this dissertation.

The references in chapters 1 and 3 are presented at the end of the dissertation, and the references for chapter 2 (the article) are provided at the end of that chapter. The referencing style of the article had to meet the specifications of the journal's author guidelines, which are different from the rest of the dissertation.

A separate literature review is not included in this dissertation, since it was the aim of the study to review the available literature to identify items for developing a screening tool to diagnose developmental delays among prematurely born babies. All the relevant literature is therefore included in the manuscript.

Permission was obtained from Dr Welma Lubbe and Dr Karin Minnie for the article (manuscript) to be submitted for examination purposes. As yet, no permission has been obtained from the editor of the journal for copyright, but this will be acquired when the journal publishes the article and this request will be lodged with the initial submission of the article.

DECLARATION FROM STUDENT THAT PLAGIARISM HAS BEEN AVOIDED

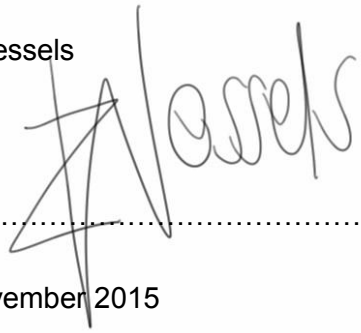
I, Ms Zarine Wessels, ID 900830 0032 087, student number: 21610444, hereby declare that I have read the North-West University's "Policy on Plagiarism and other forms of Academic Dishonesty and Misconduct" (NWU, 2011).

I did my best to acknowledge all the authors that I have cited and I tried to paraphrase their words to the best of my ability, while still portraying the correct meaning of their words.

I also acknowledge that by reading extensively about the topic, some information may have been internalised in my thinking, but I tried my best to give recognition to the original authors of the ideas.

I declare that this dissertation is my own work, although I respect the professional contribution made by my supervisors and I would like to give due recognition to them.

Zarine Wessels



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Date: November 2015

ABSTRACT

KEYWORDS: Developmental delay, screening tool, premature infant, infant assessment, early detection.

BACKGROUND

Worldwide there is an increase in premature births (before 37 weeks' gestation) leading to an increased risk of developmental delays, due to the interruption of vital structural intra-uterine development. The premature infant needs to adaptation rapidly to the extra-uterine environment. This rapid adaption can lead to developmental delays in the following areas: gross and fine motor skills; cognition, speech and language; as well as in personal, social or day to day activities. A gap was identified because no screening tool was available for health care professionals in South Africa, for the early detection of developmental delays in premature neonates.

OBJECTIVE

This study aimed to:

- explore and describe the best available evidence regarding components to be included in a screening instrument, for use by healthcare professionals, working in a low resource-restricted setting, which aims to detect preterm infants' developmental delays during follow-up visits during the first year of life.

METHODS

An integrated literature review was done to identify components needed in a screening tool. Initially 308 studies were collected and imported into the EPPI-reviewer program, whereafter 11 duplicate studies were removed. The remaining 297 studies' titles and abstracts were read and 237 did not fulfill the inclusion criteria. Thus, 60 studies were prepared for critical appraisal using the Johns Hopkins Critical Appraisal Tool. Thirty-six studies were excluded after critical appraisal due to irrelevant information, not answering the research question or being of low quality. Out of the remaining 24 studies, 20 studies were used to identify the components needed for a screening tool while four studies supported the identified components, acted as a guideline for the 20 useful studies.

RESULTS

Eleven components of a screening tool for premature infants were identified from 20 studies. These components are: birth weight, gestational age, corrected age, infant specific (focus on each infant as an individual), gender, vital observations, maternal data, parental information,

medical conditions (respiratory problems, gastro-intestinal problems, hematologic problems, central nervous system problems, retinopathy of prematurity, intra-ventricular hemorrhage), factors to consider (inflammatory stress, nutritional status, posture, hearing, language, head control, general movement, and sucking), and individualised follow-up dates.

CONCLUSION

The purpose of a screening tool is the identification of risks for premature infants to experience developmental delays, and not for making diagnoses. As the outcomes of each infant could differ due to the identification of potentially unique developmental delays, a screening tool should be infant-specific while focusing on the components identified during the current study.

OPSOMMING

SLEUTELTERME

Ontwikkelingsvertragings, opvolginstrument, premature babas, baba assesserig, vroë opsporings.

AGTERGROND

Wêreldwyd is daar `n toename in premature geboortes (voor 37 weke se swangerskap) wat lei tot ‘n verhoogde risiko vir ontwikkelingsvertragings, as gevolg van die onderbreking van lewensbelangrike strukturele intra-uterine ontwikkeling. Die premature baba moet vining aanpas by die ekstra-uterine omgewing. Hierdie vinnige aanpassing kan lei tot ontwikkelingsvertragings in die volgende areas: growwe en fyn motoriese vaardighede; kognisie, spraak en taal; sowel as in persoonlike, sosiale of dag tot dag aktiwiteite. `n Gaping was geïdentifiseer omdat geen opvolg siftingsinstrument beskikbaar was vir gesondheidsorg werkers in Suid-Afrika, vir die vroë opsporing van ontwikkelingsvertragings by premature babas nie.

DOELWIT

Die studie het gepoog om:

- die beste beskikbare bewyse aangaande die komponente wat in `n siftingsinstrument om premature babas se ontwikkelingsvertragings gedurrende opvolg besoeke tydens die eerste lewensjaar, vir gesondheidswerkers wat in ’n hulpbron beperkte gebied werk, ingesluit moet wees, te identifiseer en te beskryf.

METODE

`n Geïntegreerde literatuuroorsig is gedoen ten einde die komponente te idenfisieer vir ‘n opvolg siftingsinstrument. Aanvanklik is 308 studies versamel en in die “EPPI-reviewer Program” ingevoer, waar 11 duplikaat studies verwyder is. Die oorblywende 297 studies se titels en abstrakte was gelees en 237 het nie voldoen aan die insluitingskriteria nie. Dus is 60 studies voorberei vir ‘n kritiese waardebepaling deur die “Johns Hopkins Critical Appraisal Tool” te gebruik. Ses-en-dertig studies was uitgesluit na die kritiese waardebepaling as gevolg van ontoepaslike inligting, deur nie die navorsingsvraag te beantwoord nie of deur swak kwaliteit bronne se benutting. Uit die oorblywende 24 studies, was 20 bruikbaar om die komponente wat benodig word vir ‘n opvolginstrument te identifiseer terwyl vier bronne die geïdentifiseerde komponente ondersteun het.

RESULTATE

Elf komponente van ‘n opvolginstrument vir premature babas is geïdentifiseer vanuit 20 studies. Hierdie komponente is: gewig by geboorte, duur van swangerskap, gewysigde ouderdom, baba-spesifieke aspekte (fokus op ‘n baba as ‘n individu), geslag, vitale waarnemings, moederlike data, ouers se inligting, mediese toestande (respiratoriese probleme, gastro-intestinale probleme, hematologiese probleme, sentrale senuweestelsel probleme, retinopatie van prematuriteit, intraventrikulêre bloeding), faktore om te assesseer (inflammatoriese stres, voedingstatus, postuur, gehoor, taal, beheer van die kop, algemene bewegings, en die suigvermoë), en individuele opvolg datums.

GEVOLGTREKKING

Die doel van die opvolginstrument is die identifikasie van ‘n moontlike risiko vir ontwikkelingsvertragings en nie om ‘n diagnose te maak nie. Aangesien die uitkomste van elke baba verskillend is, as gevolg van die identifikasie van moontlike unieke ontwikkelingsvertragings, behoort ‘n opvolginstrument baba-spesifiek te wees terwyl dit fokus op die komponente wat tydens die huidige studie geïdentifiseer is.

ACKNOWLEDGEMENTS

I would like to give thanks to the following:

- My parents, Lourens and Petro Wessels, who have always supported me in my unique approach to things and life, who will always make a plan to give the best to me and who have always been there through every step with me. Thanks mom and dad.
- My inspirational supervisor, Dr. Welma Lubbe, thank you for inspiring me in a magnificent way and thank you for all the guidance you provided me.
- Prof. Karin Minnie who helped guide me through this long dark road.
- My close friends, some who came into my life at the end of this road, thank you for the support and understanding.
- My previous colleagues and mentor at Medi-Clinic Bloemfontein NICU for support.
- My technical editor, Petra Gainsford.
- My language editor, Prof. Valerie Ehlers.
- Gerda Beukman for helping me retrieve all the sought after articles.
- Maretha Kohn for co-reviewing and helping me.
- I would also like to thank the financial assistance of the National Research Foundation (NRF) of South Africa towards this research. Opinions expressed and conclusions arrived at, are those of the authors and are not necessarily to be attributed to the NRF (TTK20110914000027025).
- I would like to thank those of which I forgot about but was too overwhelmed to mention, thank you.

"I may not have gone where I intended to go, but I think I have ended up where I needed to be" – Douglas Adams

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LIST OF ABBREVIATIONS

AAP	American Academy of Pediatrics
ADA	Academy of Nutrition and Dietetics
AMA	American Medical Association
ASQ	Ages and Stages
ASD	Autism spectrum disorder
ASEBA	Achenbach System of Empirically Based Assessment
BTAIS-2	Birth to Three Assessment Intervention System
CARS	Childhood Autism Rating Scale
CBCL	Achenbach Child Behavior Checklist
CDR	Child Development Review
DIAL- 3	Developmental Indicators for the Assessment of Learning, Third Edition
DOH	Department of Health (of South Africa)
DAYC	Developmental Assessment of Young Children
EBP	Evidence Based Practice
E-LAP	Early Learning Accomplishment Profile
EPPI	Evidence for Policy and Practice Information
HINT	Harris Infant Neuromotor Test
ICH	Intra-cerebral hemorrhage
IDI	Infant Development Inventory
ILR	Integrated literature review
IMCI	Integrated management of childhood illnesses
IVH	Intra-ventricular hemorrhage

LAP	Learning Accomplishment Profile
LDS	Language Development Survey
MRC	Medical Research Council (of South Africa)
NEC	Necrotizing enterocolitis
NICU	Neonatal intensive care unit
NWU	North-West University
PEDS	Parents' Evaluation of Developmental Status
PEDS:DM	Parents' Evaluation of Developmental Status: Developmental Milestones
PIOTS	Population/participants, Intervention needed in practice, Outcome, Time frame, Setting
PQRS	Preview, Question, Read, Summarize
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
ROP	Retinopathy of prematurity
TABS	Temperament and Atypical Behavior Scale
UK	United Kingdom
UNICEF	United Nations International Children's Emergency Fund
USA	United States of America
WHO	World Health Organization

CHAPTER 1: INTRODUCTION AND BACKGROUND

1.1 Introduction and background

Worldwide more than 15 million babies are born preterm (before 37 completed weeks of gestation) annually, putting a tremendous strain on the family and health care system (WHO, 2014). Complications of premature birth are the second major cause of death for children under the age of five. Preterm births imply increased complications and problems such as behavioural, medical and neurocognitive disorders due to immaturity related to their early gestational age and immature developmental stage of their brains, organs and body systems at birth (Minde & Zelkowitz, 2008:581-591). The overall outcome of these preterm infants will vary in relation to the degree of complications (antenatal and postnatal) and the technology available to diagnose and treat complications.

During the final three months of gestation, foetal organs undergo important structural and functional development. When born prematurely, infants must adapt to extra-uterine life rapidly before all their organs and body systems have developed completely and complications (such as perinatal asphyxia, aspiration due to lack of primitive reflexes and thermal instability) are linked to the birth weight and gestational age (Levene *et al.*, 2008:80-81). As the change from intra-uterine to extra-uterine environment can be strenuous, the preterm neonate's immediate struggle is to facilitate behavioural adaptations for survival, such as breathing and temperature regulation, which could be difficult to attain and maintain due to the immature neurological system (Minde & Zelkowitz, 2008:581-591).

A better survival rate of preterm infants does not necessarily imply improved developmental outcomes, but could increase the risk of incurring developmental delays (WHO, 2012:13).
Preterm infants are at risk for short term as well as long term developmental delays (Romeo *et al.*, 2010:504) due to physiological and developmental factors. Carisch (2009) stated that both genetic and environmental factors pose risks for developmental delays in infants. Developmental delays impact not only the family of the child, but also on society as there will be increased costs for health care and education (Poon *et al.*, 2010:416).

Developmental delays are differentiated according to isolated delays and global delays, based on the domains involved and the number of delays identified (Jimenez-Gomez & Standridge, 2014:198). Developmental delays are further defined by Masri *et al.* (2011:810) as :

- gross and fine motor skills delays;
- cognition, speech and language delays; as well as

- delays in personal and social activities or performing day to day activities.

Prematurity can furthermore pose a risk for global delays, which are delays across more than one domain, as well as isolated delays referring to delays in one of the domains (Carisch, 2009:1).

In order to eliminate or minimize developmental delays, a multidisciplinary team approach is required. According to Majnemmer (1998:61), the team ideally should consist of an occupational therapist, a physiotherapist, a nurse, a paediatrician, an educator, mother/parents and a speech and language therapist. A team approach is essential to provide three types of services offered to improve the outcomes of at-risk infants (Majnemmer, 1998:61) namely:

1. Prevention which refers to early identification of possible risks and prevention of such occurrences.

2. Remediation relates to the improvement of the area affected by the delay.

3. Compensation which aims to minimize the effect of the developmental delay.

Infants who started prevention and early intervention programs before nine months of age showed improved long term outcomes, such as thriving at school level, decreased criminal activity and higher earnings. In the absence of measures to detect developmental delays, opportunities to implement early interventions also decrease. Delays in early intervention, in turn, aggravate delays that are present; late detection or undetected delays; and interventions being more costly and time consuming to manage than timely interventions would have involved.

Majnemmer (1998:62-69) concluded that early detection, and thus early intervention, could improve the outcomes for infants at risk of developmental delays, as well as those displaying developmental delays. In addition, Mackrides and Ryherd (2011:544) stated that early detection of developmental delays, along with early interventions, could improve long term outcomes such as increased academic achievement and increased adult employment opportunities. Early recognition and treatment of developmental delays could therefore lead to an improved quality of life and better outcomes for both the child and his/her family and are also less costly than chronic treatment (Poon *et al.*, 2010:416). An American study showed that 33% of developmental delays were identified prior to school entrance (Poon *et al.*, 2010:416). An estimated 13% of infants, aged 9-24 months, had developmental delays and only one out of ten infants obtained the necessary interventions before 24 months of age (Grant *et al.*, 2010:2). Patients therefore missed out on long-term benefits of early diagnosis and early interventions.

In South Africa, statistics about developmental delays and early interventions were not available. Compared to the global average of 15.5% the preterm birth rate in South Africa was 14,6% (UNICEF & WHO, 2004:9). The assumption can be made that the preterm birth rate in South Africa could have increased, but is still not higher than the international average global preterm birth rate. Thus implying that the rate of developmental delays could be higher, leading to a higher burden on South Africa's resource-restricted health care sector. This also implies that internationally there is an increase in developmental delays.

Through early assessments of high risk populations (such as low birth weight infants), using formal developmental screening instruments, health care professional could identify, document and refer developmental concerns early. Such a screening process could significantly identify risk factors and decrease intervention delays (Grant *et al.*, 2010:3). Guidelines have been recommended by the American Academy of Pediatrics (AAP) to improve the accuracy of identification of developmental delays and also to implement a fast referral service. These guidelines recommend the use of valid and reliable screening and surveillance instruments (Grant *et al.*, 2010:2). Easy administration, affordable, strong psychometric qualities and considering cultural beliefs are the factors that compose an ideal screening tool (Poon *et al.*, 2010:417).

Various internationally available screening tools, for neonatal development and social-emotional screening, are described in the literature (Grant *et al.*, 2010:2). The researcher explored the use of each of these instruments during a scoping literature review, to determine whether a suitable instrument is available which could be used or adapted for use in the South African context. Instruments that were regarded as potentially suitable were grouped into seven categories, adapted from Grant *et al.* (2010:1-37), as presented in table 1.1. The table provides reasons why each instrument might be useful or unsuitable for use during preterm infant follow-up consultations in a developing country's context, such as South Africa.

Table 1-1: International developmental screening instruments

Tool name or description	Reason why tool may be suitable for use in preterm infant follow-up assessment	Reason why not suitable
Category 1:	Developmental screening tools for infants, toddlers and young children (Only instruments which could be considered suitable for infant follow-up assessment will be discussed below. Other tools were excluded because it did not meet the criteria for the screening tool)	
ASQ (Ages and stages)	Covers all developmental delay domains Can be used in a primary care setting Age appropriate (0-60 months)	Based on parent report only
BTAIS-2 (Birth to Three Assessment and Intervention System, Second Edition (BTAIS-2) Screening Test of Developmental Abilities)	Covers all developmental delay domains Direct evaluation of infant Age appropriate (0-36 months)	Extensive training is needed to use the system and unexperienced health care professionals cannot use this instrument
Brigance-II (Brigance Screens, 2nd edition (Brigance-II): Infant & Toddler, Early Preschool; Preschool-II; K & 1 forms)	Covers all developmental delay domains Age appropriate (0-90 months)	Based on parent report only Uses nine different forms (not a basic screening tool, but rather extensive and time consuming)
Tool name or description	**Reason why tool may be suitable for use in preterm infant follow-up assessment**	**Reason why not suitable**
DAYC (Developmental Assessment of Young Children)	Covers all developmental delay domains Age appropriate (0-71 months)	Parent report only
E-LAP (Early Learning Accomplishment Profile)	Covers all developmental delay domains Directly with child	Linked with Learning Accomplishment Profile, Third Edition (LAP-3), which focuses on prewriting skills at the ages of

	Age appropriate (0-36 months)	36-72 months, E-LAP can thus not be implemented on it's own
IDI (Infant Development Inventory)	Covers all developmental delay domains Age appropriate (0-17 months)	Parent report only Linked with CDR (Child Development Review, which focuses on development from 18-60 months)
PEDS (Parents' Evaluation of Developmental Status)	Covers all developmental delay domains Age appropriate (0-96 months) Used in a primary care setting	Parent report only
PEDS:DM (Parents' Evaluation of Developmental Status: Developmental Milestones)	Age appropriate (0-95 months)	Focus on academic skills of parents Parent report only Follow-up of PEDS, therefore extensive and time consuming/follow-up needed
Categories	**Category name and reason for exclusion**	
Category 2:	**Mental health screening tools**	
	Excluded because of the mental health focus. Parent and teacher report based and the age range inappropriate (2,5-42 months). Eg. Achenbach System of Empirically Based Assessment (ASEBA) formerly Achenbach Child Behavior Checklist (CBCL).	
Category 3:	**Infant neuromotor development screening tools**	
	Excluded due to the focus on neurodevelopment and only an experienced healthcare professional, with appropriate training and experience in assessment of motor development, can administer these tools. Eg. Harris Infant Neuromotor Test (HINT).	
Category 4:	**Infant social-emotional screening tools**	
	Excluded because the focus is on social and emotional domains only. Not inclusive of all the domains. Based on parent reports.Eg. Temperament and Atypical Behavior Scale (TABS), TABS Screener.	

Category 5:	Early childhood speech-language screening tools
	Excluded due to the focus being limited to the communication domain and only trained and skilled professionals in speech and language can administer these tools. Parent report based. Eg. Language Development Survey (LDS).
Category 6:	**Autism spectrum disorder (ASD) screening tools**
	Excluded due to focus on one selected mental condition, autism, therefore not suitable for screening across the different domains. Parent report based, age inappropriate (16 months and older/through adulthood) and only skilled and trained professionals, who specialized in pshyciatric disorders, can administer these instruments. Eg. The Childhood Autism Rating Scale (CARS).
Categories	**Category name and reason for exclusion**
Category 7:	**Screening tools for preschool age children**
	Excluded due to age inappropriate implementation (36-83 months) and it is based on parent report. Eg. Developmental Indicators for the Assessment of Learning, Third Edition (DIAL-3).

The conclusion reached from this scoping review of the available instruments, is that none of the available international tools can be used as a comprehensive, easy-to-use screening tool which requires limited or no training and which can be used in poorly resourced settings.

Limited information could be retrieved about South African developmental assessment tools. Swanepoel *et al.* (2006:1248) identified one of the screening components, a hearing test. This was excluded from the instruments available in South Africa, as it is not a comprehensive screening tool, because it focuses only on one area of hearing. Table 1.2 displays the tools available in South Africa and the focus of each tool.

Table 1-2: Developmental screening instruments available in South Africa

Name	Focus	Reason for exclusion
Road to Health chart	• Monitors growth (Labadarios *et al.*, 2005:100) and immunization recordkeeping. A dissertation by Mudau (2010:21-26) discussed how the utilisation of the Road to Health chart could improve health of children under five years of age. • It further provides information about oral rehydration therapy, breastfeeding, family spacing and female education, but contains no information specifically about premature infants.	• Focuses on the healthy full term infant only.
The Integrated Management of Childhood Illnesses (IMCI), which focuses on the well-being of a child in a holistic manner	• Attempts to decrease child morbidity and mortality rates and ultimately to improve infants' health in developing countries (Ahmed & Hedt, 2010:129).	• IMCI does not address the assessment of the premature infant (WHO, 2014:94).
Management of the sick and small newborn baby in hospital	• This tool comprises various charts with guidelines on routine care for all babies at birth, but it is only used in a hospital setting and not in a primary health care situation (DOH, 2014).	• Has a discharge and follow-up section, but does not focus on the infant as an individual.

The information displayed in tables 1.1 and 1.2 support the need for this study, because none of these mentioned tools were developed as a screening tool for the assessment of premature infants' development. Although various screening tools for conducting newborn follow-up assessments are available, no one addresses screening of premature infants in a resource-restricted context.

1.2 Problem statement

Developmental delays do not only impact on family life, academic skills or socio-economic aspects but might also include physical deficiencies. Early detection of developmental delays improve opportunities for early intervention which, in turn, contribute to improved short and long term developmental outcomes with a subsequent improved quality of life and decreased burden of illnesses.

No comprehensive screening tool for the early detection of developmental delays in preterm infants, with the aim to initiate early interventions and improve the quality of life, could be deemed suitable for use in resource-restricted settings by health care practitioners with limited skills, knowledge, and experience in the field of infant assessments.

The research question was: "What is the available evidence regarding components of a developmental screening tool that can be used by health care professionals with limited skills, knowledge and experience in the field of infant developmental assessments in resource-restricted settings?"

1.3 Research aim and objective

1.3.1 Aim

This study forms part of a larger research project, which is concerned with infant development. This part of the larger study aimed to contribute to the development of a screening tool that could be used for the assessment and early identification of preterm infants' developmental delays in settings where healthcare professionals have limited skills, knowledge and experience in the field of preterm infant assessments.

1.3.2 The research objective

The objective of this specific study was to:

explore and describe the best available evidence regarding components to be included in a screening instrument, for use by healthcare professionals, working in a resource-restricted

setting, which aims to detect preterm infants' developmental delays during follow-up visits during the first year of life

1.4 Research method

The choice of an integrated literature review (ILR) was guided by the purpose of an ILR, as stated by Whittemore and Knafl (2005:547), to fully understand the varied perspectives of the phenomenon by exploring and describing components to be included in a screening tool, to detect developmental delays early in prematurely born infants in a resource-restricted setting with the aim to initiate early referrals and interventions. There are four purposes for an ILR, namely to *define concepts, review theories, review evidence* and *analyse methodological issues on a certain topic.* The two purposes addressed to understand the varied perspectives in this study, were to: *define concepts*, such as developmental delays, screening tool, and premature birth, and to r*eview evidence.* An ILR could contribute significantly to evidence based practice (EBP). This is the case because various evidence would be reviewed in order to suggest items to be included in an appropriate screening tool for a resource-restricted setting for prematurely born infants. Cronin *et al.* (2008:38) reasoned that a literature review is necessary to develop policies or determine the best evidence available for a specific phenomenon.

1.5 Research design

The six phase guide for preparing the integrative literature review (ILR), established by De Souza *et al.* (2010:104-105), was used as a framework for the current study:

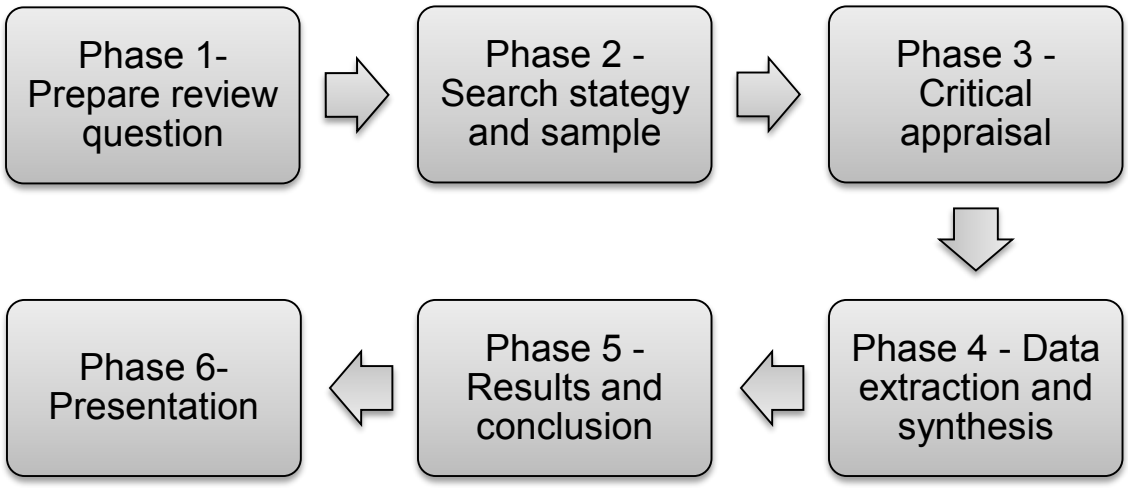

Figure 1-1: Phases of Integrative Literature Review (De Souza *et al.*, 2010:104-105)

1.5.1 Phase 1: Preparing a review question

The review question aimed to act as a defining and guiding factor for the researcher in terms of guiding which evidence to include in the review, focussing on participants, interventions, comparisons of interests and outcomes (De Souza *et al.*, 2010:104). The review question further provided a guide regarding the data to be extracted from selected studies' reports (Botma *et al.*, 2010:242).

A good research question should not impose overt limitations on the literature search, and should permit a researcher to focus on what is significant (ADA, 2012:17). The PIOTS format was utilized in this review as it is one of the most common and reliable formats used to develop a clinical question to guide research (Grove *et al.*, 2013:474). This format includes the necessary elements: as indicated in table 1.3.

Table 1-3: PIOTS question for this review

	Item	Description
P	Population/participants	Prematurely born infants
I	Intervention needed in practice	Components for developmental screening by health care professionals with limited skills, knowledge and experience in the field of infant developmental assessment
O	Outcome	Developmental assessment
T	Time frame	Birth to 1 year of age/time
S	Setting	Resource-restricted setting

The research question was therefore formulated as: What is the best evidence available regarding components of a developmental screening tool that can be used by healthcare professionals with limited skills, knowledge and experience in the field of infant developmental assessment and working in resource-restricted settings?

1.5.2 Phase 2: Searching and sampling literature

The sampling in an ILR lies within the literature search phase. In order to enhance the literature search, rigorous search strategies should be precise due to the fact that inadequate search strategies could produce false results. Inconsistency of computerized databases play a role due to the differences in search terminology. Thus it is recommended that further searches should be done (such as networking and physical hand searching) to ensure that no sources are excluded. The whole search process is documented in this section as well as in the article

section (search terms, databases used, search strategies, inclusion and exclusion criteria) (Whittemore & Knafl, 2005:548-549).

1.5.2.1 Keywords

The review question is used as a guiding factor to formulate keywords. Different keywords and their synonyms were used during a scoping review, which was done before the proposal was finalised in order to emphasize the necessity of conducting the current study, and exploring the literature to determine the most applicable keywords. The identified keywords guided the search for the correct population and sample. Different spelling versions such as United Kingdom (UK) English and the United States of America (USA) English were taken into account when searching various databases.

Keywords/phrases used in this study included: developmental delays, premature birth, neonatal development, infant development, developmental screening, recognizing developmental delays, neonatal examinations, neonatal follow-up tools/assessments, follow-up care of preterm infants, premature babies' risks, early premature baby risk identification, detecting developmental delays, developmental delays for premature babies, premature babies and long term delays, management of developmental delays.

1.5.2.2 Inclusion and exclusion criteria

Integrative literature reviews allow for the inclusion of research studies that utilized diverse methodologies (Whittemore & Knafl, 2005:547), but inclusion and exclusion criteria need to be identified in order to direct a literature search. By utilising PIOTS, the search criteria for each element become more detailed and guided (Grove *et al.*, 2013:474). Exclusion criteria refer to elements/subjects that do not fit into the specific sample of the data (Grove *et al.*, 2013:694), whereas inclusion criteria are the opposite. Thus, elements identified must be present in a sample/study (Grove *et al.*, 2013:696). The inclusion criteria for this study were:

- Studies which used different types of research methodologies were included in order to gather different perspectives.
- All types of studies were considered for inclusion; articles, documents, reports, letters, policies, guidelines, opinion papers and reviews published in Afrikaans or English were considered for inclusion, since the researcher is competent in these languages. However, only published research studies were found to address the review question.

- English and Afrikaans titles and summaries of relevant studies reported in other languages were read, to determine their relevance for inclusion in the current study. However, since none were found in foreign languages, no translations of full articles were required.
- Theses and dissertations were included in order to decrease limitations of information bias.
- Grey literature, which has limited distribution, such as unpublished research reports, were included in order to decrease the limitations of this study, by gathering various types of information.
- Studies addressing the review question in a comprehensive manner were included.
- Only studies published within the last 10 years (for most recent evidence) were included so as to ensure relevance and accuracy.

Exclusion criteria were:

- Duplicated studies where only the most recent version of the study was included.
- Studies with little or no relevance to the review question.
- Non-expert opinions, due to the lack of strong psychometric qualities and the lack of validity and reliability, it is also not research studies.
- Textbooks were excluded, since they contained secondary data, and it is non-research material.
- Sources excluded if they did not meet the Johns Hopkins criteria.
- Sources excluded if they had major flaws or were of low quality according to the Johns Hopkins criteria.

1.5.2.3 Sources

In order to gather sufficient information, the search was broad and diverse. The search of electronic databases, as well as manual searches, were conducted; fellow researchers were contacted and grey literature and unpublished materials were sourced (De Souza *et al.*, 2010:104). After the identification of the above mentioned parameters, a comprehensive literature search was conducted and appropriate information obtained. The librarian at the library of the North-West University (NWU) was contacted to facilitate the literature search process. The following databases were consulted during the course of the current study:

Electronic databases: ScienceDirect, EBSCOhost, Elsevier, SAePublications, university catalogues (theses and dissertations), Google Scholar, Google (academic and non-academic sources), Cochrane library (systematic reviews).

1.5.2.4 Recording literature search

Grove *et al.* (2013:476) stated that a record should be kept for each database searched, such as the date of the search, and the results found. In order to keep a clear record of studies, the software programme 'Evidence for Policy and Practice Information' (EPPI) reviewer was used, and the included and excluded studies are portrayed in appendices E and F of this dissertation.

The search process is documented in Chapter 2 (search terms, databases used, search strategies, inclusion and exclusion criteria) (Whittemore & Knafl, 2005:548-549) in more detail. In order to present a full electronic search strategy, the strategies outlined by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram were used. The PRISMA flow chart was used to record the number of documents included which identified and defined the components of a screening tool to identify developmental delays in premature infants in a resource-restricted setting. The format of the PRISMA flow chart was retrieved from Moher *et al.* (2009:877) and was utilized during literature recording (see Appendix B). The report quality was improved by using the PRISMA flow chart, as well as by using detailing tables including all excluded studies and the reasons for such exclusions. Thus, as much as possible information was searched and reviewed to get a clear picture of which reports should be included and which reports should be excluded.

1.5.2.5 Selection of studies and population

After all the information had been gathered (n=308), duplicated studies (n=11) were removed and only the most recent report was retained about any specific study. The remaining titles and abstracts were read by two independent reviewers, to determine the suitability for inclusion in the current study. Studies which did not meet the inclusion criteria were removed with a reason provided for each excluded study (Grove *et al.*, 2013:476). A total of 297 studies (n=297), suitable for review were included in the sample, at that point in time.

The development of a neonate and infant was studied, and appropriate information was used to describe the content of a preterm screening tool that would ensure early detection of developmental delays. The components necessary for such a standardized screening tool, and studies, which might impact on the development of an appropriate screening tool comprised the population of studies from which the sample of studies, used during this review, was selected.

The population of this study comprised research reports concerning premature infants and developmental delays. A total of 60 studies fulfilled the inclusion criteria at that point in time.

1.5.3 Phase 3: Critical appraisal

A critical appraisal of studies included in a sample was done to ensure that only good quality studies were included. The Johns Hopkins Evidence Appraisal Instruments (Newhouse *et al.*, 2007:206-211), were selected for the critical appraisal process, which could be applied to research and non-research studies, utilizing different types of methodology. These appraisal tools were comprehensive and gave an overview of the information found in the included studies (see appendices C & D for the appraisal tool). After the critical appraisal had been completed, the sampling process was also completed and a total of 24 studies of good evidence comprised the final sample. Table 1.4 provides a summary of the level of evidence of studies included in the current study's sample, based on the Johns Hopkins Evidence Appraisal Instruments.

Quality rating scale and level of evidence in table 1.4 is as follows:

Quality of study: A) High quality- clearly evident or consistent results. B) Good quality- credible or reasonably consistent results. C) Low quality/major flaws- discernible or inconsistent results.

Studies were excluded if of low quality/major flaws, thus cut-off at (C), thus only utilized studies with quality ratings (A) or (B).

Level of evidence: 1) Highest: Experimental study; meta-analysis of randomized control trials. 2) Quasi-experimental study. 3) Non-experimental study, qualitative study, meta-synthesis. 4) Systematic review, clinical practice guidelines. 5) Organizational, expert opinion, case study, literature review.

Table 1-4: Quality and level of evidence of studies used

Citation	Quality of study	Level of evidence
Amess *et al.*, 2010	B	1
Burns *et al.* 1989	B	1
Craig *et al.* 2000	B	1
Cusson, 2003	B	5
D'Agostino *et al.*, 2013	B	5
Dusing *et al.*, 2014	A	1
El-Dib *et al.*, 2012	B	1
Espinal & Msall, 2008	B	5
Grant *et al.* 2010	A	5
Gucuyener *et al.*, 2006	A	1
Kalia *et al.*, 2009	B	1
Kelly, 2006	A	5
Kiechl-Kohlendorfer *et al.*, 2009	A	1
Lenke, 2003	A	5
Lundqvist-Persson *et al.*, 2012	B	1
McCourt & Griffin, 2000	A	5
Meade *et al.*, 2012	A	1
Phillips-Pula & McGrath, 2012	B	5
Polinski, 2003	A	4
Purdy & Melwak, 2012	B	5
Sanders *et al.* 2007	A	1
Simard *et al.*, 2011	A	1
Tsai *et al.*, 2010	A	1
Van de Weijer-Bergsma *et al.*, 2010	A	1
Total number of studies included for data extraction:	**24**	

1.5.4 Phase 4: Data extraction and synthesis

In traditional studies this would have been known as data collection. During data extraction, good quality studies were reviewed in a critical manner and presented in a comparable format such as a table (see appendix F). This format helped the researcher to gain an answer to the research question, by only considering the best quality studies. Ultimately all results were compared, resulting in a comparative data extraction table (see a sample in Appendix G), listing the findings of each study enabling the researcher to identify repeating categories and compnents. The format provided by the EPPI reviewer software was used for this aspect of the study's reporting.

Data synthesis is defined by Grove *et al.* (2013:711) as "clustering and interrelating ideas from several sources to form a gestalt or new complete picture of what is known and not known in an area." Thus different studies' results were combined to provide a clear answer and support the conclusion of the study.

In order to ensure that appropriate information has been gathered from research documents the Preview, Question, Read and Summarize (PQRS) system was used. This system kept the researcher focused, it is reliable and eventually it simplifies identification and retrieval of information if a large number of documents need to be researched (Cronin *et al.*, 2008:41). Data from the included studies were synthesized by means of conceptual and logical reasoning and 11 components were identified as: factors to consider when doing a screening, gestational age, gender, corrected age, infant specific issues, maternal data, birth weight, medical conditions, follow-up dates, parental information, vital signs. (Refer to appendix I)

1.6 Phase 5: Results

Results were phrased in the researcher's own words. This portrays a complete understanding of the central topic of this study, namely to identify the components of a preterm screening tool that would ensure early detection of developmental delays when using this tool in a resource-restricted context. An interpretation of the comparison of the gathered evidence was discussed, conclusions were formulated, and this review concluded with the identification of components to be included in a screening tool for preterm infants.

1.7 Phase 6: Presentation

The review findings were presented in a clear, comprehensive and sequential manner in order to facilitate the reader's understanding and comprehension of the reviewed information. The components, to be included in a screening tool for preterm infant development, are presented

and discussed in this study. The studies included in this review were discussed and conclusions were formulated based on the information gathered. The results are contained in an article that will be submitted to the *Journal of Perinatal and Neonatal Nursing* (please see chapter 2 of this dissertation) and it will be presented at appropriate congresses.

1.8 Rigour

Rigour is defined as the attempt to attain brilliance in research through the use of discipline, dependable adherence to detail and exactness (Grove *et al.*, 2013:708). Data were extracted in an objective manner in order to ensure an impenetrable truth value of a document. Due to the use of an integrated literature review, different studies with different research methods were gathered during sampling. This is of the utmost importance to ensure decreased bias and increased truth of the findings.

Whittemore and Knafl (2005:548-552) stated that a clear research framework is needed to enable the study to meet the standards of a traditional study. The framework should consist of:

Problem identification – a well-specified goal for this study increased the ability to accurately sample documents and extract relevant data for the review. The aim was to determine the content of the screening tool and to suggest a tool for the early detection of developmental delays. The PIOTS questions helped to retain this focus.

Literature search – an all-inclusive search was utilized, with clear record keeping for determination and recording of relevant primary sources. Clear inclusion and exclusion criteria supported the search and the PRISMA flow diagram (appendix B) was used to record the search process.

The data collection process –The Johns Hopkins Evidence Appraisal Instruments (appendices B & C) were used to evaluate the quality of research and non-research evidence. The use of these instruments contributed to evaluating all the selected documents in a similar fashion.

Data extraction and synthesis – the goal of this process was to conduct a detailed and unbiased interpretation of the included studies' findings, resulting in an innovative presentation of the evidence from individual documents. Data extraction is presented in an extraction table (see appendix G). Data-synthesis combined and compared evidence from individual studies and documents by comparing all information gathered, drawing conclusions and ultimately identifying the items which should be included in a screening tool.

Presentation – The results of what should comprise the content of a preterm screening tool for early detection of developmental delays in premature neonates, is presented in an article format (please see chapter 2 of this dissertation) to be submitted to the *Journal of Perinatal and Neonatal Nursing*, in order to gain an understanding of the problem of concern, due to the target group the journal publication will reach. Limitations are also clearly stated and further research is proposed.

As an ILR is a combination of various methodologies it can lead to a lack of rigour, inaccuracy, as well as bias (De Souza *et al.*, 2010:106). The clinical experience of a researcher therefore contributes when checking the validity of the studies gathered (De Souza *et al.*, 2010:104). The researcher thus got support from study supervisors in order to ensure validity. During the critical appraisal process two reviewers appraised the studies to ensure validity and rigour.

The researcher used distinctive characteristics in the form of research, as identified by Torraco (2005:356-367) in this review to increase the rigour. The researcher identified where knowledge was required by doing a thorough scoping of literature on the identified topic. Conceptual structuring of the identified topic took place early in the research in order to ensure that structured research took place. It was reported in chapters 1 and 2 how literature was identified (by using EPPI reviewer program), how it was analysed and synthesized. The purpose of an ILR is not to report what is already known but to combine and reconstruct the information gained during research, thus gaining a clearer understanding of the research topic(Torraco, 2005:356-367). The components of a developmental screening tool for prematurely born infants were identified during this study. Another aim of an ILR is to create and generate new ideas, these ideas can be found in chapter 3 where limitations and recommendations are addressed. The study was written in a clear scientific manner without lengthy or unnecessary discussions.

Validity refers to the exactness of findings checked by the researcher by using certain procedures such as: providing rich and thick descriptions, clarifying bias on the part of the researcher, including negative or discrepant information, prolonged engagement with the study's findings, peer debriefing and using an external auditor to confirm the results of the data analyses procedures (Botma *et al.*, 2010:231). Reliability is defined by Grove *et al.* (2013:707) as the expression of logical coherence of the measure obtained. Transparency, as well as neutrality, was ensured by the use of the EPPI reviewer, the PRISMA diagram and a co-reviewer, which were all bias-free. The abovementioned was ensured by using Whittemore and Knafl (2005:548-552) strategies to enhance rigour and also by ensuring that the five epistemological standards (truth value, applicability, consistency, neutrality and authenticity) were implemented.

Truth value: The data which were collected throughout this study, involved the discovery of human experiences (Botma *et al.*, 2010:233). This was ensured by the use of research studies that were included in the review.

Applicability: The components which were discovered in the review, when compiled into a screening tool would be applied in a resource-restricted setting but could also be used in a resource-rich context. This ensures that the findings could be applied to various groups and settings (Botma *et al.*, 2010:233).

Consistency: This was ensured by gathering studies which addressed the research question, a clear audit trail was kept of how the studies were obtained, what kind of studies were obtained and what data extraction took place (Botma *et al.*, 2010:233).

Neutrality: In order to ensure freedom from bias, an independent co-reviewer checked all the selected studies and a consensus discussion was held to ensure that relevant studies were included in this review (Botma *et al.*, 2010:233). Data from various primary research sources were considered for inclusion such as unpublished studies. However, none arose during the search. In order to be completely free from bias, studies in all languages should be included even though the researcher and reviewer were only competent in Afrikaans and English. Relevant research reports published in other languages should be translated and then reviewed, no such studies appeared during the current search for relevant sources. In order to increase rigour all studies included and excluded are listed in appendices E and F.

1.9 Ethical considerations

In this study the researcher was fully committed to ethical research by complying with ethical standards and provided the research results, which would be published after completion of this study.

In order to commence the research, one of the ethical considerations was to gain permission for conducting the study. Ethical approval from the Health Research Ethics Committee, Faculty of Health Sciences of the North-West University was obtained (NWU-00332-15-S1) (see appendix A).

The Medical Research Council (MRC, 2003:12) of South Africa, has five objectives in order to ensure the morality of research: To promote health (this study determined the content of a screening tool and suggested items for inclusion in a tool for early detection of developmental delays and to improve future health); to care, heal, alleviate pain, and to prevent suffering (this was a systematic review, thus literature was collected with proper authenticity of each researcher's work, the end result of this research study identified components needed to

improve a preterm infant's health, thus also prevention of suffering). The studies used were therefore screened in order to determine whether the ethical objectives had been met in the primary studies in order to be included in the current study.

In order for information to be presented in an unambiguous, unbiased manner, and maintain scientific integrity, correct records of all information were kept to prevent confusion and misunderstanding, and to ensure the scientific quality of the study (NWU, 2013:16).

The researcher acted honestly. As this is an integrative literature review study, acknowledgement of original authors was of the utmost importance in order to prevent plagiarism by perpetrating acts of intellectual theft. By referencing in the correct manner, which is the Harvard style for the master's dissertation and AMA (American Medical Association manual of style, 10th edition, 2007) for the article, plagiarism was avoided to the best of the researcher's ability (NWU, 2013:5).

1.10 Research report structure

The following structure was used in this research report:

Chapter 1: Introduction and background information

Chapter 2: Article – The manuscript titled: "Components of a tool for early detection of developmental delays in preterm infants: an integrative literature review", will be submitted to the *Journal of Perinatal and Neonatal Nursing.* The study's results and methodology will be discussed in this chapter in an article format.

Chapter 3: Conclusions and limitations.

Since this dissertation is a report on the literature aiming to identify concepts of screening tool for preterm babies, an additional literature review chapter was not included. All the relevant literature is included and discussed in Chapter 2.

1.11 Conclusion

This chapter identified the need for constructing a screening tool for premature infants during the first year of life. The components of such a tool will be identified and discussed in the second chapter along with supporting studies. An ILR was the method of choice for this study and was explained as gathering information from various sources, then reconstructing it by merging the research findings in order to develop a proposed framework. In the current study, the purpose was to identify the components needed for a screening tool to identify developmental delays when assessing prematurely born infants. The six phases of an ILR, as

presented by De Souza *et al.* (2010:104-105), were followed: preparing a research question, search strategy and sample, critical appraisal, data extraction and synthesis, results and conclusion and presentation.

PIOTS was the most appropriate format for the review question, as it is the most commonly used and reliable format to formulate a research question. The search was thus guided and more detailed and appropriate information was obtained from the studies identified during the research process. The search strategy included various medical or health-related platforms and the sample comprised studies concerning prematurely born infants and developmental delays. Out of the 308 identified studies retrieved from the initial search, 60 studies were prepared for critical appraisal, which was done by using the Johns Hopkins Research Evidence Appraisal, 60 studies were appraised and 20 studies addressed the research question and were of high or good quality. Four sources were used as supportive studies and acted as guidelines for the 20 studies which addressed the question. The complete sample was presented using the PRISMA in order to keep a clear audit trail of the identified studies (see appendix B). The EPPI Reviewer Program was also utilized in order to ensure a clear record of the studies included in and excluded from this study (see appendices E and F). Data from the included studies were synthesized by means of conceptual and logic reasoning and 11 components were identified with various components to be included in a screening tool during the first year of life, for identifying developmental delays in prematurely born infants in resource-restricted settings. Results are presented in chapter 2 in an article format with supporting information in the appendices. The implementation thereof in this study will be explained and supported by relevant sources. Rigour was explained and obtained throughout this study. Ethical considerations were taken into account during this study.

Chapter 1 provided a comprehensive overview of the study and, due to the nature of the ILR, included a discussion of the relevant and supporting literature. The next chapter is presented as a manuscript to be submitted to the *Journal of Perinatal and Neonatal Nursing* and will differ in style from the first and third chapters of this dissertation to comply with the author guidelines of the specific the journal (included in Appendix K of this dissertation).

CHAPTER 2:

MANUSCRIPT

COMPONENTS OF A TOOL FOR EARLY DETECTION OF DEVELOPMENTAL DELAYS IN PRETERM INFANTS: AN INTEGRATIVE LITERATURE REVIEW

Permission to submit this article for examination purposes

We, the supervisors, hereby declare that the input and the effort of Zarine Wessels in writing this article reflect research done by her on this topic.

We hereby grant permission that she may submit this article for publication for examination in partial fulfilment of the requirements for the degree Magister Curationis.

Supervisor: Dr Welma Lubbe

Date: November 2015

Co-supervisor: Dr Karin Minnie

Date: November 2015

Date: November 2015

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Date:20/11/2015

Dear editor

SUBMISSION OF ARTICLE FOR CONSIDERATION FOR PUBLICATION TO THE *JOURNAL OF PERINATAL & NEONATAL NURSING*

Attached please find our manuscript entitled: 'Components of a tool for early detection of developmental delays in preterm infants: an integrative literature review'. The authors are Z Wessels, W Lubbe and CS Minnie, who have read and approved the paper. Dr Welma Lubbe will be the corresponding author.

Z Wessels conceptualized, drafted and designed the manuscript. W Lubbe and CS Minnie were responsible for co-writing and critical review of the manuscript as well as the technical preparation for submission. As supervisors of the study, Dr W Lubbe and Dr K Minnie accompanied the first author through all the phases of conducting the research from proposal writing untill finalization of the prepared article. All authors read and approved the final manuscript.

This paper discusses the components to be included in a screening tool for early identification of developmental delays in prematurely born infants, to be used during follow-up assessments by health care professionals with limited skills, knowledge and experience working in resource-restricted facilities.

It was chosen to submit this paper as a topic for review to your journal, as the journal provides open access to current, evidence-based systematic research on issues addressing developmental delays in preterm infants. Since the 30th Anniversary issue of the journal, guest edited by Drs. Premji and Kenner, is inviting articles in this field for January 2016, we thought this paper might fit in very well.

We believe that our findings deserve to reach other researchers, as well as nurses in practice, in order to guide them by offering the best available evidence, to enable them to make informed decisions during the screening of premature infants.

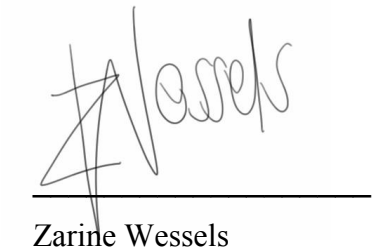
We hope that you will find our contribution and its far-reaching implications for the clinical setting as interesting as we do, and that you will consider sending the paper to reviewers. We look forward to your reply.

Yours sincerely

Zarine Wessels

Declaration by the researcher

I hereby declare that this research '**Components of a tool for early detection of developmental delays in preterm infants: an integrative literature review'** is entirely my own work and that all sources have been fully referenced and acknowledged.



Zarine Wessels

Date: November 2015

Declaration by the language editor

I, Valerie Janet Ehlers, hereby certify that I have edited the article titled: "Components of a tool for early detection of developmental delays in preterm infants: an integrative literature review".

Yours sincerely

Prof VJ Ehlers

Components of a tool for early detection of development delays in preterm infants: an integrative literature review

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Disclosure: The authors have no relationship or financial interest in any companies pertaining to this study. The authors declared no potential conflicts of interests with respect to the research, authorship, and/or publication of this article.

Funding: The financial assistance of the National Research Foundation (NRF) of South Africa towards this research is hereby acknowledged. Opinions expressed and conclusions arrived at, are those of the authors and are not to be attributed to the NRF (TTK20110914000027025).

Abstract

This study aimed to contribute to the knowledge about the early detection of developmental delays. Such early detection can influence early interventions, contributing to improved short and long-term developmental outcomes of preterm infants with subsequent improved quality of life and decreased burden of illnesses.

No existing screening tool for early detection of developmental delays in preterm infants was available for use in resource-restricted settings.

The components to be included in such a screening tool were identified and described by conducting an integrated literature review, comprising the phases: preparing a research question, searching and sampling literature, critical appraisal, data extraction and synthesis, results and presentation.

Eleven components were identified for inclusion in a developmental delay screening tool for premature infants, to be used by healthcare professionals with limited skills and experience in resource-restricted settings.

Keywords: Developmental delay, screening tool, premature infant, infant assessment, early detection.

Precis:

Through an integrative literature review eleven components were identified for a screening tool for prematurely born neonates to recognise early developmental delays.

Background

Worldwide, more than 15 million babies are born preterm (before 37 completed weeks of gestation) annually. [1] Preterm births imply an increased risk for complications and problems such as behavioural, medical and neurocognitive disorders due to immaturity of the preterm infant's organs and body systems.[2]

Preterm infants are at risk of experiencing developmental delays, which could impact on the child's family and on the child's academic skills with potential socio-economic disadvantages.[3] Early detection of developmental delays improve opportunities for early interventions which, in turn, could contribute to improved short and long term developmental outcomes with a subsequent improved quality of life and decreased burden of illness.[4]

A scoping literature search was done of assessment tools used during early preterm infant screening during the first year of life. Various instruments were found such as ASQ (Ages and Stages), BTAIS-2 (Birth to Three Assessment Intervention System), Brigance- II, DAYC (Developmental Assessment of Young Children), E-LAP (Early Learning Accomplishment Profile), IDI (Infant Development Inventory), PEDS (Parents' Evaluation of Developmental Status) and PEDS:DM (Parents' Evaluation of Developmental Status: Developmental

Milestones)[5]. However, these tools were not suitable for use in limited resource settings and by health care practitioners with limited skills, knowledge, and experience in the field of infant assessment. All the identified tools required extensive skills, training and/or resources for application.

Through early detection and early intervention the outcome of those at risk of experiencing developmental delays could improve, including increased academic achievements and increased chances of gainful adult employment.[4] Improved outcomes for the at-risk child and his/her family could imply decreased costs and treatment for fewer chronic conditions.[3] Health care professionals should identify, document and appropriately refer the at-risk infant, to significantly decrease the potential developmental delays.[5,6,7]

The aim of this study was to identify the components of a screening tool, thus to detect early developmental delays in preterm infants, utilized by professionals with limited skills, knowledge and experience concerning preterm infants' assessments, in resource-restricted settings.

Methods

Evidence is available for comprehensive infant assessment tools to determine developmental delays and to structure interventions to prevent further delays and plan interventions to improve the condition.[3] However, limited evidence is available about a screening tool to be used in resource- restricted situations with the aim to refer these infants timeously for more in-depth evaluations and targeted treatments.

An integrated literature review (ILR) can contribute significantly to evidence based practice (EBP). Consequently, this study reviewed the evidence to identify items to be included in an appropriate preterm infant screening tool for resource-restricted settings. Cronin, Ryan and Coughian [8] reasoned that a literature review is necessary to determine best evidence and/or to develop policies. In this study an ILR was used to understand the different perspectives and to *define concepts* in this study by means of keywords, such as developmental delays, screening tools, and premature infants.

Procedure

This ILR was performed using a combination of the processes described by De Souza, Da Silva and De Carvalho [9] consisting of six steps: preparing a review question, searching and sampling literature, critical appraisal, data extraction and synthesis, results, and finally presentation.

Research question

The review question is critical, since it guides the selection of the correct keywords.[10] The PIOTS format was utilized in this review as it is one of the most common and reliable formats used to develop a clinical question to guide the research [10]. PIOTS refer to literature which discuss the following: *P - population*, prematurely born infants. *I - intervention,* Components for developmental screening by health care professionals with limited skills, knowledge and experience in the field of infant developmental assessment. *O - outcomes,* Developmental assessment. *T- time,* Birth to 1 year of age/time. *S - setting*, resource-restricted setting. Therefore the question was formulated as: What is the best available evidence regarding components to be included in a developmental screening tool that could be used by healthcare

professionals with limited skills, knowledge and experience in the field of infant developmental assessments and working in resource-restricted settings?

Searching and sampling literature

The sampling in an ILR lies within the literature search phase. Rigorous search strategies should be precise to prevent using inadequate search strategies that could produce false results. The research question is the guiding factor for the identification of keywords and included the following key phrases: developmental delay, premature birth, neonatal development, infant development, developmental screening, recognizing developmental delays, neonatal examinations/assessments, neonatal follow-up tools/assessments, follow-up care of preterm infants, premature babies' risks, early premature baby risk identification, detecting developmental delays, premature babies' developmental delays, premature babies' long term delays, management of developmental delays.

These keywords were used to search electronic databases: Science Direct, EBSCOhost, Elsevier, SAePublications, University catalogues (theses and dissertations), Google Scholar, Google (academic and non-academic sources), Cochrane Library (systematic reviews), PubMed, between 8 August 2015 and 14 September 2015.

Inclusion and exclusion criteria were determined to ensure that relevant literature would be identified during the search.

Inclusion criteria

Studies with diverse methodologies were included for obtaining varied perspectives. As the authors were competent in Afrikaans and English, research reports published in other

languages but with English abstracts would be considered for inclusion, subsequent to translations into English, but none were found. Theses and dissertations were included as well as grey literature, such as unpublished research reports. Studies published within the last 10 years were included to ensure relevance.

Exclusion criteria

Duplicate studies were excluded, as only the most recent version was included. Studies with limited relevance to the research question were excluded. Secondary sources such as books were also excluded. Studies published in other languages, without English abstracts, were excluded due to language barriers. Non-expert opinions were excluded, as it was not seen as research studies and lacks strong psychometric qualities as well as validity and reliability, as grey literature was included as it has limited distribution and unpublished research reports.

Process

The Evidence for Policy and Practice Information (EPPI) reviewer software was used during this review. During this search n=308 titles were found, apparently addressing the review question, and imported into the EPPI-reviewer software program. Eleven duplicate studies were eliminated. Thus the titles and abstracts of n=297 articles were read, n=237 articles did not fulfil the inclusion criteria and were excluded. At this point n=60 studies met the inclusion criteria and were prepared for critical appraisal. Figure 1 provides the details of the sampling process.

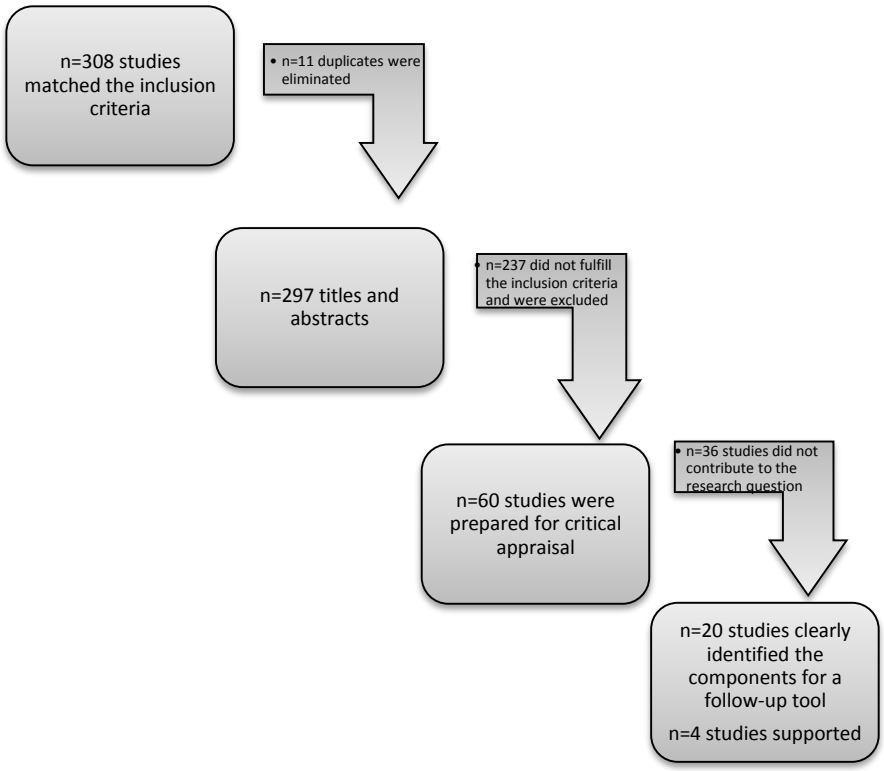

Figure 1: Sampling process

Critical appraisal

The Johns Hopkins Research and Non-Research Evidence Appraisal Instruments (2007) were identified as the most suitable critical appraisal instrument for reviewing these 60 research reports. This was the case since it can be applied to research studies which used different methodologies, of good quality. Using these instruments allowed the reviewers to compare different types of methodologies used by different researchers.

The first author, as well as an independent reviewer familiar with developmental delays in premature infants and with the ILR methodology, appraised the 60 selected studies, by utilizing the same instrument. They then discussed these appraisals until consensus had been reached about the studies to be included in the final sample. The Johns Hopkins instrument

allowed each document to be rated with regard to the level of evidence: high quality- clearly evident or consistent results, good quality- credible or reasonably consistent results, low quality/major flaws- discernable or inconsistent results.

At the end of the critical appraisal 24 studies were included which had been appraised to be good and high quality documents. The other 38 studies were excluded due to low quality data/flawed data, failure to contribute any data which could be used to formulate components of a screening tool. Twenty of the 24 studies provided clear identifications of the components and were therefore included in the final sample. The remaining four studies did not provide clear identifications of components needed for a tool but were used as supportive studies. The results of this phase are portrayed in table 1.

The rating scales of the table are as follow:

Quality of the study: A) High quality- clearly evident or consistent results. B) Good quality- credible or reasonably consistent results . C) Low quality/major flaws- discernible or inconsistent results.

Level of evidence: 1) Highest: Experimental study, meta-analysis of randomized control trials. 2) Quasi-experimental study. 3) Non-experimental study, qualitative study, meta-synthesis. 4) Systematic review, clinical practice guidelines. 5) Organizational, expert opinion, case study, literature review.

Table 1: Quality and level of evidence

Data extraction

After critical appraisal had been completed, utilizing the Johns Hopkins instrument (2007), critical components were extracted. Only components deemed to be of the utmost importance (such as neurological developmet,medical information, parental information and infnat information) for identifying developmental delays were extracted from the 20 good and high quality studies, which answered the research question in a comprehensive manner. Four studies supported the answers for the research question, thus supporting the 20 good and high quality studies. In order to extract data, the research question, objective and inclusion criteria were considered to identify the components required for a screening tool for prematurely born infants to detect developmental delays during the first year of life. The PIOTS questions provided detailed direction for deciding which research results, from each study, should be included in the extraction table (see table 2).

Developmental delays can be detected in various domains: gross and fine motor skills, cognition language and speech, personal/social activities or daily tasks.[11] Developmental delays can be categorized into: isolated developmental delays (affecting only one of the domains) and global developmental delays (affecting more than one of the domains).[12] The domains were considered during the data extraction process, to ensure that all domains were included in the identified components. In order to facilitate comparisons, the extracted data, from the critically appraised studies, were displayed in table with the following headings: author and year of publication, study title, geographical site of the study and the main findings applicable to the

current review, methodology, findings of study, and components identified during data synthesis (see Table 2).

Synthesis

Data synthesis is the combination and reconstruction of data gathered.[10] By stating this, the data gathered by the researcher was compiled into table 2, to give a clear overview of what information was retrived from the 24 studies researched. There were 3 categories which rose from the research and 11 components falling under each individual category.

After components were determined and whether or not to include in a developmental screening tool, a list of 11 components was compiled, which addressed three categories. These components, discussed in the results section, included: birth weight, gestational age, parental information, medical conditions (respiratory problems, gastro-intestinal problems, hematologic problems, central nervous system problems, retinopathy of prematurity, intra ventricular hemorrhage, inflammatory stress) , follow-up dates (at 2, 4, 6, 9 and 12 months), corrected age, factors to consider when screening infants (nutritional status, posture, hearing, language, head control, general movement, five minute APGAR score and sucking), infant specific issues (focus on the already known delay), gender, maternal data and vital signs. The three categories were: infant data, parental data and medical data, also discussed in the result section.

The independent reviewer verified the identified categories and components to increase the validity. Two independent reviewers agreed on the below stated categories and components, after discussions of relevance. The studies on which the independent reviewer did not agree upon was discussed with the researcher and an agreement was reached to include all 24 studies.

Categories and components for a screening tool to detect developmental delays in a preterm infant were identified by the use of 24 high and good quality research and non-research studies, according to the Johns Hopkins evidence appraisal instument's scoring.

Tabel 2: Data extraction and summary

Results

Developmental delays, due to premature birth, are well-known international problems, as shown by research reports from different countries. An increase in premature survival rates leads to an increased risk of developing developmental delays, due to the interruption of a critical period of foetal brain growth and maturation, as well as the incomplete development of its organs and body systems. [13,14]

The components identified during the data extraction phase were: birth weight, gestational age, parental information, medical condition (inflammatory stress, respiratory problems, gastro-intestinal problems, hematologic problems, central nervous system problems, retinopathy of prematurity, intra ventricular hemorrhage, follow-up dates (2, 4, 6, 9 and 12 months), corrected age, factors to consider (nutritional status, posture, hearing, language, head control, general movement, five minute APGAR and sucking), infant-specific aspects, gender, maternal data, and vital signs.

The components identified during the first step of synthesis were then grouped to form three new categories:

- Infant data (birth weight, gestational age, infant-specific aspects, gender, corrected age and follow-up dates)

- Medical data (factors to consider when screening infant, medical conditions, vital signs).
- Parental data (parental information and maternal data).

Infant data

The infant-related data include birth weight, gestational age, infant-specific issues, gender, corrected age and follow-up dates.

Birth weight is a critical factor determining developmental outcomes, including neurodevelopmental outcomes of a premature infant.[14] Preterm infants with low birth weights are at risk of developing illnesses which could lead to long-term complications.[15] Conclusion: An extremely negative profile for developmental delay outcomes is created with a low birth weight (of less than or equal to 2500 grams)[16]

Gestational age: A shorter gestational age implies a higher incidence of intra-ventricular hemorrhage (IVH) and intra-cerebral hemorrhage (ICH), which can lead to motor impairment and adverse developmental outcomes.[14,17] Older prematurely born infants might also be at a high risk for experiencing developmental problems as they might be regarded as being near term infants, and problems might thus not be detected. [18,19] Infants born before 30 weeks' gestation are at higher risk for IVH and ICH.[14,17] Infants are at increased risk of developing motor anomalies due to the low gestational age which creates a negative profile for the outcomes of developmental delays.[15] Conclusion: Infants born <28 weeks gestational age are at increased risk for potential developmental delays.

Infant specific: Complexity of developmental delay identification increase due to the varied outcomes of each individual infant.[20] The health care practitioner should thus focus on the infant as an individual, as infants have unique needs after discharge from the hospital, depending on the already existing delays.[21] Conclusion: Infants can be misdiagnosed if not screened as individuals and could be treated incorrectly and/or inadequately.

Gender: Males have a greater biological risk factor for experiencing developmental delay problems, by showing a slower rate of developmental change.[13] Heightened risk of brain insults or immaturity of the brain can lead to decreased cerebral volume during childhood, which is more likely to affect males than females.[13] Female gender could positively influence the infant's developmental outcome.[16] Conclusion: A male infant is a greater risk to experience developmental delays than a female infant.

Corrected age and follow-up dates: The earlier the identification of any developmental delay, the earlier an intervention can take place.[22] Follow-up assessments at 4 months and at 8 months corrected age and thereafter are vital, to ensure accurate identification of possible developmental delays.[22] Corrected age/ adjusted age (chornological age subtracted by number of weeks premature), should be utilized during follow-up screenings to correctly identify possible developmental delays and implement the correct interventions.[23] Conclusion: Early identification of developmental delays, during the first year of life could lead to early interventions. Corrected age should be utilized to prevent incorrect interpretations.

Medical data

Medical conditions: Premature infants are at risk of hospital readmissions after discharge from the NICU as they could develop problems due to prematurity, as listed in the results section.[21,24]

Medical conditions could cause major cognitive deficits requiring special education.[25] Prematurely born infants are at risk of developing complications due to their premature birth and incomplete development of their brains, organs and body systems.[15] Conclusion: If the infant has any medical conditions due to prematurity, the focus should be on that specific area. Hospital readmissions should also be considered during follow-up screenings, to determine the severity of the condition.

Factors to consider when screening an infant: Nurses might not receive sufficient education about prematurely born infants' developmental delays and might thus be unaware of factors to be considered during follow-up screenings of premature infants.[26] The following factors, identified during the current study should be considered: 5 min APGAR (should have adapted to the extra-uterine life by this time), duration of hospitalization, basic neurological function/intactness, receptive function, expressive function, cognitive function, infant feeding, locomotor movements and posture, fine manipulation, hearing, interactive social, speech and language, self-care, vision, admission to a NICU, environment, medication used, body structure, body function, activities and participation, early executive function, sepsis, length and head circumference, sucking, general movements, drug exposure, head ultrasound anomalies, neurological and brain disease. [13,16-18,20,27-33] Conculsion: The factors named, should be an indicator of how well the infant adapted to extra-uterine life, and also of what possible factors could cause developmental delays in future.

Vital signs: As inflammatory stress causes an alteration in vital signs due to the body's response to the inflammatory reaction. This implies a risk for circulatory and/or respiratory insufficiency; it could therefore affect the brain's maturation, resulting in an impaired developmental outcome.[17] Conclusion: Vital signs play a great role in brain maturation and if the vital signs

deviate from the normal vital signs at a specific age, inflammatory stress should be suspected and appropriate interventions implemented.

Parental data

Parental information: Parents can recall past events and can be a valid source of information, if the questions asked are formulated correctly. Parents might feel more comfortable when a personal connection has been established with the professional, person.[19] Parents have their own perceptions of how their children should develop which might influence the infant's development.[31] Conclusion: Parental information can be valuable for a health care practitioner.

Maternal data: Age, education, smoking during pregnancy, using antenatal steroids, premature rupture of membranes and mode of giving birth, could influence the developmental outcomes of the prematurely born infant.[17] A mother's education level could influence social factors impacting on the infant's development.[31] Conclusion: Maternal information could determine an infant's developmental outcomes due to the mother's daily inputs.

Tabel 3: Concluding statements and proposed items to be included in a screening instrument to detect preterm infants' developmental delays.

Discussion

The data synthesized during the current study are supported by a number of sources, increasing the validity of the identified components. [13]

Infant data

Birth weight and gestational age: Factors which can influence the outcome of the risk of developmental delays negatively include a short gestational age and a low birth weight, the shorter the gestational age the lower the birth weight, the higher the risk for experiencing developmental delays. [14,16,17]

Infant specific, follow-up dates and corrected age: Dusing, Izzo, Thacker, Galloway [20] suggested that follow-up assessments should take place at specific dates, but to implement early interventions, the follow-up screenings should be infant-specific and commence in the NICU.[25] The initial follow-up observation is suggested at 40 ± 2 weeks.[34] It is important that the corrected age is used during follow-up assessments, due to the possibility of incorrect interpretation of developmental delays.[23] A study done by Burns, Ensbey, Norrie [22], showed that out of the developmental delays identified at four months of age, 88% of the evaluated children had been correctly diagnosed with developmental delays. Burns, Ensbey, Norrie [22] further concluded that eight months of age was found to be the optimal age of accurate identification without discrimination.

Gender: The likelihood of premature male infants to develop developmental delays is more than for females due to premature birth leading to decreased cerebral volumes especially in male infants.[13]

Medical data

Factors to consider: Various screening tools are available according to Grant, Gracy, Brito [5] which focus on developmental and social-emotional screening. An ideal screening tool

should be easy to administer, cheap, have strong psychometric qualities and consider cultural beliefs.[3]

Medical conditions and vital signs: Medical conditions such as: intra-ventricular hemorrhage (IVH), necrotizing enterocolitis (NEC), and retinopathy of prematurity (ROP) could cause developmental delays.[25] Inflamatory response can alter the vital signs and is a great stressor on the neonate.[17]

Parental data

Parental information: Grant, Gracy and Brito [5] identified available screening instruments for developmental and socio-emotional screening in pediatric primary care contexts. However, most of these tools' administration relied on parents' reports.

Maternal data: Lundqvist-Persson, Lau, Nordin, Bona and Sabel [32] reported that maternal education level influenced a preterm infant's development[31] because of the mother's daily inputs and constant interaction with the infant.

Limitations

Components of a screening tool were identified based on in-depth literature review and analysis. However, the development of the actual tool fell beyond the scope of the current study.

The reviewer is a novice user of the methodology of ILR and some information might have been missed due to inexperience. However, the use of a second, skilled independent reviewer ensured that the impact of this potential limitation was minimized.

The identified components only focus on the first year of life but could be expanded to 24 months, since literature suggested that follow-up should continue to 24 months. Studies in languages other than English and Afrikaans were excluded due to language barriers, thus relevant information could be missed. ILR's are fairly new to the field of nursing research, the study structure and methodology were vague and might have been influenced by a systematic review's methodology, such as the formulation of a research question. Even though limited information was available about ILR's, this was considered the best way to conduct this study.

Recommendations for future research

Development of a screening tool, for conducting follow-up screenings of preterm infants, is suggested. The developed screening tool should be implemented and applied in practice to determine the effectiveness of the identified components, and also to identify the strengths and weaknesses off such a tool. Statistics gathered about developmental delays of premature infants born in South Africa (based on the implementation of the developed tool), could help to address the lack of knowledge about this issue in a resource-restricted context. Parents' knowledge should be explored with regard to premature infants' development and developmental delays. The knowledge of healthcare professionals and the implementation of a screening tool should be tested to provide the relevant training for using the screening tool.

Conclusion

Components of a screening tool for premature infants during the first year of life were identified. Evidence showed that it is important to focus on the individual infant, and not to generalize each follow-up appointment. To ensure appropriate interpretations during follow-up appointments, the corrected age of the infant should be used rather than the chronological age. A

shorter gestation implies a lower birth weight and an increased likelihood of developmental delays. Late preterm infants should be regarded as premature infants and not near term infants to prevent missing developmental delays. Screenings should take place until the 24th month of life. Maternal and/or parental information is important as the parents are aware of what developmental goals the infant should reach at certain ages, thus detect if there is a delay. Although some parents are unaware or uneducated of what stage to reach developmental goals and the healthcare practitioners should educate the parents if there is a need.

The 20 studies of good quality were identified which addressed the review question. From these studies, components were identified and grouped into three categories: infant data, medical data, and parental data. Eleven conclusive statements were formulated which were used to formulate the items to be included in a screening tool.

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Table 1: Quality and level of evidence

Citation	Quality of study	Level of evidence
Amess *et al.*, 2010 [28]	B	1
Burns *et al.* 1989 [22]	B	1
Craig *et al.* 2000 [15]	B	1
Cusson, 2003 [31]	B	5
D'Agostino *et al.*, 2013 [23]	B	5
Dusing *et al.*, 2014 [20]	A	1
El-Dib *et al.*, 2012 [16]	B	1
Espinal & Msall, 2008 [30]	B	5
Grant *et al.* 2010 [5]	A	5
Gucuyener *et al.*, 2006 [27]	A	1
Kalia *et al.*, 2009 [18]	B	1
Kelly, 2006 [35]	A	5
Kiechl-Kohlendorfer *et al.*, 2009 [17]	A	1
Lenke, 2003 [14]	A	5
Lundqvist-Persson *et al.*, 2012 [32]	B	1
McCourt & Griffin, 2000 21	A	5
Meade et al., 2012 19	A	1

Phillips-Pula & McGrath, 2012 24	B	5
Polinski, 2003 29	A	4
Purdy & Melwak, 2012 25	B	5
Sanders et al. 2007 26	A	1
Simard et al., 2011 34	A	1
Tsai et al., 2010 33	A	1
Van de Weijer-Bergsma et al., 2010 13	A	1
Total number of studies included for data extration:	**24**	

Tabel 2: Data extraction and summary

Data extraction					Components	Supporting evidence										
Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
Lenke, 2003	Motor outcomes in premature infants	United States of America	Literature review	Critical factors determining developmental outcomes: birth weight, gestational age (the shorter the gestational age, the lower the birth weight the higher the risk).	Birth weight Gestational age		✓	✓								
Meade *et al*. 2012	Modifying the parent's evaluation of developmental status to target 4-month-old infants who would benefit from the Meade Movement Checklist during community	United States of America	Experimental study	Older premature infants are also at risk. Parents' information can be useful as they can recall past events.	Gestational age Parental information		✓		✓							

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
	screening															
Simard *et al*., 2011	Prediction of developmental performance in preterm infants at two years of corrected age: contribution of the neurological assessment at term age	Canada	Experimental study	A clinical assessment tool should be short and easy to perform. The first observation should take place at 40 weeks gestational age ±2 weeks. Usually multiple examiners.	Gestational age			✓								
Gücüyener *et al*., 2006	Use of the Bayley Infant Neurodevelopmental Screener with premature infants	Turkey	Experimental study	Premature infants can show continuous improvement during the first two years of life, thus follow-up should take place during the first year. The earlier the identification of developmental delays, the	Follow-up dates Factors to consider (basic neurological					✓	✓					

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
				earlier interventions can take place. Four factors were identified: basic neurological function/intactness, receptive function, expressive function, cognitive function.	function/intact-ness, receptive function, expressive function, cognitive function)											
McCourt and Griffin, 2000	Comprehensive primary follow-up for premature infants	United States of America	Literature review	Follow-up is needed depending on gestational age, birth weight and medical condition. A framework was identified addressing problems of a premature infant by system: respiratory problems, gastro-	Birth weight Gestational age Medical condition Respiratory problems, gastro-		✓	✓				✓				

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
				intestinal problems and nutritional problems, infectious disease problems, hematologic problems, central nervous system problems, other problems (dentition, nasal deformities, scars).	intestinal and nutritional problems, infectious diseases, hematologic problems, central nervous system problems)											
Kelly, 2006	The medically complex premature infant in primary care	United States of America	Literature review	The survival rate of premature infants at 23-26 weeks gestational age is 70% with a 30-50% chance of moderate to severe developmental delays.	Medical conditions (retinopathy of prematurity, respiratory			✓			✓	✓				

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
				Neurodevelopmental issues such as retinopathy of prematurity, respiratory conditions and infant feeding emerged.	conditions) Factors to consider (infant feeding) Gestational age											
D'Agostino *et al*., 2013	Provider use of corrected age during health supervision visits for premature infants	United States of America	Literature review	Incorrect interpretations may be the result of the use of chronological age instead of corrected age/adjusted age. Health visits and immunizations take place at chronological age. Follow-up at 2, 4, 6, 9, 12	Corrected age Follow-up dates					✓						✓

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
				months corrected age was suggested.												
Amess *et al*., 2010	Developmental outcome of very preterm babies using an assessment tool implemented by health visitors	United Kingdom	Experimental study	A possible final identification of developmental delays can take place at 12 months with a follow-up at 24 months. Ideas for areas to focus on in a follow-up: locomotor and posture, fine manipulation, hearing and language, interactive social, speech and language, self-care, vision and cognitive.	Factors to consider (locomotor & posture, fine manipulation, hearing and language, interactive social, speech and language, self-care, vision and						✓					

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
					cognition)											
Polinski, 2003	Hearing outcomes in the neonatal intensive care graduate	United States of America	Systematic review	Hearing loss is an increased risk if admitted in the neonatal intensive care unit (NICU) (due to the environment, medication and clinical conditions). Infant should be screened by 3 months. Preterm infants are 50% more likely to develop hearing loss and should be evaluated before discharge from NICU.	Factors to consider (Hearing, admission in the NICU, environment, medication used)						✓					
Phillips-Pula and	Follow-up care of the neonatal intensive care	United States	Literature	NICU graduates have a high risk for hospital readmissions,	Parental				✓							

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
McGarth, 2012	graduate	of America	review	making follow-up a costly challenge. Parents want a personal connection with the staff, thus providing the healthcare professional with sufficient information.	information											
Purdy and Melwak, 2012	Who is at risk? High-risk infant follow-up assessments	United States of America	Literature review	Identification of developmental delays start in the NICU. Premature infants are born prior to 37 weeks' gestation. Three identified areas could possibly cause developmental delays: Intra-ventricular hemorrhage, necrotizing enterocolitis (NEC),	Medical conditions (Intra-ventricular hemorrhage, necrotizing enterocolitis (NEC), and retinopathy of					✓		✓				

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
				and retinopathy of prematurity (ROP). A six to eight-month follow/up is advised.	prematurity (ROP).) Follow-up dates											
Espinal and Msall, 2008	Developmental disabilities: physical	United States of America	Literature review	The child's health and well-being consists of four components: body structure (anatomical parts), body function (physiology and psychology), activities (tasks that are done), and participation (involvement in community life).	Factors to consider (Body structure, body function, activities and participation)							✓				

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
Cusson, 2003	Factors influencing language development in preterm infants	United States of America	Experimental study	Normal hearing is necessary for normal language development. Communication disorders consist of: language disorder and speech disorder. Preterm infants develop language milestones only at later stages. Maternal input provides valuable clues about development.	Parental information Factors to consider (Hearing)				✓		✓					
Dusing *et al*. 2014	Postural complexity influences development in infants born preterm with brain injury: relating	United States of America	Experimental study	Development is the interaction of multiple systems in the environment. Head control, reaching and global	Factors to consider (head control, reaching and					✓	✓		✓			

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
	perception-action theory to 3 cases			development must be checked for developmental delays. Developmental delays can be due to a lack of postural control which can lead to an atypical perception-action cycle and limited postural complexity. Infant should be assessed every 0,5-3 months for the first year of life. It is difficult to predict the developmental delay due to varied outcomes.	global development) Follow-up dates Infant specific guidelines											
Van de Weijer-Bergsma *et al.*,	Individual differences in developmental trajectories of	The Netherlands	Experimental study	Early executive function (higher-order cognitive process)	Factors to consider		✓				✓				✓	

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
2010	a-not-b performance in infants born preterm			can be a developmental delay and learning difficulty predictor. An increased survival rate also leads to an increased risk for developing developmental delays. Preterm birth leads to decreased cerebral volumes. Male infants are more likely to be affected by developmental delays. Birth weight plays a role in developmental delays.	Early executive function Gender Birth weight											
Kiechl-Kohlendorfer *et al*.,	Adverse neurodevelopmental outcomes in preterm infants:	Austria	Experimental study	Increased risk for developmental delays:	Medical conditions	✓	✓				✓	✓		✓		

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
2009	risk factors for different gestational ages			Intracerebral hemorrhage, small for gestational age, late-onset sepsis. Antenatal steroids can decrease the risk for developmental delays. Maternal data, which can affect the risk of developmental delays: age, education, smoking during pregnancy, antenatal steroids, rupture of membranes and mode of delivery. Neonatal data, which can affect the risk of developmental delays: birth weight, gestational age, multiple pregnancy, gender,	(Intracerebral hemorrhage, NEC and ROP) Factors to consider (Sepsis, vision, hearing, length and head circumference) Birth weight Vital signs											

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
				intracerebral hemorrhage, NEC, ROP and infection. A follow-up visit consists of a physical, neurological examination, neuromotor examination, cognitive development, vision, hearing, weight, length and head circumference. Inflammatory stress can affect brain maturation and can result in impaired neurodevelopmental outcomes.	Maternal data										
Lundqvist-Persson *et al*., 2012	Preterm infants' early developmental status is	Sweden	Experimental study	Maternal education plays a role in an infant's development.	Maternal data	✓				✓	✓					

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
	associated with later developmental outcomes			Developmental deviations persisted and increased for 18 months. Infants with low levels of self-regulation and abnormal qualities of general movements were likely to experience poorer development.	Follow-up dates Factors to consider (General movements)											
Tsai *et al*., 2010	Prediction of developmental delays on Neonatal Oral Motor Assessment Scale in preterm infants without brain lesions	Taiwan	Experimental study	Normality is predicted during the last quarter of the first year of life. Sucking is critical for communication, and persistence of disorganized sucking after 37 weeks can lead to decreased developmental scores at 6-12	Factors to consider (Sucking)						✓					

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
				months of age.												
El-Dib *et al*., 2012	Neurobehavioural assessment as a predictor of neurodevelopmental outcome in preterm infants	United States of America	Experimental study	Early prediction is important to facilitate parental counselling and also for early interventions. Negative factors influencing developmental delays include: drug exposure, decreased gestational age, low birth weight, head ultrasound anomalies, neurological and brain disease. Positive factors that influence developmental delays: female gender, antenatal steroids and breastfeeding.	Factors to consider (Drug exposure, head ultrasound anomalies, neurological and brain disease) Gestational age Birth weight Gender	✓	✓	✓			✓				✓	

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
					Maternal data											
Kalia *et al*., 2009	Comparison of enrolment in interventional therapies between late-preterm and very preterm infants at 12 months corrected age	United States of America	Experimental study	Late preterms are also at risk of experiencing developmental delays and should not be regarded as near term infants. Factors which can lead to neurological insults, and thus poor developmental outcomes include, 5min APGAR, apnoea of prematurity, respiratory distress syndrome, length of stay in the hospital and bronchopulmonary dysplasia.	Factors to consider (5 min APGAR, length of stay in hospital) Medical conditions (Neurological insults, apnoea of prematurity, respiratory			✓			✓	✓				

Author Year of publication	Study title	Geographical area discussed	Methodology	Findings of study	Identified component in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
					distress syndrome, bronchopulmo-nary dysplasia) Gestational age											

Tabel 3: Concluding statements and proposed items to be included in a screening instrument to detect preterm infants' developmental delays

Categories	Components	Concluding statement	Proposed items for tool	Specific items
Infant data	Birth Weight	Low birth weight of less than or equal to 2500 gram can be an indicator of potential developmental delays	What is the infant's birth weight?	Determine the birth weight and current weight (has the infant gained weight).
	Gestational age	Infants born <28 weeks gestational age are at increased risk of experiencing developmental delays.	At what gestational age was the infant born?	How many weeks gestation was the mother at the time of the birth.
	Infant specific	Infants can be misdiagnosed if not screened as an individual and can be treated wrongfully.	Focus on each infant's unique needs and focus on follow-up and referrals.	Has any delays been identiefied.
	Gender	A male infant is a greater risk to experience developmental delays.	Male or female?	Gender specific.

Categories	Components	Concluding statement	Proposed items for tool	Specific items
	Corrected age/ Follow-up date	Early identification, during the first year of life could results in early interventions. Corrected age should be utilized to prevent incorrect interpretation of screening results.	The corrected/adjusted age should be determined and follow-up dates should be infant-specific.	Corrected age is chornological age subtracted by number of weeks premature. Depending on the corrected age, but this would be a contiuous follow-up for infants.
Medical data	Medical conditions	If the infant has any medical conditions due to prematurity, the focus should be on that specific medical area. Hospital readmissions should be considered during follow-up screenings, to determine the	Determine any conditions that could influence hospital readmission(s).	Conditions such as congenital heart defects, respiratory defects, any surgery or hospital readmission due to exisisitng medical

Categories	Components	Concluding statement	Proposed items for tool	Specific items
		severity of the condition.		conditions.
	Factors to consider	The mentioned factors should indicate how well the infant had adapted to extra-uterine life, and also what factors could cause future developmental delays	Determine any of the following factors' presence as they could influence developmental outcomes: 5 min APGAR (should have adapted to the extra-uterine life by this time), duration of hospitalization, basic neurological function/intactness, receptive function, expressive function, cognitive function, infant feeding, locomotor	5 min APGAR score. Hospital stay after birth. (Dis)organized suck-swollow-breath reflex. Reaction to sound and stimulation. Response to parental bonding. Reflexes present. List of medication received. Diagnosis on admission and

Categories	Components	Concluding statement	Proposed items for tool	Specific items
			movements and posture, fine manipulation, hearing, interactive social, speech and language, self-care, vision, admission to a NICU, environment, medication used, body structure, body function, activities and participation, early executive function, sepsis, length and head circumference, sucking, general movements, drug exposure, head ultrasound anomalies, neurological and	discharge from NICU. Meassurements of the infant. Any anomalies known and what they are, does the infant receive any treatment for it.

Categories	Components	Concluding statement	Proposed items for tool	Specific items
			brain disease.	
	Vital Signs	Vital signs play a great role in brain maturation and if the vital signs deviate from the normal vital signs at a specific age, inflammatory stress should be suspected and appropriate interventions implemented.	With every follow-up screening vital signs of infant should be determined and recorded.	Determine vital signs with evey visit.
Parental data	Maternal factors	Maternal information is important as it can determine the outcome of the infant due to the daily maternal inputs	Age, education, smoking during pregnancy, antenatal steroids, premature rupture of membranes and mode of the baby's birth.	Maternal history taken, such as a medication list during pregnancy, and gyneacological as well as obstetric history.
	Parental	Parental information can be valuable for a health care practitioner, the focus should	An interview with the parent who brings the infant for the	A list of concerns should be compiled, such as

Categories	Components	Concluding statement	Proposed items for tool	Specific items
	information	thus be on the area of parental concern.	screening process focussing on the parent's concerns about the baby's development.	unreached milestones.

CHAPTER 3: CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

3.1 Introduction

Throughout this study the aims, objective, study design, methodology, appraisal, analysis and synthesis, as well as the results, were discussed. The aims and objective were reached as stated in the conclusions based on the reviewed studies. Limitations are addressed later in this chapter. Recommendations are suggested by the researcher related to the findings of this study. This chapter summarises the findings of the ILR.

3.1.1 Aim and objective

Even though this study forms part of a larger research project, concerned with premature infants' development, this study's aim was to contribute to the development of a tool that could be used in a resource-restricted setting were healthcare professionals have limited skills, knowledge and experience in the field of the early detection of developmental delays in prematurely born infants.

The researcher formulated the following objective to reach the aim:

- To explore and describe the best available evidence regarding components to be included in a screening instrument, which aims to detect preterm infants' developmental delays during follow-up visits during the first year of life.

3.1.2 Conclusion: aim and objective

The objective specified for this study had been accomplished. By exploring the best available evidence, regarding developmental delays in premature infants, the components of a screening tool were identified and formulated based on the literature review's results.

3.2 Conclusion: literature review

This study consists of background information (Chapter 1: Introduction and background information), a thorough overview of existing information was provided and the need for conducting this study was addressed. Information gathered and synthesized was presented in an article format (Chapter 2: Article).

There are screening tools available for conducting new born babies' follow-up assessments but no one was appropriate for use as a premature screening tool in a resource-restricted context.

However, literature supports the need for a screening tool to identify developmental delays during the first year of life. The aim and objective of the current study attempted to identify components to be included in a screening tool for the assessment of prematurely born infants, in resource-restricted settings.

During this research, 30 studies were identified which and categorised as providing good quality evidence and which answered the research question in a thorough manner. Out of these 30 studies, 24 were identified of which 20 answered the research question and identify the 11 components, 4 studies which supported the 20 studies answers. The 11 components that should be included in a screening tool for assessing prematurely born infants, and four supportive studies which acted as guidelines for the included studies were also included. The following 11 components were identified:

- Factors to consider (when screening an infant)
- Gestational age
- Gender
- Corrected age
- Infant specific
- Maternal data
- Birth weight
- Medical conditions
- Follow-up dates
- Parental information
- Vital signs

These components which were extracted from the 24 studies are presented in a table (see appendix G). The components were further classified into three new categories as:

1: Infant data: birth weight, gestational age, infant specific, gender, corrected age and follow-up dates.
2: Medical data: factors to consider (when screening an infant), medical conditions, vital signs, and

3: Parental data: parental information and maternal data.

Based on the findings of the current study, the components of of the screening tool address developmental delays in all domains:

Table 3-1: Components and domains

Categories	Component	Domains
Infant data	Gestational age	Gross and fine motor skills, cognition language and speech, personal/social activities or daily tasks
	Gender	Cognition, language and speech
	Corrected age	Gross and fine motor skills, cognition language and speech, personal/social activities or daily tasks
	Infant specific	Gross and fine motor skills, cognition language and speech, personal/social activities or daily tasks
	Birth weight	Gross and fine motor skills, cognition language and speech, personal/social activities or daily tasks
	Follow-up dates	When to do follow-up assessments depends on all domains and is individualized by each preterm infant's unique needs
Medical data	Medical conditions	Gross and fine motor skills, cognition language and speech, personal/social activities or daily tasks
	Factors to consider	Gross and fine motor skills, cognition language and speech, personal/social activities or daily tasks
	Vital signs	Gross and fine motor skills, cognition language and speech, personal/social activities or daily tasks
Parental data	Maternal data	Personal/social activities or daily tasks
	Parental information	Personal/social activities or daily tasks

Evidence showed that a screening tool for conducting follow-up assessments of prematurely born infants should be infant specific, but the identified categories should be individualized according to each infant's needs. Birth weight is one of the critical factors, alongside gestational age, which could have a major influence on the outcomes. A short gestation period implies a

low birth weight, thus increasing the likelihood of developmental delays (Lenke, 2003:104-109), due to the increased risk for complications ascribed to prematurity and incompletely developed organs and body systems. A parent has an idea of how the infant should develop, which plays a role in the actual development of an infant (Cusson, 2003:402-409). Thus it is important to obtain parental information about the development of a child, as parents are able to recall past events which could be helpful to identify possible developmental delays. Premature infants might be prone to develop medical conditions due to their premature condition, causing increased hospital readmissions after discharge from the NICU. Medical conditions could be the major cause of cognitive deficits, requiring special education (Purdy & Melwak, 2012:221-226). Gender implies a biological risk factor as males have a slower rate of developmental/maturity (Van de Weijer-Bergsma *et al.*, 2010:606-612). In order to improve the infant-specific approach the infant's chronological age should not be used during the screening, but rather the infant's corrected age, to decrease the chance of false interpretation of results. A lower gestational age leads to lower birth weight, and thus an increased risk of developmental delays. However, late preterm infants should not be regarded as term infants, as they also experienced an interruption in the structural and functional development of foetal organs, similar to preterm infants of lower gestational age and lower birth weight. The importance of parental input and maternal data should be recognised, as these are the people who spend most time with the infant.

3.3 Limitations of this study

Limitations for this study are listed below:

- The need for a screening tool, which helps to identify developmental delays in premature infants in a resource-restricted setting, was identified during an in-depth literature review. As only limited literature could be obtained about this topic, the need for the current study, and future similar studies, was emphasized.

- As ILRs are fairly new to the field of nursing research, the study's structure and methodology were influenced by a systematic review's methodology, such as the formulation of a research question.

- Studies published in Afrikaans and English were utilized during the current study, thus limiting the information obtained in order to identify the components needed for a screening tool for assessing prematurely born infants, as studies in other languages were not used. However, relevant reports published in other languages were consulted if their titles and abstracts were in English. In case any relevant article would thus be identified in another language, that article or document would have been translated into English, but this was never necessary.

- The researcher is still a novice researcher with limited experience, which might have impacted on the validity of the study. However guidance and support were received from the researcher's supervisors who are experienced researchers.

3.4 Recommendations

Recommendations are suggested for practice, as well as for future research, based on the findings of the current study:

3.4.1 Recommendations for practice

- Nurses/healthcare professionals who practise in a resource-restricted setting should stay up to date with the evaluation of follow-up tools for prematurely born infants by receiving inservice training or basic education.

- Parents should be aware that their input and information are valuable during screenings to identify possible developmental delays, parents should receive health education in hospital when infant is discharged from the NICU.

- Parents of the premature infants discharged from NICUs should be aware of the milestones a premature baby should reach, and should know about developmental delays that a premature infant could experience.

- Identification of developmental delays should start in the NICU, in order to enhance the individualized screening process. Consequently nurses/healthcare professionals working in NICUs should thus also remain up to date about developmental delays and the identification thereof.

- Identification of developmental delays in prematurely born infants should take place as soon as possible to ensure that early interventions can be implemented. Early interventions could help to decrease the negative impact of developmental delays on the family as well as on society and on the healthcare system.

3.4.2 Recommendations for future research

- A screening tool, with the identified components for detecting developmental delays in premature infants during the first year of life, should be developed as a matter of great urgency.

- As there are no available statistics about prematurely born infants' developmental delays in South Africa, research should be done to discover the extent and the nature of these developmental delays in South Africa.

- After the development and implementation of a screening tool the strengths and weaknesses should be identified in order to improve the components of a screening tool for prematurely born infants.

- When a screening tool has been developed and implemented, it should be used regularly until the baby reaches 24 months of age. This would ensure that developmental delays are not missed, not recognized, wrongfully identified and if any early intervention had been initiated to identify its influence on the outcomes reported for the specific infant.

- As parental information is a component which was identified in this study, future researchers can explore parents' knowledge and experience concerning premature infants' development and developmental delays.

- If a developmental tool has been developed, healthcare professionals, implementing the tool, should be trained to ensure accuracy of the identification of developmental delays. Regular checks, audits and observations should be sustained to ensure that the tool is implemented correctly during premature infants' assessments.

- A community project for screening of premature babies at well baby clinics up to the age of two years can be conducted. This will provide a retrospective case control study as well as correlate the age-specific outcomes up to two years of age, with interventions implemented.

3.5 Closing statement

Worldwide 14% of babies are born prematurely annually (UNICEF & WHO, 2004). Premature infants have an increased risk for experiencing developmental delays due to the interruption of vital structural and organ development and the demanding adaptation to extra-uterine life (Levene *et al.*, 2008). Developmental delays can be categorized into; global delays occurring across all developmental domains, and isolated delays which affect only domain (Carisch, 2009). The domains are: gross and fine motor skills, cognition, language and speech, personal/ social activities or daily tasks (Masri *et al.*, 2011:810-815). Developmental delays, which go undetected, could have a major impact on a family and on health care services as well as on the education system (Poon *et al.*, 2010:415-422).

In conclusion, the researcher can declare that the aim and objective of this study have been accomplished. The aim was to identify the components needed for a screening tool for

prematurely born infants to identify developmental delays during the first year of life. The best quality evidence available was utilized in order to reach the aim. The ILR methodology was used in order to gain structure during the research process. The aim and objective have been successfully reached and the research question has been answered.

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APPENDIX A: Ethical approval

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7 September 2015

Dr W Lubbe
Nursing Science

Dear Dr Lubbe

ETHICS APPLICATION: NWU-00332-15-S1 (W LUBBE-Z WESSELS) COMPONENTS OF A TOOL FOR EARLY DETECTION OF DEVELOPMENTAL DELAYS IN PRETERM INFANTS: AN INTETRATIVE LITERATURE REVIEW

APPROVAL

The executive committee has reviewed your application. They felt it is a well written application and that overall the process indicated is appropriate and effective by also using some of the rigorous methods used in a systematic review.

The following comment could improve the quality of your science:

On Pg. 11 where the PIOTS strategy is explained, the applicants must specify exactly which outcomes (O in the PIOTS) they will be looking at. This is an important part to ensure that the literature search is done in an *a priori* way. In the protocol the applicants discuss the main areas of developmental delays, and these will serve as their outcomes. This should be discussed in detail.

This application has been approved.

Yours sincerely

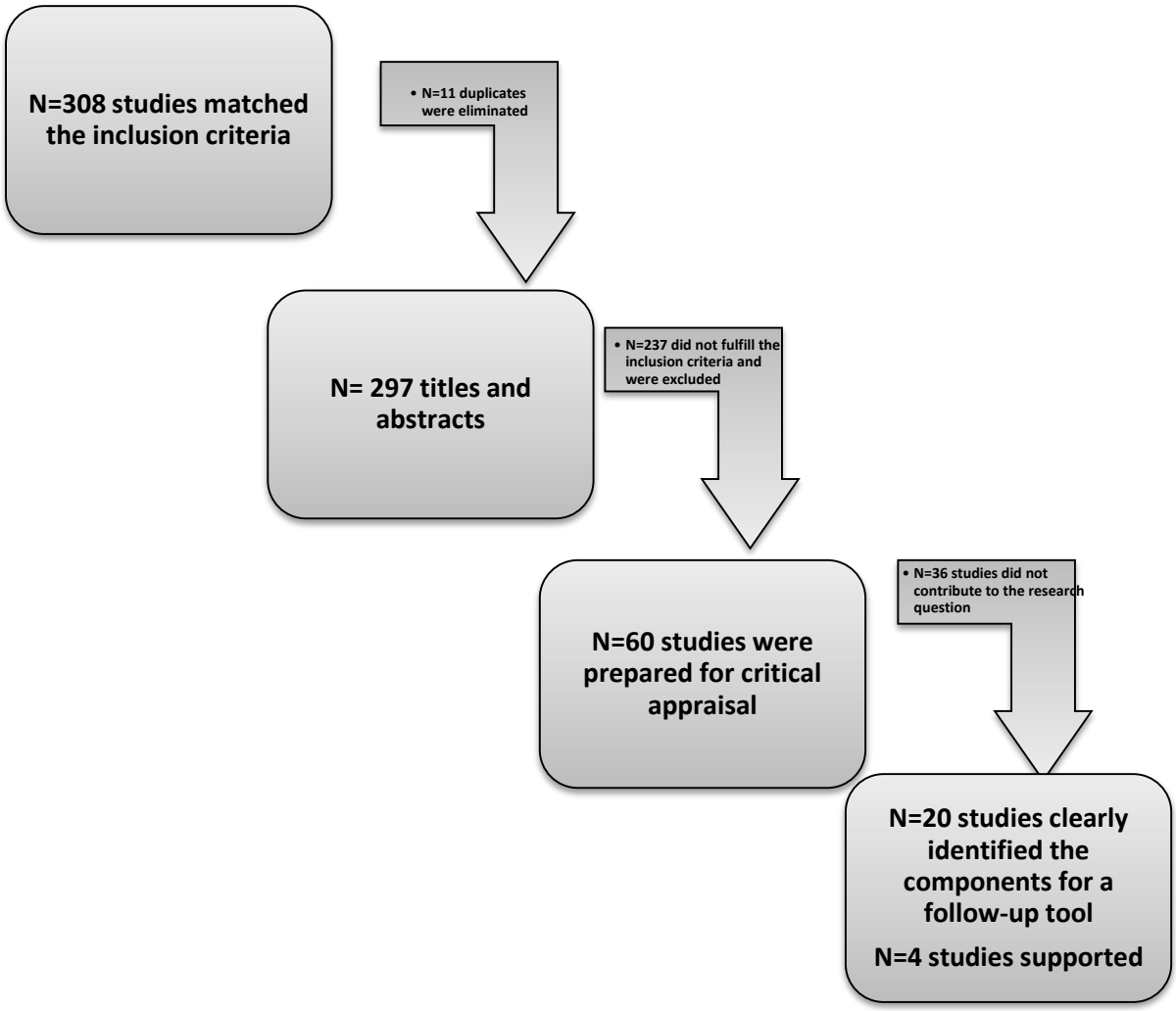
Prof Minrie Greeff
HREC Chairperson

Current details: (13210572) C:\Users\13210572\Documents\HREC\HREC - Applications\2015 Applications\Applications 08 - 10 September 2015\NWU-00332-15-S1 (W Lubbe-Z Wessels)\NWU-00332-15-S1 (W Lubbe-Z Wessels) - AL\NWU-00332-15-S1 (W Lubbe-Z Wessels) - AL.docm
7 September 2015

File reference: 9.1.5.3

1

APPENDIX B: PRISMA FLOW DIAGRAM



APPENDIX C: Johns Hopkins Evidence Appraisal Instrument (Research)

(Newhouse *et al.* 2007:206-211)

JHNEBP Research Evidence Appraisal

Evidence Level:_____

ARTICLE TITLE:					NUMBER:
AUTHOR(S):					DATE:
JOURNAL:					
SETTING:				SAMPLE (COMPOSITION/SIZE)	
☐ Experimental	☐ Meta-analysis	☐ Quasi-experimental	☐ Non-experimental	☐ Qualitative	☐ Meta-synthesis
Does this study apply to my patient population?				☐Yes	☐No
If the answer is No, STOP here (unless there are similar characteristics).					
Strength of Study Design					
• Was sample size adequate and appropriate?				☐Yes	☐No
• Were study participants randomized?				☐Yes	☐No
• Was there an intervention?				☐Yes	☐No
• Was there a control group?				☐Yes	☐No
• If there was more than one group, were groups equally treated, except for the intervention?				☐Yes	☐No
• Was there adequate description of the data collection methods				☐Yes	☐No
Study Results					
• Were results clearly presented?				☐Yes	☐No
• Was an interpretation/analysis provided?				☐Yes	☐No
Study Conclusions					
• Were conclusions based on clearly presented results?				☐Yes	☐No
• Were study limitations identified and discussed?				☐Yes	☐No
PERTINENT STUDY FINDINGS AND RECOMMENDATIONS					
Will the results help me in caring for my patients?				☐Yes	☐No

Evidence Rating (scales on back)

Strength of Evidence Rating			
Quality Rating (check one)	☐ High (A)	☐ Good (B)	☐ Low/major flaws(C)

APPENDIX D: Johns Hopkins Evidence Appraisal Instrument (Non-research)

(Newhouse *et al.* 2007:206-211)

JHNEBP Non-Research Evidence Appraisal

Evidence Level:_____

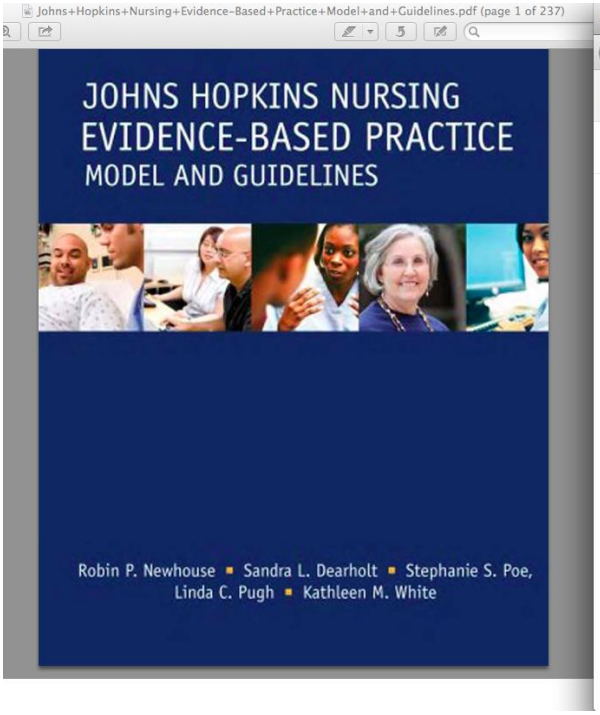
ARTICLE TITLE:			NUMBER:
AUTHOR(S):			DATE:
JOURNAL:			
☐ Systematic Review	☐ Clinical Practice Guidelines	☐ Organizational (QI, financial data)	☐ Expert opinion, case study, literature review

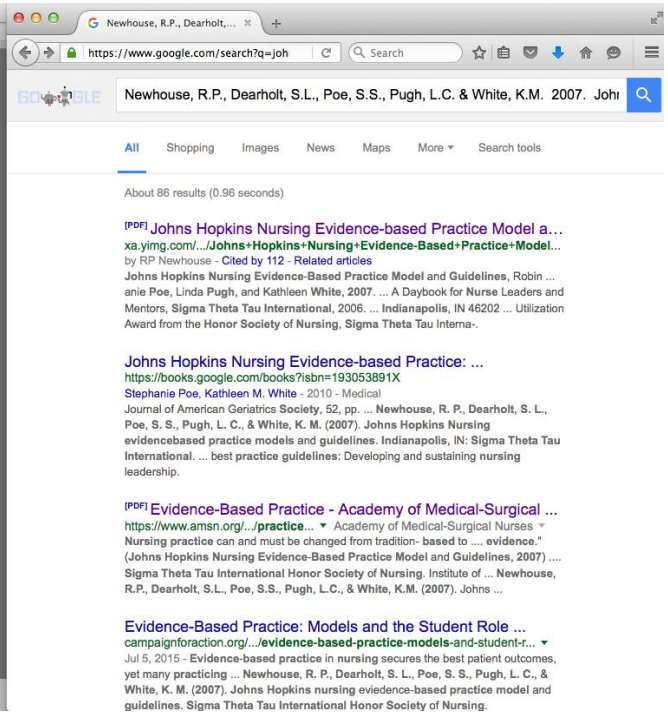
Does review/expert opinion address my practice question?	☐ Yes	☐ No
If the answer is No, STOP here (unless there are similar characteristics).		
Systematic Review		
• Is the question clear?	☐ Yes	☐ No
• Are search strategies specified, and reproducible?	☐ Yes	☐ No
• Are search strategies appropriate to include all pertinent studies?	☐ Yes	☐ No
• Are criteria for inclusion and exclusion of studies specified?	☐ Yes	☐ No
• Are details of included studies (design, methods, analysis) presented?	☐ Yes	☐ No
• Are methodological limitations disclosed?	☐ Yes	☐ No
• Are the variables in the studies reviewed similar, so that studies can be combined?	☐ Yes	☐ No
Clinical Practice Guidelines		
• Were appropriate stakeholders involved in the development of this guideline?	☐ Yes	☐ No
• Are groups to which guidelines apply and do not apply clearly stated?	☐ Yes	☐ No
• Have potential biases been eliminated?	☐ Yes	☐ No
• Were guidelines valid (reproducible search, expert consensus, independent review, current, and level of supporting evidence identified for each recommendation)?	☐ Yes	☐ No
• Are recommendations clear?	☐ Yes	☐ No
Organizational Experience		
• Was the aim of the project clearly stated?	☐ Yes	☐ No
• Is the setting similar to setting of interest?	☐ Yes	☐ No
• Was the method adequately described?	☐ Yes	☐ No
• Were measures identified?	☐ Yes	☐ No
• Were results adequately described?	☐ Yes	☐ No
• Was interpretation clear and appropriate?	☐ Yes	☐ No
Individual expert opinion, case study, literature review		
• Was evidence based on the opinion of an individual?	☐ Yes	☐ No
• Is the individual and expert on the topic?	☐ Yes	☐ No
• Is author's opinion based on scientific evidence?	☐ Yes	☐ No
• Is the author's opinion clearly stated?	☐ Yes	☐ No
• Are potential biases acknowledged?	☐ Yes	☐ No
PERTINENT CONCLUSIONS AND RECOMMENDATIONS		
Were conclusions based on the evidence presented?	☐ Yes	☐ No
Will the results help me in caring for my patients?	☐ Yes	☐ No

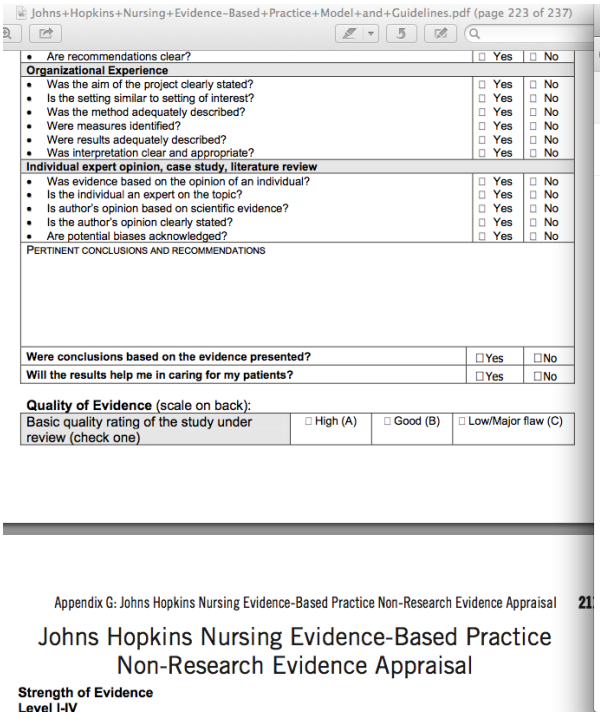
Quality Rating (scale on back):

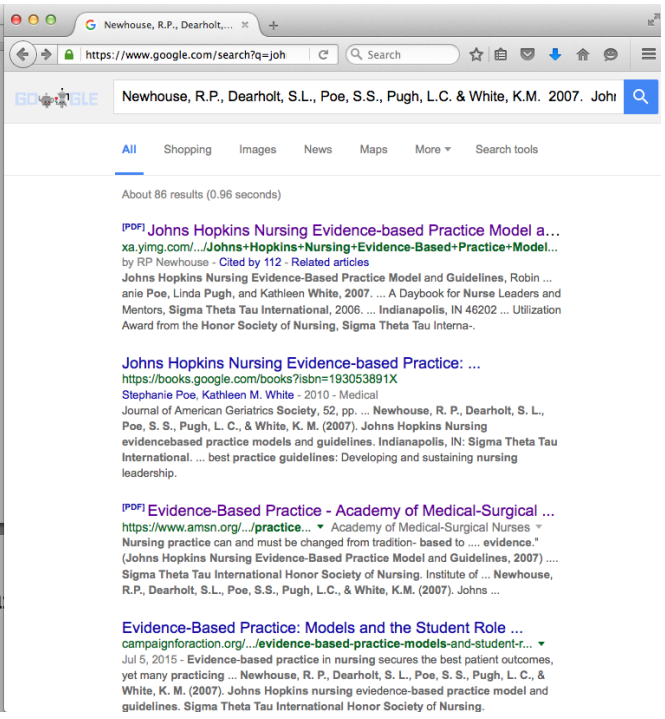
Basic quality rating of the study under review (check one)	☐ High (A)	☐ Good (B)	☐ Low/major flaws(C)

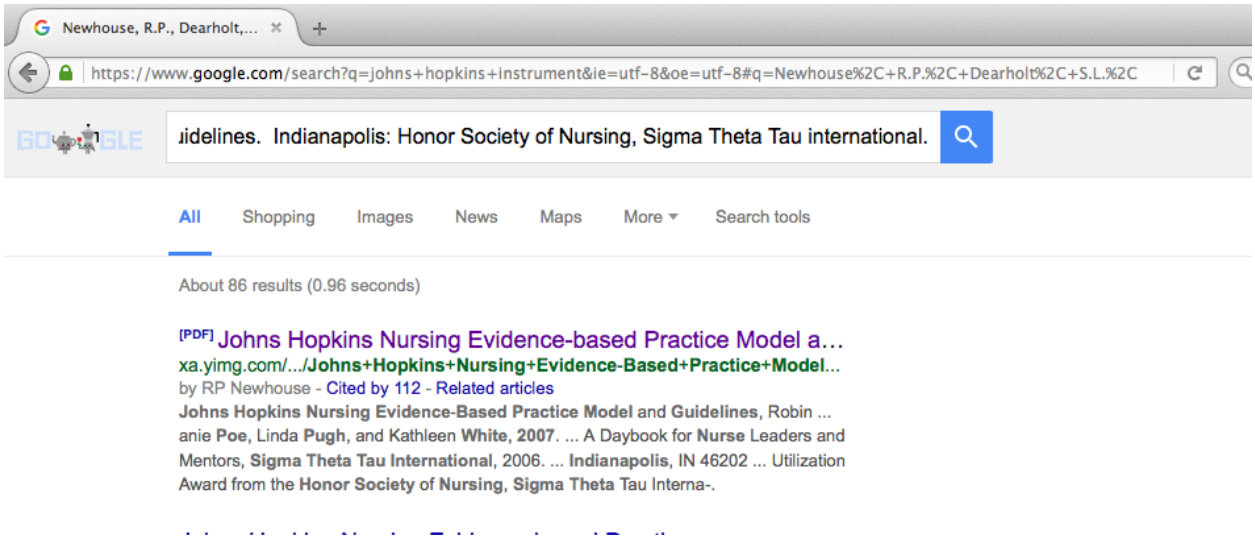
APPENDIX E: Johns Hopkins Evidence Appraisal Instrument (Permission granted online, due to an open source on google)










Newhouse, R.P., Dearholt,...
https://www.google.com/search?q=johns+hopkins+instrument&ie=utf-8&oe=utf-8#q=Newhouse%2C+R.P.%2C+Dearholt%2C+S.L.%2C
ıidelines. Indianapolis: Honor Society of Nursing, Sigma Theta Tau international.
All
Shopping
Images
News
Maps
More
Search tools
About 86 results (0.96 seconds)
[PDF] Johns Hopkins Nursing Evidence-based Practice Model a…
xa.yimg.com/.../Johns+Hopkins+Nursing+Evidence-Based+Practice+Model...
by RP Newhouse - Cited by 112 - Related articles
Johns Hopkins Nursing Evidence-Based Practice Model and Guidelines, Robin ...
anie Poe, Linda Pugh, and Kathleen White, 2007. ... A Daybook for Nurse Leaders and
Mentors, Sigma Theta Tau International, 2006. ... Indianapolis, IN 46202 ... Utilization
Award from the Honor Society of Nursing, Sigma Theta Tau Interna-.

APPENDIX F: Excluded sources

Please refer to the exclusion criteria discussed in chapter one, this table was directly imported from EPPI-reviewer. The descriptions of the excluded criteria were as follows:

Exclude on source: The place the document was publish was a secondary source, such as a book, which forms part of the exclusion criteria

Excluded on relevance: The study did not address the review question after the title was read

Exclude on date: The study was outdated and a newer version was available

Exclude on title: The title of the study did not address the review question

Excluded on abstract: Abstract was read and the study was excluded as it did not address the review question

Short Title	Title	Exclusion
Aagaard-Tillery (2012)	Contributors	• EXCLUDE on source [Info] *Published in a book excluded*
Allen (2005)	Chapter 67 - Risk assessment and neurodevelopmental outcomes	• EXCLUDE on source
Altimier (2013)	The Neonatal Integrative Developmental Care Model: seven neuroprotective core measures for family-centered developmental care	• EXCLUDE on relevance
Araújo (2013)	Factors associated with late motor development in premature children admitted to a neonatology unit	• EXCLUDE on relevance
Ashkenazi-Hoffnung (2014)	Nosocomial respiratory syncytial virus infections in the palivizumab-prophylaxis era with implications	• EXCLUDE on relevance

Short Title	Title	Exclusion
	regarding high-risk infants	
Atkinson (2008)	Vision disorders and visual impairment	• EXCLUDE on source • EXCLUDE on date • EXCLUDE on relevance
Back (2005)	Chapter 63 - Congenital malformations of the central nervous system	• EXCLUDE on source • EXCLUDE on date • EXCLUDE on relevance
Banta-Wright (2003)	Not so rare: errors of metabolism during the neonatal period	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Berde (2003)	Chapter 37 - Pain in children	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Bolisetty (2014)	Intra-ventricular hemorrhage and neurodevelopmental outcomes in extreme preterm infants	• EXCLUDE on abstract
Bondurant (2003)	Developmentally supportive care in the newborn intensive care unit: early intervention in the community	• EXCLUDE on date • EXCLUDE due to title • EXCLUDE on abstract
Boyd (2013)	Social–emotional delays at 2 years in extremely low gestational age survivors: correlates of impaired orientation/engagement and emotional regulation	• EXCLUDE on relevance [Info] *Age is irrelevant* • EXCLUDE due to title • EXCLUDE on abstract

Short Title	Title	Exclusion
Bozzette (2007)	A review of research on premature infant-mother interaction	• EXCLUDE on date • EXCLUDE due to title • EXCLUDE on abstract
Mahurin-Smith	Breastfeeding and language outcomes: a review of the literature	• EXCLUDE due to title • EXCLUDE on abstract
Brodlie (2008)	Prostaglandin therapy for ductal patency: how long is too long?	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Brown (1997)	The effect of developmental care on preterm infant outcome	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE on abstract
Cabral (2015)	Motor development and sensory processing: a comparative study between preterm and term infants.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Campbell (2005)	Chapter 3 - The quest for measurement of infant motor performance	• EXCLUDE on source
Carlson (1997)	Long-chain polyunsaturated fatty acid supplementation of preterm infants	• EXCLUDE on source • EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract

Short Title	Title	Exclusion
Carreiro (2003)	Chapter 5 - The respiratory system	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Carreiro (2003)	Chapter 12 – Gastroenterology	• EXCLUDE on source • EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title
Carreiro (2003)	Chapter 11 – Pulmonology	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Carreiro (2009)	Chapter 10 - Movement, perception and cognitive development	• EXCLUDE on source
Cataltepe (2008)	Chapter 5B - Surgical management of hydrocephalus and postoperative care of the shunted patient	• EXCLUDE on source • EXCLUDE on relevance • EXCLUDE due to title
Chiu (2012)	Transforming mother-infant interaction within cultural and caregiving contexts: home-based occupational therapy for preterm infants	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Cho (2007)	Gender and racial differences in the looking and talking behaviors of mothers and their 3-Year-old prematurely born children	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Chow (2007)	Chapter 198 - Radiology for the pediatric hospitalist	• EXCLUDE on source • EXCLUDE on relevance

Short Title	Title	Exclusion
		• EXCLUDE due to title
Cole (1994)	Paediatric physiotherapy: a review of some contributions made in Australia since 1954	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Cornette (2002)	Magnetic resonance imaging of the infant brain: anatomical characteristics and clinical significance of punctate lesions	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Courage (2008)	Attention	• EXCLUDE on source • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Cuttini (2012)	Cognitive assessment of very preterm infants at 2-year corrected age: performance of the Italian version of the PARCA-R parent questionnaire	• EXCLUDE on relevance [Info] *Age is irrelevant*
Dale (2008)	Chapter 21 - Pediatrics	• EXCLUDE on source • EXCLUDE due to title
Darcy (2012)	State of the science: the association between perinatal brain injury and school performance in very-low-birth-weight infants	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Davis (2000)	Long-term follow-up of premature infants treated	• EXCLUDE on date

Short Title	Title	Exclusion
	with prophylactic, intra-tracheal recombinant human CuZn superoxide dismutase.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Davis (2005)	Visual perceptual skills in children born with very low birth weights	• EXCLUDE on relevance [Info] *Participants are age inappropriate*
De Graaf (2011)	Long-term effects of routine morphine infusion in mechanically ventilated neonates on children's functioning: five-year follow-up of a randomized controlled trial	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
De Wolfe (2007)	Chapter 74 - Apparent life-threatening event, infant apnea, and pediatric obstructive sleep apnea syndrome	• EXCLUDE on source • EXCLUDE due to title
Dihigo (1998)	New strategies for the treatment of colic: modifying the parent/infant interaction	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title
Dixon (2006)	Chapter 8 - Neonatal intensive care unit: special issues for the at-risk infant and family	• EXCLUDE on source • EXCLUDE due to title
Donangelo (2003)	Lactation/human milk: composition and nutritional value	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Doyle (2010)	Pulmonary and neurological follow-up of extreme preterm infants.	• EXCLUDE on relevance • EXCLUDE due to title

Short Title	Title	Exclusion
DRACK (2005)	Chapter13 - Pediatric ophthalmology*	• EXCLUDE on source • EXCLUDE due to title
Berk & Friman (1991)	Epidemiologic aspects of toilet training	• EXCLUDE on date • EXCLUDE due to title
Regina	Factors influencing language development in preterm infants.	• EXCLUDE duplicate
Fair (2008)	Brain development	• EXCLUDE on source
Fanaroff (2001)	Index	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Feldman (1994)	Language abilities following prematurity, periventricular brain injury, and cerebral palsy	• EXCLUDE on date • EXCLUDE on relevance
Ferrari (2011)	Prem Baby Triple P: a new parenting intervention for parents of infants born very preterm: acceptability and barriers	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Field (2000)	Chapter 1 - Enhancing growth	• EXCLUDE on source [Info] *Secondary source (Book)* • EXCLUDE on date [Info] *Exclude due to date 2000* • EXCLUDE duplicate [Info] *Not a duplicate* • EXCLUDE on relevance

Short Title	Title	Exclusion
		[Info] *Irrelevant* • EXCLUDE on version [Info] *Secondary source in a book* • EXCLUDE on non-expert opinion [Info] *In a book, expert opinion*
Field (2006)	Appendix 1 - Massage therapy abstracts	• EXCLUDE on source • EXCLUDE due to title
Filippi (2014)	Lesions of the corpus callosum and other commissural fibers: diffusion tensor studies	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Fischer (2010)	Severe postnatally acquired cytomegalovirus infection presenting with colitis, pneumonitis and sepsis-like syndrome in an extremely low birth weight infant.	• EXCLUDE due to title
FitzGerald (2005)	An analysis of high myopia in a pediatric population less than 10 years of age	• EXCLUDE on relevance • EXCLUDE due to title
Fritz (2014)	Neonatal neurosonography	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Gardner (1991)	Physiologic sequelae of prematurity: The nurse practitioner's role. Part V. Feeding difficulties and growth failure (pathophysiology, cause, and data collection)	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title

Short Title	Title	Exclusion
Ghaddhab (2012)	Hypoglycemia and nitro-oxidative stress in the neonatal period.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Giménez (2008)	Accelerated cerebral white matter development in preterm infants: a voxel-based morphometry study with diffusion tensor MR imaging.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Golden (2004)	Chapter 7 - Thyroid disease d during pregnancy	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Gottesman (2003)	Helping parents make sense of ADHD diagnosis and treatment	• EXCLUDE on date • EXCLUDE due to title
Govaert (2003)	Changes in globus pallidus with (pre)term kernicterus	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Grau (2015)	Normal intellectual development in children born from women with hypothyroxinemia during their pregnancy	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Greenfeld (2003)	Obstructive sleep apnea syndrome due to adenotonsillar hypertrophy in infants	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract

Short Title	Title	Exclusion
Greenough (2006)	Editorial	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Allen & Alexander (1991)	Gross motor milestones in preterm infants: correction for degree of prematurity	• EXCLUDE on date • EXCLUDE due to title
Guerrini (2009)	Chapter 5 - Epilepsy in cerebral palsy	• EXCLUDE on source
Phillips	Guest Editorial: Neuroprotection in the NICU	• EXCLUDE due to title
Guillerman (2010)	Infant craniospinal ultrasonography: beyond hemorrhage and hydrocephalus	• EXCLUDE on relevance • EXCLUDE due to title
Gupta (2008)	Chapter 3D - Intrauterine growth restriction	• EXCLUDE on source • EXCLUDE due to title
Halbwachs (2013)	Usefulness of parent-completed ASQ for neurodevelopmental screening of preterm children at five years of age	• EXCLUDE duplicate • EXCLUDE due to title • EXCLUDE on relevance
Halliday (2000)	Early postnatal (<96 hours) corticosteroids for preventing chronic lung disease in preterm infants	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title
Hanebutt (2008)	Long-chain polyunsaturated fatty acid (LC-PUFA)	• EXCLUDE on relevance

Short Title	Title	Exclusion
	transfer across the placenta	• EXCLUDE due to title • EXCLUDE on abstract
Hansen (2005)	Chapter 43 - Control of breathing	• EXCLUDE on source • EXCLUDE due to title
Hellström-Westas (2005)	Electroencephalography and brain damage in preterm infants.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Hendricks-Muñoz (2002)	Developmental care: the impact of Wee Care developmental care training on short-term infant outcome and hospital costs	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Herrero (2011)	Escalas de desenvolvimento motor em lactentes: test of infant motor performance on the Alberta Infant Motor Scale. (Portuguese)	• EXCLUDE on abstract
Hitchcock (2010)	Letter from Australia	• EXCLUDE due to title
Holditch-Davis (2000)	Developmental problems and interactions between mothers and prematurely born children	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title
Hou (2012)	Cerebellar hemorrhage in the extreme preterm infant.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract

Short Title	Title	Exclusion
Hudson (2013)	Hospital readmissions and repeat emergency department visits among children with medical complexity: an integrative review	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Hume (2005)	Glucose homeostasis in the newborn.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Hummel (2003)	Parenting the high-risk infant	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title
Hunter (2002)	Effect of sleep and play positions on infant development: reconciling developmental concerns with SIDS prevention	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
In other journals (1999)	In other journals	• EXCLUDE on date • EXCLUDE due to title
In the Literature.	In the Literature.	• EXCLUDE on relevance • EXCLUDE due to title
Index to volume 2 Author... (1988)	Index to volume 2 author index	• EXCLUDE on date • EXCLUDE due to title
Innis (1997)	Polyunsaturated fatty acid nutrition in infants born at term	• EXCLUDE on source • EXCLUDE on relevance • EXCLUDE due to title

Short Title	Title	Exclusion
		• EXCLUDE on abstract
Iwata (2007)	Abnormal white matter appearance on term FLAIR predicts neuro-developmental outcome at 6 years old following preterm birth.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Iwata (2007)	Abnormal white matter appearance on term FLAIR predicts neuro-developmental outcome at 6 years old following preterm birth.	• EXCLUDE duplicate
Jangaard (2008)	Outcomes in a population of healthy term and near-term infants with serum bilirubin levels of ≥325 µmol/L (≥19 mg/dL) who were born in Nova Scotia, Canada, between 1994 and 2000.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Janssen (2008)	Influence of behaviour and risk factors on motor performance in preterm infants at age 2 to 3 years.	• EXCLUDE on relevance • EXCLUDE due to title
Jones (2007)	Cerebral palsy: introduction and diagnosis (Part I)	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Jones (2007)	Primary care of the child with cerebral palsy: a review of systems (Part II)	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
July 2015 New in... (2015)	July 2015 New in Review	• EXCLUDE due to title
Kanazawa (2014)	Subcutaneous fat accumulation in early infancy is more strongly associated with motor development	• EXCLUDE on relevance • EXCLUDE due to title

Short Title	Title	Exclusion
	and delay than muscle growth.	
Kanemaru (2013)	Specific characteristics of spontaneous movements in preterm infants at term age are associated with developmental delays at age 3 years.	• EXCLUDE on relevance • EXCLUDE due to title
Kaur (2014)	Reliability and repeatability of quantitative tractography methods for mapping structural white matter connectivity in preterm and term infants at term-equivalent age.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Keane (2004)	Chapter 13 - Failure to thrive and malnutrition	• EXCLUDE on source • EXCLUDE on date
Kelly (2012)	Comparison of functional status of 8-12 year old children born prematurely: an integrative review of literature	• EXCLUDE on relevance • EXCLUDE due to title
Kennedy (1999)	Growth patterns and nutritional factors associated with increased head circumference at 18 months in normally developing, low-birth-weight infants	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title
Kenner (1998)	Career opportunities for neonatal nurses	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title
Kenner (2007)	Transition to home: family perspectives on care in Russia	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Kessenich (2003)	Developmental outcomes of premature, low birth	• EXCLUDE on date

Short Title	Title	Exclusion
	weight, and medically fragile infants	
Kidokoro (2010)	Absent cyclicity on aEEG within the first 24 hours is associated with brain damage in preterm infants	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Kiechl-Kohlendorfer (2010)	Smoking in pregnancy: a risk factor for adverse neurodevelopmental outcome in preterm infants?	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Kiechl-Kohlendorfer (2015)	Effect of developmental care for very premature infants on neurodevelopmental outcome at 2 years of age	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Kliegman (2004)	Chapter 5 - Airway obstruction in children	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Klinger (2000)	Controversies in antenatal corticosteroid treatment	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Kuiri-Hänninen (2011)	Postnatal developmental changes in the pituitary-ovarian axis in preterm and term infant girls	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Kültürsay (2012)	Probiotics in the prevention of necrotizing enterocolitis in preterm infants. Premature	• EXCLUDE on relevance • EXCLUDE due to title

Short Title	Title	Exclusion
	bebeklerde nekrotizan enterokolitten korunma amaci ile probiyotik kullanm.	• EXCLUDE on abstract
Lacey (2004)	Assessment of neurological status in preterm infants in neonatal intensive care and prediction of cerebral palsy	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Langkamp (2001)	Temperament of pre-term infants at 9 months of age.	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Lekskulchai (2000)	Scarf ratio: a method of measuring the scarf sign in preterm born infants	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Lekskulchai (2001)	Effect of a developmental program on motor performance in infants born preterm	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE on abstract
Lennon (2008)	Bayley Scales of Infant Development	• EXCLUDE on source
Li (2013)	Sex and gestational age effects on auditory brainstem responses in preterm and term infants	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Liptak (2004)	Chapter 32 - Mental retardation and	• EXCLUDE on source

Short Title	Title	Exclusion
	developmental disability	• EXCLUDE on date • EXCLUDE due to title
Lobo (2015)	Characterization and intervention for upper extremity exploration and reaching behaviors in infancy	• EXCLUDE on relevance • EXCLUDE on abstract
Loh (2005)	Chapter 95 - Congenital malignant disorders	• EXCLUDE on source • EXCLUDE due to title
Loman (2003)	The use of complementary and alternative health care practices among children	• EXCLUDE on date • EXCLUDE due to title • EXCLUDE on abstract
Lutz (2012)	Feeding problems of neonatal intensive care unit and pediatric intensive care unit graduates: perceptions of parents and providers	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Mace (2008)	Clinical policy: critical issues in the sedation of pediatric patients in the emergency department	• EXCLUDE due to title
Madan (2005)	Chapter 79 - Neonatal hyperbilirubinemia	• EXCLUDE on source • EXCLUDE due to title
Maddalena (2013)	Long term outcomes of preterm birth: the role of epigenetics	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Magriples (2004)	Chapter 1 - Obstetric management of the high-risk patient	• EXCLUDE on source

Short Title	Title	Exclusion
Månsson (2014)	Children born extremely preterm show significant lower cognitive, language and motor function levels compared with children born at term, as measured by the Bayley- III at 2.5 years	• EXCLUDE on source
Martin (2013)	Performance of the Parent Report of Children's Abilities-Revised (PARCA-R) versus the Bayley Scales of Infant Development III	• EXCLUDE on relevance • EXCLUDE on abstract
Martinez (2005)	Chapter 12 - Perinatal substance abuse	• EXCLUDE on source • EXCLUDE due to title
Mason (2004)	Chapter 25 - Substance abuse	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Suttora	Maternal speech to preterm infants during the first 2 years of life: stability and change	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Maunu (2011)	Ventricular dilatation in relation to outcome at 2 years of age in very preterm infants: a prospective Finnish cohort study	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Mayhew (2007)	Chapter 6 - Neonatal care	• EXCLUDE on source
Maypole (2008)	Chapter 5E - Neurodevelopmental assessment and care of premature infants in primary care: an evidence-based approach	• EXCLUDE on source
McAdams (2006)	Ventricular peritoneal shunt infection resulting	• EXCLUDE on relevance

Short Title	Title	Exclusion
	from group B streptococcus	• EXCLUDE due to title
McGrath (1995)	Mastery motivation and cognitive development in 4-year-old children born at various degrees of medical risk	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
McGrath (1997)	Estimating risk and protective indexes in high-risk children	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
McGrath (2002)	Efficacy and utilization of skin-to-skin care in the NICU	• EXCLUDE on date • EXCLUDE on relevance
McLaughlin (2006)	Chapter 86 - Acquired immune dysfunction	• EXCLUDE on source • EXCLUDE due to title
Merewood (2006)	Maternal birthplace and breastfeeding initiation among term and preterm infants: a statewide assessment for Massachusetts	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Meylan (2010)	Severe postnatally acquired cytomegalovirus infection presenting with colitis, pneumonitis and sepsis-like syndrome in an extremely low birth weight Infant	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Milidou (2014)	Gestational age, small for gestational age, and infantile colic	• EXCLUDE on relevance • EXCLUDE due to title

Short Title	Title	Exclusion
		• EXCLUDE on abstract
Miller (2009)	The effects of perinatal morbidity and environmental factors on health status of preterm children at age 12	• EXCLUDE on relevance • EXCLUDE due to title
Mock (2005)	BIOTIN	• EXCLUDE on source • EXCLUDE due to title
Mock (2013)	Biotin: Physiology, dietary sources, and requirements	• EXCLUDE on source • EXCLUDE due to title • EXCLUDE on abstract
Moeskops (2015)	Development of cortical morphology evaluated with longitudinal MR brain images of preterm infants.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Morrow (1995)	Temperament of the infant with myelomeningocele	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Munakata (2013)	Gray matter volumetric MRI differences late-preterm and term infants.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Nahlen (2010)	News flash	• EXCLUDE due to title
Nahlen (2012)	News Flash	• EXCLUDE duplicate

Short Title	Title	Exclusion
		• EXCLUDE due to title
Nasef (2013)	Effect of clinical and histological chorioamnionitis on the outcome of preterm infants.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
New in review (1993)	New in review	• EXCLUDE on date • EXCLUDE due to title
Newnam (2010)	Understanding the inflammatory response of the neonate: clinical implications for caregivers in the neonatal intensive care unit	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
News (2010)	News	• EXCLUDE due to title
Nickel(2008)	Chapter14 - Motor disabilities and multiple handicapping conditions	• EXCLUDE on source • EXCLUDE due to title
Norouzieh (1998)	CEU Comprehensive case management of the preterm infant	• EXCLUDE on relevance • EXCLUDE due to title
Nugent (2008)	Chapter 11 - Supporting parents of premature infants: an infant-focused, family-centered approach	• EXCLUDE on source • EXCLUDE due to title
Palmer (2004)	Strategies for the early diagnosis of cerebral palsy.	• EXCLUDE on date • EXCLUDE due to title • EXCLUDE on abstract

Short Title	Title	Exclusion
Pan (2005)	Chapter 37 - Viral Infections of the fetus and newborn	• EXCLUDE on source • EXCLUDE due to title
Parker (2012)	Neuroprotective strategies for hypoxic ischemic encephalopathy	• EXCLUDE on source
Parker (2012)	Current controversies in neonatal care	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Pauc (2011)	The Babinski sign in sickness and in health	• EXCLUDE on relevance • EXCLUDE due to title
Pedroso (2008)	Reflexes	• EXCLUDE on source • EXCLUDE due to title
Perrin (2008)	Chapter23 - Feeding and eating conditions	• EXCLUDE on source • EXCLUDE due to title
Perrin (2008)	Chapter 7 - Screening and assessment tools	• EXCLUDE on source
Perrin (2008)	Chapter 10 - Developmental-behavioral aspects of chronic conditions	• EXCLUDE on source
Petrie (2012)	Focused attention, heart rate deceleration, and cognitive development in preterm and full-term infants	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Piao (2008)	Chapter 5C - White matter injury	• EXCLUDE on source • EXCLUDE due to title

Short Title	Title	Exclusion
Poskitt (2003)	Infants/feeding problems	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Pountney (2004)	Chapter 18 - The cerebral palsies and motor learning disorders	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Kültürsay	Prematüre bebeklerde nekrotizan enterokolitten korunma amacı ile probiyotik kullanımı. (Turkish)	• EXCLUDE on relevance • EXCLUDE due to title
Ruffini	Pulmonary hypertension in a premature infant with bronchopulmonary dysplasia	• EXCLUDE due to title
Rabie (2015)	ADHD and developmental speech/language disorders in late preterm, early term and term infants.	• EXCLUDE on relevance
Ramon-Casas (2013)	Word recognition and phonological representation in very low birth weight preterms.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Rehm (2013)	Nursing's contribution to research about parenting children with complex chronic conditions: an integrative review, 2002 to 2012	• EXCLUDE on relevance • EXCLUDE due to title
Reiterer (2015)	Severe primary pulmonary lymphangiectasis in a premature infant: management and follow up to early childhood.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract

Short Title	Title	Exclusion
Resch (2006)	Correlation of grading and duration of periventricular echodensities with neurodevelopmental outcome in preterm infants.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Ringer (2008)	Chapter 6B - Indirect hyperbilirubinemia	• EXCLUDE on source • EXCLUDE due to title
Rivkin (2004)	Chapter 41 - Stroke in childhood	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Rodrigues (2015)	Neurodevelopmental outcome of extremely preterm infants born to rural and urban residents' mothers in Australia	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Rodriguez (2014)	Low birth weight and subsequent poor weight gain	• EXCLUDE due to title
Rodriguez-Pinilla (2007)	2.15 – Hormones	• EXCLUDE on source • EXCLUDE due to title
Rubin (2005)	Chapter 89 - Disorders of calcium and phosphorus metabolism	• EXCLUDE on source • EXCLUDE due to title
Ares	S29-02 Thyroid hormones and the psychomotor development of the newborn	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract

Short Title	Title	Exclusion
Sakornbut (2008)	Chapter 3 - Content of prenatal Care	• EXCLUDE on source • EXCLUDE due to title
Sakornbut (2008)	Chapter 9 - Commonly encountered medical problems in pregnancy	• EXCLUDE on source • EXCLUDE due to title
Scher (2001)	Chapter 17 - Brain disorders of the fetus and neonate	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Schultz (1999)	Preverbal, early verbal pediatric pain scale (PEPPS): development and early psychometric testing	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title
Schulze (2005)	ANEMIA Iron-deficiency anemia	• EXCLUDE on source • EXCLUDE due to title
Tanaka	Selected papers: case reports	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Phillips	Seven core measures of neuroprotective family-centered developmental care: creating an infrastructure for implementation	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Shandor (1995)	Compensatory parenting: how mothers describe parenting their 3-year-old, prematurely born children	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title

Short Title	Title	Exclusion
Shanholtz (2013)	Congenital hypothyroidism	• EXCLUDE due to title
Shim (2014)	Serial diffusion tensor images during infancy and their relationship to neuromotor outcomes in preterm infants.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Singer (1997)	Methodological considerations in longitudinal studies of infant risk	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Smith (2001)	Midwifery management of breastfeeding: using the evidence	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title
Smith (2001)	Transitions on and off AFDC: implications for parenting and children's cognitive development	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title
Smith (2008)	Birth complications and outcomes	• EXCLUDE on source
Smith (2009)	Polyhydramnios, fetal overgrowth, and macrocephaly: prenatal ultrasound findings of Costello Syndrome	• EXCLUDE on relevance • EXCLUDE due to title
Soleimani (2009)	Perinatal and neonatal risk factors for neurodevelopmental outcome in infants in Karaj	• EXCLUDE on relevance • EXCLUDE on abstract
Soliman (2006)	Chapter 21 - The pediatric patient	• EXCLUDE on source • EXCLUDE due to title

Short Title	Title	Exclusion
Sonntag (2000)	Growth and neurodevelopmental outcome of very low birthweight infants with necrotizing enterocolitis	• EXCLUDE on date • EXCLUDE on relevance • EXCLUDE due to title
Soraisham (2006)	Does necrotising enterocolitis impact the neurodevelopmental and growth outcomes in preterm infants with birth weight ≤1250 g?	• EXCLUDE on relevance • EXCLUDE on abstract
Souto (2011)	Evidence-based care management of the late preterm infant	• EXCLUDE due to title
Spitzer (2006)	Chapter 54 - Apnea syndromes	• EXCLUDE on source • EXCLUDE due to title
Stein (2006)	Appendix	• EXCLUDE on source • EXCLUDE due to title
Steinkrauss (2005)	Effects of hypoglycemia on developmental outcome in children with congenital hyperinsulinism	• EXCLUDE on relevance • EXCLUDE due to title
Strand (2012)	Development of smooth pursuit eye movements in very preterm born infants: 3. association with perinatal risk factors.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Sturm (2007)	Hirudin treatment for multiple thromboses in a preterm infant with inherited thrombophilia.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Subject index (1988)	Subject index	• EXCLUDE on date • EXCLUDE due to title

Short Title	Title	Exclusion
Subject index (1993)	Subject index	• EXCLUDE on date • EXCLUDE due to title
Suchy (2004)	Chapter 18 – Hepatomegaly	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Sullivan (2007)	Functional performance of preterm children at age 4	• EXCLUDE on relevance • EXCLUDE due to title
Symanski (1992)	Maternal-infant bonding: practice issues for the 1990s	• EXCLUDE on date • EXCLUDE due to title
Tecklin (2004)	Chapter 16 - Respiratory failure in the Neonate—Preferred Practice Pattern 6G	• EXCLUDE on source • EXCLUDE on date • EXCLUDE due to title
Teresa (2007)	Chapter 7 - Cerebral palsy	• EXCLUDE on source • EXCLUDE due to title
Teti (2008)	Postpartum depression, effects on infant	• EXCLUDE on source • EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Gilbert	The cost of preterm birth: the low cost versus high value of tocolysis	• EXCLUDE on relevance • EXCLUDE due to title

Short Title	Title	Exclusion
Heathcock	The effects of movement training on the development of hand reaching in infants born preterm.	• EXCLUDE on relevance • EXCLUDE due to title
Thompson (2008)	Neonate hippocampal volumes: prematurity, perinatal predictors, and 2-year outcome	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Thompson (2012)	Corpus callosum alterations in very preterm infants: perinatal correlates and 2year neurodevelopmental outcomes	• EXCLUDE on relevance • EXCLUDE due to title
Thompson (2013)	Hippocampal shape variations at term equivalent age in very preterm infants compared with term controls: perinatal predictors and functional significance at age 7	• EXCLUDE on relevance • EXCLUDE due to title
Thureen (2012)	Chapter 9 - Nutritional requirements of the very-low-birth weight infant	• EXCLUDE on source • EXCLUDE due to title
Tin (2006)	Chapter 73 - Discharge planning and follow-up of the NICU graduate	• EXCLUDE on source
Tremblay (2014)	Delayed early primary visual pathway development in premature infants: high density electrophysiological evidence	• EXCLUDE on relevance • EXCLUDE due to title
Tronick (2008)	Social interaction	• EXCLUDE on source • EXCLUDE due to title
Trotter (2001)	Management of the extremely preterm infant: is the replacement of estradiol and progesterone	• EXCLUDE on date • EXCLUDE on relevance

Short Title	Title	Exclusion
	beneficial?	• EXCLUDE due to title
Trumpff (2013)	Mild iodine deficiency in pregnancy in Europe and its consequences for cognitive and psychomotor development of children: a review	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Tse (2008)	Concurrent validity of the Harris Infant Neuromotor Test and the Alberta Infant Motor Scale	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Van der Aa (2013)	Neonatal posterior cerebral artery stroke: clinical presentation, MRI findings, and outcome	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Van der Aa (2013)	Neonatal posterior cerebral artery stroke: clinical presentation, MRI findings, and outcome	• EXCLUDE duplicate
Van Rheenen (2006)	Delayed umbilical cord clamping for reducing anaemia in low birth weight infants: implications for developing countries	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Van Riper (2010)	Position of the American Dietetic Association: providing nutrition services for people with developmental disabilities and special health care needs	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Van Schie (2008)	General movements in infants born from mothers with early-onset hypertensive disorders of pregnancy in relation to one year's neurodevelopmental outcome	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract

Short Title	Title	Exclusion
Vincer (2005)	A population-based study to determine the performance of the Cognitive Adaptive Test/Clinical Linguistic and Auditory Milestone Scale to predict the mental developmental index at 18 months on the Bayley Scales of Infant Development-II in very preterm infants.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Viveca (2006)	Obstetric and perinatal outcome and preliminary results of development of children born after in vitro maturation of oocytes	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Waitzman (2007)	The Importance of positioning the near-term infant for sleep, play, and development	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Westerbeek (2013)	The effect of enteral supplementation of specific neutral and acidic oligosaccharides on the faecal microbiota and intestinal microenvironment in preterm infants	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Whyte (2009)	Neurodevelopmental outcome of extremely low birth weight infants randomly assigned to restrictive or liberal hemoglobin thresholds for blood transfusion.	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Williams (1986)	Children at risk: perinatal events, developmental delays and the effects of a developmental stimulation program	• EXCLUDE on date • EXCLUDE on relevance
Wright (2005)	Chapter 1 - Perinatal-neonatal epidemiology	• EXCLUDE on source • EXCLUDE due to title

Short Title	Title	Exclusion
Wuttikul (2008)	Prominent signal intensity of T 1/T 2 prolongation in subcortical white matter of the anterior temporal region on conventional screening MRI of late preterm infants with normal development	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Wynn (2012)	Chapter 19 - The neonatal gastrointestinal tract as a conduit to systemic inflammation and developmental delays	• EXCLUDE on source
Yao-Chia (2007)	Neurodevelopment in very low birth weight premature infants with postnatal subependymal cysts	• EXCLUDE on relevance • EXCLUDE due to title
Yerushalmy-Feler (2014)	Electroencephalographic characteristics in preterm infants born with intrauterine growth restriction	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract
Yıldız (2012)	Evaluation of etiologic and prognostic factors in neonatal convulsions	• EXCLUDE on relevance • EXCLUDE due to title
Youngblut (2005)	Child care use by low-income single mothers of preschoolers born preterm versus those of preschoolers born full term	• EXCLUDE on relevance • EXCLUDE due to title • EXCLUDE on abstract

APPENDIX G: Studies included & prepared for Critical appraisal

Short Title	Title	Included after title and abstract were read	Included after entire study was read and critical appraisal done	Final decision: I-Included E-Excluded S-Supportive study (acting as guidelines for include studies)
Gasson	A longitudinal investigation of the development of full term, preterm and 'at risk' infants from birth to four years using a parent-report measure.	✓		E
Amess (2010)	Developmental outcome of very preterm babies using an assessment tool deliverable by health visitors.		✓	I
Ben-Sasson (2014)	Feasibility and validity of early screening for identifying infants with poor social-communication development in a well-baby clinic system	✓		E
Bhide (2011)	Fetal growth restriction and developmental delay: current understanding and future possibilities.	✓		E
Browne (2012)	Developmental supports for newborns and young infants with special health and developmental needs and their families: the BABIES Model	✓		E
Burns(1989)	The neuro-sensory motor developmental assessment: part II: predictive and concurrent validity		✓	I
Craig (2000)	Detecting motor abnormalities in preterm infants.		✓	S

Short Title	Title	Included after title and abstract were read	Included after entire study was read and critical appraisal done	Final decision: I-Included E-Excluded S-Supportive study (acting as guidelines for include studies)
D'Agostino (2013)	Provider use of corrected age during health supervision visits for premature infants		✓	I
de Albuquerque (2015)	Accuracy of the Alberta Infant Motor Scale (AIMS) to detect developmental delay of gross motor skills in preterm infants: a systematic review.	✓		E
Dusing (2014)	Postural complexity influences development in infants born preterm with brain injury: relating Perception-Action Theory to 3 cases.		✓	I
El-Dib (2012)	Neurobehavioral assessment as a predictor of neurodevelopmental outcome in preterm infants.		✓	I
Espinal (2008)	Developmental disabilities: physical		✓	I
Cusson (2003)	Factors influencing language development in preterm infants.		✓	I
Orfeo (2011)	First year follow-up of extremely low birth weight premature sextuplets: case report.	✓		E
Gladstone (2011)	Post-neonatal mortality, morbidity, and developmental outcome after ultrasound-dated preterm birth in rural Malawi: a community-based cohort study.	✓		E
Gnanendran (2015)	Neurodevelopmental outcomes of preterm singletons, twins and higher-order gestations: a population-based cohort	✓		E

Short Title	Title	Included after title and abstract were read	Included after entire study was read and critical appraisal done	Final decision: I-Included E-Excluded S-Supportive study (acting as guidelines for include studies)
	study.			
Grant (2010)	Developmental and social-economical screening instruments for use in pediatric primary care in infants and young children		✓	S
Grönqvist (2011)	Development of smooth pursuit eye movements in very prematurely born infants: 2. The low-risk subgroup.	✓		E
Gücüyener (2006)	Use of the Bayley Infant Neurodevelopmental Screener with premature infants.		✓	I
Heaman (1995)	Perceived stressors and coping strategies of parents who have children with developmental disabilities: a comparison of mothers with fathers.	✓		E
Hediger (2002)	Birth weight and gestational age effects on motor and social development.	✓		E
Van de Weijer-Bergsma *et al*. (2010)	Individual differences in developmental trajectories of A-not-B performance in infants born preterm.		✓	I
Palmer (2012)	Introducing solid foods to preterm infants in developed countries.	✓		E
Kalia (2009)	Comparison of enrollment in interventional therapies between late-preterm and very preterm infants at 12 months' corrected age.		✓	I

Short Title	Title	Included after title and abstract were read	Included after entire study was read and critical appraisal done	Final decision: I-Included E-Excluded S-Supportive study (acting as guidelines for include studies)
Kelly (2006)	The medically complex premature infant in primary care		✓	I
Kiechl-Kohlendorfer (2009)	Adverse neurodevelopmental outcome in preterm infants: risk factor profiles for different gestational ages.		✓	I
Lando (2005)	Developmental delay at 12 months in children born extremely preterm.	✓		E
Lenke (2003)	Motor outcomes in premature infants		✓	I
Liao (2005)	Concurrent validity of the Comprehensive Developmental Inventory for Infants and Toddlers with the Bayley Scales of Infant Development-II in preterm infants.	✓		E
Lundqvist-Persson (2012)	Preterm infants' early developmental status is associated with later developmental outcome.		✓	I
Luo (2013)	[Infant Neurological International Battery predicts neurological outcomes of preterm infants discharged from the neonatal intensive care unit].	✓		E
Marriott (2003)	Advances in the nutrition of preterm infants.	✓		E
McCourt & Griffin (2000)	Comprehensive primary care follow-up for premature infants		✓	I

Short Title	Title	Included after title and abstract were read	Included after entire study was read and critical appraisal done	Final decision: I-Included E-Excluded S-Supportive study (acting as guidelines for include studies)
Meade (2012)	Modifying the parent evaluation of developmental status to target 4-month-old infants who would benefit from the Meade Movement Checklist during community screening		✓	I
Mossabeb (2012)	Language development survey provides a useful screening tool for language delay in preterm infants.	✓		E
Murphy (1991)	The high-risk infant: some new views on early assessment	✓		E
Phillips-Pula (2012)	Follow-up care for the neonatal intensive care unit graduate		✓	I
Pin (2007)	A review of the effects of sleep position, play position, and equipment use on motor development in infants.	✓		E
Polinski (2003)	Hearing outcomes in the neonatal intensive care unit graduate		✓	I
Purdy & Melward (2012a and 2012b)	Who Is at risk? High-risk infant follow-up		✓	I
Reifsnider (1998)	Reversing growth deficiency in children: the effect of a community-based intervention	✓		E
Richter (2007)	A validation study of the Norwegian version of the Ages and Stages Questionnaires.	✓		E

Short Title	Title	Included after title and abstract were read	Included after entire study was read and critical appraisal done	Final decision: I-Included E-Excluded S-Supportive study (acting as guidelines for include studies)
Samantha (2004)	Validation of a parent report measure of cognitive development in very preterm infants.	✓		E
Sanders *et al*. (2007)	Caring for children with intellectual and developmental disabilities: virtual patient instruction improves students' knowledge and comfort level		✓	S
Schafer (2014)	Development and validation of a parent-report measure for detection of cognitive delay in infancy.	✓		E
Schonhaut (2015)	Gestational age and developmental risk in moderately and late preterm and early term infants.	✓		E
Sen-Wei (2010)	Prediction for developmental delay on Neonatal Oral Motor Assessment Scale in preterm infants without brain lesion.	✓		E
Simard *et al*. (2011)	Prediction of developmental performance in preterm infants at two years of corrected age: Contribution of the neurological assessment at term age.		✓	I
Skellern (2001)	A parent-completed developmental questionnaire: follow up of ex-premature infants.	✓		E
Soleimani (2013)	Developmental outcome of low birth-weight and preterm newborns: a review of current evidence. (English)	✓		E
Sugiura (2011)	Neurodevelopmental outcomes at 18 months' corrected age of infants born at 22 weeks of gestation.	✓		E

Short Title	Title	Included after title and abstract were read	Included after entire study was read and critical appraisal done	Final decision: I-Included E-Excluded S-Supportive study (acting as guidelines for include studies)
Symington (2006)	Developmental care for promoting development and preventing morbidity in preterm infants.	✓		E
Tsai *et al*. (2010)	Prediction for developmental delay on Neonatal Oral Motor Assessment Scale in preterm infants without brain lesions.		✓	I
Hadders-Algra (2013)	Typical and atypical development of reaching and postural control in infancy.	✓		E
Vaivre-Douret (2004)	Effect of positioning on the incidence of abnormalities of muscle tone in low-risk, preterm infants.	✓		E
Wood (2000)	Neurologic and developmental disability after extremely preterm birth.	✓		E
Yuge (2011)	Movements and postures of infants aged 3 to 5 months: to what extent is their optimality related to perinatal events and to the neurological outcome?	✓		E
Zarem (2013)	Psychometrics of the Neonatal Oral Motor Assessment Scale.	✓		E
Zuk (2011)	Fetal and infant spontaneous general movements as predictors of developmental disabilities.	✓		E

APPENDIX H: Data collection/ extraction table

Data extraction					Components	Supporting evidence										
Citation	Title	Geographical area discussed	Methodology	Findings of study	Identified category in data	Maternal data	Birth weight	Gestational age	Parental information	Follow-up dates	Factors to consider	Medical conditions	Infant specific	Vital signs	Gender	Corrected age
Lenke, 2003	Motor developmental outcomes in premature infants	United States of America	Literature review	Critical factors determining developmental outcomes: birth weight, gestational age (the shorter the gestational age, the lower the birth weight, the higher the risk).	Birth weight Gestational age		✓	✓								
Meade *et al.* 2012	Modifying the parent evaluation of developmental status to target 4-month-old infants who would benefit from the Meade Movement Checklist during community screening	United States of America	Experimental study	Older premature infants are also at risk. Parent information can be useful as they can recall past events.	Gestational age Parental information		✓		✓							
Simard *et al.,* 2011	Prediction of developmental performance in preterm infants at two years of	Canada	Experimental study	A clinical assessment tool should be short and easy to perform. The first observation should take	Gestational age			✓								

	corrected age: contribution of the neurological assessment at term age			place at 40 weeks gestational age ±2 weeks. Usually multiple examiners.												
Gücüyener *et al.*, 2006	Use of the Bayley Infant Neurodevelopmental Screener with premature infants	Turkey	Experimental study	Premature infants can show continuous improvement during the first two years of life, thus follow-up should take place during the first year. The earlier the identification of developmental delays the earlier one can intervene. Four factors were identified: basic neurological function/intactness, receptive function, expressive function, cognitive function.	Follow-up dates Factors to consider (basic neurological function/intact-ness, receptive function, expressive function, cognitive function)					✓	✓					
McCourt and Griffin, 2000	Comprehensive primary follow-up for premature infants	United States of America	Literature review	Follow-up is needed depending on gestational age, birth weight and medical condition. A framework was identified addressing problems of a premature infant by system: Respiratory problems, gastro-intestinal problems and nutritional problems, infectious disease problems, hematologic problems,	Birth weight Gestational age Medical condition (respiratory problems, gastro-intestinal problems and nutritional problems, infectious disease		✓	✓				✓				

				central nervous system problems, other problems (dentition, nasal deformities, scars).	problems, hematologic problems, central nervous system problems)										
Kelly, 2006	The medically complex premature infant in primary care	United States of America	Literature review	The survival rate of premature infants at 23-26 weeks gestational age is 70% with a 30-50% chance of moderate to severe developmental delays. Neurodevelopmental issues. such as retinopathy of prematurity, respiratory conditions and infant feeding emerged.	Medical condition (retinopathy of prematurity, respiratory conditions) Factors to consider: infant feeding gestational age			✓			✓	✓				
D'Agostino *et al*., 2013	Provider use of corrected age during health supervision visits for premature infants	United States of America	Literature review	Incorrect interpretations may be the result of the use of chronological age instead of corrected age/ adjusted age. Health visits and immunizations take place at chronological age. Follow-up at 2, 4, 6, 9, 12 months corrected age was suggested.	Corrected age Follow-up dates					✓						✓
Amess *et al*., 2010	Developmental outcome of very preterm babies using	United Kingdom	Experimental study	A possible final identification of developmental delays can	Factors to consider						✓					

	an assessment tool deliverable by health visitors			take place at 12 months with a follow-up at 24 months. Ideas for areas to focus on in a follow-up: locomotor functions and posture, fine manipulation, hearing and language, interactive social, speech and language, self-care, vision and cognitive.	Llocomotor and posture, fine manipulation, hearing and language, interactive social, speech and language, self-care, vision and cognitive)											
Polinski, 2003	Hearing outcomes in the neonatal intensive care graduate	United States of America	Systematic review	Hearing loss is an increased risk if admitted in the neonatal intensive care unit (NICU) (due to the: environment, medication and clinical conditions). Infant should be screened by 3 months. Preterm infants are 50% more likely to develop hearing loss and should be evaluated before discharge from the NICU.	Factors to consider Hearing, admission in the NICU, environment, medication used.						✓					
Phillips-Pula and McGarth, 2012	Follow-up care for the neonatal intensive care graduate	United States of America	Literature review	NICU graduates have a high risk for hospital readmission, making follow-up a costly challenge. Parents want a personal connection with the staff.	Parental information				✓							

Purdy and Melwak, 2012a and 2012b	Who is at risk? High-risk infant follow-up	United States of America	Literature review	Identification of developmental delays start in the NICU. Premature infants are born prior to 37 completed weeks. Three areas have been identified that can possibly cause developmental delays: Intra-ventricular hemorrhage, necrotizing enterocolitis (NEC), and retinopathy of prematurity (ROP). A six to eight-month follow/up assessment is advised.	Medical conditions (Intra-ventricular hemorrhage, necrotizing enterocolitis (NEC), and retinopathy of prematurity (ROP).) Follow-up dates					✓		✓				
Espinal and Msall, 2008	Developmental disabilities: physical	United States of America	Literature review	The child's health and well-being consists of four components: body structure (anatomical parts), body function (physiology and psychology), activities (tasks that are done), and participation (involvement in community life).	Factors to consider Body structure, body function, activities and participation.							✓				
Cusson, 2003	Factors influencing language development in preterm infants	United States of America	Experimental study	Normal hearing is necessary for normal language development. Communication disorders consist of language disorder and speech disorder. A	Parental information Factors to consider: hearing				✓		✓					

				preterm infant develops language milestones only at a later stage. Maternal input offers valuable clues for development.												
Dusing *et al*. 2014	Postural complexity influences development in infants born preterm with brain injury: relating Perception-Action Theory to 3 cases	United States of America	Experimental study	Development is the interaction of multiple systems in the environment. Head control, reaching and global development are areas to watch for developmental delays. Developmental delays can be due to lack of postural control which can lead to an atypical perception-action cycle and limited postural complexity. Infant should be assessed every 0,5-3 months for the first year of life. It is difficult to predict the developmental delay due to varied outcome.	Factors to consider: head control, reaching and global development) Follow-up dates Infant specific decisions					✓	✓		✓			
Van de Weijer-Bergsma *et al*., 2010	Individual differences in developmental trajectories of a-not-b performance in infants born preterm	Netherland	Experimental study	Early executive function (higher-order cognitive process) can be a developmental delay and learning difficulty predictor. An increased survival rate	Factors to consider: Early executive function Gender Birth weight		✓				✓				✓	

				also leads to an increased risk for experiencing developmental delays. Preterm birth leads to decreased cerebral volumes. Male infants are more likely to be affected by developmental delays. Birth weight plays a role in developmental delays.													
Kiechl-Kohlendorfer *et al*., 2009	Adverse neurodevelopmental outcome in preterm infants: risk factors for different gestational ages	Austria	Experimental study	Increased risk for developmental delays: Intra-cerebral hemorrhage, small for gestational age, late-onset sepsis. Antenatal steroids can decrease the risk for developmental delays. Maternal data, which can affect the risk of developmental delays: age, education, smoking in pregnancy, antenatal steroids, rupture of membranes and mode of delivery. Neonatal data, which can affect the risk of developmental delays: birth weight, gestational age, multiple pregnancy, gender,	Medical conditions Intra-cerebral hemorrhage, NEC and ROP Factors to consider: sepsis, vision, hearing, length and head circumference Birth weight Vital signs Maternal data	✓	✓				✓	✓		✓		

				intra-cerebral hemorrhage, NEC, ROP and infection. A follow-up visit consists of a physical, neurological and neuromotor examination, cognitive development, vision, hearing, weight, length and head circumference. Inflammatory stress can affect brain maturation and can result in impaired neurodevelopmental outcomes.											
Lundqvist-Persson *et al.* ,2012	Preterm infants' early developmental status is associated with later developmental outcomes	Sweden	Experimental study	Maternal education plays a role in development of an infant. Developmental deviations persisted and increased for 18 months. Infants with low levels of self-regulation and abnormal qualities of general movements were likely to have poorer development.	Maternal data Follow-up dates Factors to consider: general movements	✓				✓	✓					
Tsai *et al.*, 2010	Prediction for developmental delay on neonatal oral motor assessment scale in preterm infants without	Taiwan	Experimental study	Normality is predicted during the last quarter of the first year of life. Sucking is critical for communication, and persistence of disorganized	Factors to consider: sucking						✓					

	brain lesion			sucking after 37 weeks can lead to decreased developmental scores at 6-months' gestation.												
El-Dib *et al.*, 2012	Neurobehavioural assessment as a predictor of neurodevelopmental outcomes in preterm infants	The United States of America	Experimental study	Early prediction is important to facilitate parental counselling and also to start with early intervention. Negative factors that influence developmental delays: drug exposure, decreased gestational age, low birth weight, head circumference, ultrasound anomalies, neurological and brain disease. Factors that influence developmental delays positively: female infants, antenatal steroid and breastfeeding.	Factors to consider: drug exposure, head circumference, ultrasound anomalies, neurological and brain diseases Gestational age Birth weight Gender Maternal data	✓	✓	✓			✓				✓	
Kalia *et al.*, 2009	Comparison of enrolment in interventional therapies between late preterm and very preterm infants at 12 months' corrected age	United States of America	Experimental study	A late preterm is also at risk for developmental delays and should not be seen as near term infants. Factors which can lead to neurological insults and thus poor developmental outcomes include, 5min APGAR score, apnoea of	Factors to consider: 5 min APGAR, length of stay in hospital Medical conditions: neurological insults, apnoea			✓			✓	✓				

				prematurity, respiratory distress syndrome, duration of hospitalization and bronchopulmonary dysplasia.	of prematurity, respiratory distress syndrome, bronchopulmo-nary dysplasia Gestational age											

APPENDIX I: Supporting evidence

Category	Components	Supporting evidence																			
		Lenke	Meade *et al*	Simard *et al.*	Gucuyener *et al*	McCourt & Griffin	Kelly	Amess *et al.*	Polinski	Purdy & Melwak	Phillips-Pula & McGrath,	Espinal & Msall	Cusson	Dusing *et al*	van de Weijer-Bergsma *et al*	Kiechl-Kohlendorfer *et al*	Lundqvist-Persson *et al.*	Tsai *et al*	El-Dib *et al*	Kalia *et al*	D'Agostino *et al*
Infant data	Birth Weight	✓				✓									✓	✓			✓		
	Gestational age	✓	✓	✓		✓	✓												✓	✓	
	Infant specific													✓							
	Gender														✓				✓		
	Corrected age																				✓
	Follow-up				✓					✓				✓			✓				✓
Medical data	Medical condition					✓	✓														
	Factors to consider				✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Vital signs															✓					
Parental data	Parental information		✓								✓		✓								
	Maternal data															✓	✓		✓		

APPENDIX J: Data-analysis guide

DATA-ANALYSIS GUIDE FOR CO-REVIEWER

TITLE OF THE RESEARCH PROJECT: Components of a tool for early detection of developmental delays in preterm infants: an integrative literature review

RESEARCHER: Zarine Wessels

ADDRESS: 16 Windsor Place
28 Malherbe street
Potchefstroom

CONTACT INFORMATION: 0763170913
zarine3@gmail.com

Thank you for agreeing to act as co-reviewer for the abovementioned study. The Johns Hopkins research evidence appraisal assessment (Newhouse *et al.*, 2007) can be utilized for the appraisal of each study provided. At the end of your co-review, I will need an undersigned document agreeing or disagreeing with the selected studies.

- The studies selected for appraisal are provided with highlighted important sections for the research study.
- Read through all the studies provided in a thorough manner and give critique of each study and attach to the study.
- While reading through the studies keep the research title (as seen in the beginning of this guide), question and objective in mind:
  The question :
  What is the best evidence available regarding components of a developmental screening tool that can be used by healthcare professionals with limited skills, knowledge and experience in the field of infant developmental assessment and working in resource restricted settings

The objective is

To explore and describe best available evidence regarding components to be included in a screening tool that aims to detect developmental delays in preterm infants during follow-up visits of first year of life.

- Use the Johns Hopkins research evidence appraisal to determine the quality and level of evidence. Assessment tools are attached for each study.
- After reading through the studies, please give your opinion of each study and also provide the appraisal score of each study.
- Compile a table based on the opinion as well as the appraisal score.
- Go through the table and opinion and make a final decision on the chosen studies.
- Give feedback to the researcher and hold a consensus discussion, if there are any queries on the chosen studies, reach an agreement on the studies.
- Provide an undersigned letter of which you agree/disagree with the chosen studies.

APPENDIX K: Letter of agreement from co-reviewer

NORTH-WEST UNIVERSITY
YUNIBESITI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT
POTCHEFSTROOM CAMPUS

Letter of agreement of chosen studies

I, Maretha Kohn, student nr of NWU: 20078919, hereby declare that I agree with the studies selected by the researcher, for the research project: Components of a tool for early detection of developmental delays in preterm infants: an integrative literature review.
I adhered to the co-reviewer guide as prescribed by the researcher.

The research studies of which I didn't agree upon were discussed with the research and an agreement was reached to include the studies. The supportive studies were also included

A personal score out of ten, 1 being the lowest and 10 being the highest quality, was given to each study, to determine the quality of each study. The Johns Hopkins research and non-research appraisals were used as provided by the researcher, to determine the quality and level of evidence. Below a table of my opinion as co-reviewer:

Citation	Quality of study (based on Johns Hopkins appraisal)	Level of evidence	Quality score of co-reviewer (1-10)	Co-reviewer opinion
Amess *et al.*, 2010	B	1	7	Very good study with ideas for areas
Burns *et al.* 1989	B	1	8	Outdated, but good study
Craig *et al.* 2000	B	1	7	Very good study
Cusson, 2003	B	5	Query arised, was discussed with researcher and thus included in the	Focus on second year of life, is it relevent?

			study.	
D'Agostino *et al.*, 2013	B	5	6	Good study
Dusing *et al.*, 2014	A	1	6	Good study
El-Dib *et al.*, 2012	B	1	6	Good study
Espinal & Msall, 2008	B	5	6	Good study
Grant *et al.* 2010	A	5	7	Very good study with a good framework
Gucuyener *et al.*, 2006	A	1	6	Good study
Kalia *et al.*, 2009	B	1	6	Good study
Kelly, 2006	A	5	6	Good study
Kiechl-Kohlendorfer *et al.*, 2009	A	1	7	Very good study
Lenke, 2003	A	5	7	Very good study
Lundqvist-Persson *et al.*, 2012	B	1	6	Good study
McCourt & Griffin, 2000	A	5	7	Very good study with an idea for the framework
Meade *et al.*, 2012	A	1	8	Very good study with good evidence
Phillips-Pula & McGrath, 2012	B	5	7	Very good study
Polinski, 2003	A	4	6	Good study
Purdy & Melwak, 2012b	B	5	6	Good study
Sanders *et al.* 2007	A	1	6	Can support evidence but good study
Simard *et al.*, 2011	A	1	6	Good study
Tsai *et al.*, 2010	A	1	8	Very good study with useful information
van de Weijer-Bergsma *et al.*, 2010	A	1	7	Very good study

....

Maretha Kohn Date

APPENDIX L: Author guidelines for article

Journal of Perinatal & Neonatal Nursing

Online Submission and Review System

Scope The primary objective of *The Journal of Perinatal & Neonatal Nursing* (JPNN) is to provide practicing nurses with evidence-based information on perinatal/neonatal nursing that will improve care and outcomes. Manuscripts that do not have implications for perinatal/neonatal nursing practice will not be considered. In general, each issue of JPNN features one topic, to be presented in depth. Each year there is also a Selected Topics issue. Upcoming topics are posted at the JPNN website and can be used as a guide with regard to manuscripts that might be of interest. JPNN has a limited ability to publish online.

Authors are encouraged to submit to *The Journal of Perinatal & Neonatal Nursing* (JPNN) clinically focused, academically sound articles that (1) add new knowledge to the field of perinatal/neonatal nursing, and (2) codify existing knowledge or (3) add to the present and future roles of practitioners in the field.

Manuscripts should encompass both perinatal and neonatal aspects whenever possible. Clinical research articles will also be considered. Acceptance or rejection of articles is based on the judgment of the editors and peer reviewers.

Query letters including an outline of the proposed manuscript are encouraged and should be e-mailed directly to the appropriate editors. Authors are encouraged to submit articles that provide practical, authoritative, clinical information that encompass the practice and management responsibilities of advanced practice roles in the perinatal and neonatal settings. Review manuscripts should follow established guidelines for systematic reviews and evidence-based interventions, such as the Cochrane Handbook of Systematic Reviews for Interventions. For Systematic Reviews and Meta-Analyses the PRISMA statement found on the website. www.prisma-statement.org is recommended for appropriate formatting and flow diagrams for all systematic reviews. Acceptance or rejection of an article is based on the judgment of peer reviewers. For all Corresponding authors... It is expected that the Corresponding author will respond to all editorial questions and inquiries in a timely manner at the time the page proofs are forthcoming from the publisher as to not delay publication of the issue.

Ethical and Legal Considerations A submitted manuscript must be an original contribution not previously published (except as an abstract or a

preliminary report), must not be under consideration for publication elsewhere, and, if accepted, must not be published elsewhere in similar form, in any language, without the consent of the publisher. Each person listed as an author is expected to have participated in the study and/or manuscript process to a significant extent. Although the editors and referees make every effort to ensure the validity of published manuscripts, the final responsibility rests with the authors, not with the Journal, its editors, or the publisher.

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Conflicts of Interest and Source of Funding: A has received honoraria from Company Z. B is currently receiving a grant (#12345) from Organization Y, and is on the speaker's bureau for Organization X – the CME organizers for Company A. For the remaining authors none were declared.

Patient Anonymity and Informed Consent It is the author's responsibility to ensure that a patient's anonymity be carefully protected and to verify that any experimental investigation with human subjects reported in the manuscript was performed with informed consent and following all the guidelines for experimental investigation with human subjects required by the institution(s) with which all the authors are affiliated. Authors should mask patients' eyes and remove patients' names from figures unless they obtain written consent from the patients and submit written consent with the manuscript.

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Manuscript Preparation Manuscripts that do not adhere to the following instructions will be returned to the corresponding author for technical revision before undergoing peer review. Each manuscript **must** include the following, each on its own page:

Title page including (1) title of the article, (2) author names (with highest academic degrees) and affiliations (including titles, departments, and name and location of institutions of primary employment), (3) corresponding author's name and complete address including email, and (4) any acknowledgments credits, or disclaimers.

The title page must also include disclosure of funding received for this work

from any of the following organizations: National Institutes of Health (NIH); Wellcome Trust; Howard Hughes Medical Institute (HHMI); and other(s). See the "Conflicts of Interest" section above for more information.

Abstract of 200 words or fewer describing the main points of the article. If it is a research article, prepare a structured abstract describing (1) what was observed or investigated, (2) the subjects and methods, and (3) the results and conclusions.

Unstructured Abstract and Key Words - *Include in Manuscript Text File* Limit the abstract to 200 words. It must be factual and comprehensive. Limit the use of abbreviations and acronyms, and avoid general statements (e.g. the significance of the results is discussed, etc.)

Key Words 3-5 key words that describe the contents of the article like those that appear in the *Cumulative Index to Nursing and Allied Health Literature* (CINAHL) or the *National Library of Medicine's Medical Subject Headings* (MeSH).

Abbreviations Write out the full term for each abbreviation at its first use unless it is a standard unit of measure. Avoid error prone abbreviations as identified by the Institute for Safe Medicine Practices, a complete list is available at: http://www.ismp.org/Tools/errorproneabbreviations.pdf

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- Prepare the manuscript double spaced in Microsoft Word. Leave a one-inch margin on all sides. Do not right justify.
- Type all headings on a separate line.
- Number all manuscript pages consecutively in the upper right-hand corner (text and references, followed by illustrations on separate pages).
- All legends for Tables and Figures are to be included with the manuscript;

include these at the end of manuscript after the list of references. Tables and Figures are attached as separate files when you reach "attach files" in the submission process. Prepare tables and figures in a format ready for reproduction. Further instructions for preparing figures are given below.

- Manuscript length (excluding all references, tables, figures) should be no more than 20 pages (standard 8.5 x 11 inch page size).
- Use the *American Medical Association Manual of Style*, 10 Edition, Copyright 2007, AMA.
- For citations and references. See examples for citations and references below.
- No identifying information (authors' names) should be included on the manuscript. If you cite your own works, list them as "Author, YYYY" in the citation and the reference list in order to maintain your anonymity for the review process.

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References must be cited in text and styled in the reference list according to the *American Medical Association Manual of Style*, Ed. 9, Copyright 1998, AMA.

References should **not** be created using Microsoft Word's automatic footnote/endnote feature.

References should be included on a separate page at the end of the article and should be double spaced

References should be numbered consecutively in the order they are cited; reference numbers can be used more than once throughout an article.

Page numbers should appear with the text citation following a specific quote.

Examples:

Journals: Author. Article title. *Journal.* Year; volume: inclusive pages.

Banta-Wright SA, Steiner RD. Tandem mass spectrometry in newborn screening: a primer for neonatal and perinatal nurses. *J Perinat Neonat Nurs*. 2004; 18:41—58.

Books: Author. *Book Title.* Place of publication: Publisher: year.

Long VE, McMullen P. *Telephone Triage for Obstetrics and Gynecology.* Philadelphia, Pa: Lippincott Williams & Wilkins; 2002.

Simpson KR, Creehan PA. Strategies to develop an evidence-based approach to prenatal care and pregnancy and childbirth practices of selected cultures and religions. *AWHONN's Perinatal Nursing*. 2nd ed. 2001.

For multiple authors in journals and books: • If six or fewer, list all authors • If more than six, list the first three followed by et al.

Figures A) Creating Digital Artwork

1. Learn about the publication requirements for Digital Artwork: http://links.lww.com/ES/A42
2. Create, Scan and Save your artwork and compare your final figure to the Digital Artwork Guideline Checklist (below).
3. Upload each figure to Editorial Manager in conjunction with your manuscript text and tables.

B) Digital Artwork Guideline Checklist Here are the basics to have in place before submitting your digital artwork:

- Artwork should be saved as TIFF, EPS, or MS Office (DOC, PPT, XLS) files. High resolution PDF files are also acceptable.
- Crop out any white or black space surrounding the image.
- Diagrams, drawings, graphs, and other line art must be vector or saved at a resolution of at least 1200 dpi. If created in an MS Office program, send the native (DOC, PPT, XLS) file.
- Photographs, radiographs and other halftone images must be saved at a resolution of at least 300 dpi.
- Photographs and radiographs with text must be saved as postscript or at a resolution of at least 600 dpi.
- Each figure must be saved and submitted as a separate file. Figures should not be embedded in the manuscript text file.

Remember:

- Cite figures consecutively in your manuscript.
- Number figures in the figure legend in the order in which they are discussed.
- Upload figures consecutively to the Editorial Manager web site and enter figure numbers consecutively in the Description field when uploading the files.

If a figure has been previously published, in part or in total, acknowledge the original source and submit written permission from the copyright holder to reproduce or adapt the material. Include a source line. Type "Source: Author" on figures that you created. This will help Lippincott Williams & Wilkins identify the status of each figure.

Supply a caption for each figure, typed double spaced on a separate sheet from the artwork. Captions should include the figure title, explanatory statements, notes, or keys; and source and permission lines.

Tables Tables will be submitted as a separate file when you are instructed to attach files to your submission. Create tables using the table creating and editing feature of your word processing software. Do not use Excel or comparable spreadsheet programs. Group all tables in a separate file. Cite tables consecutively in the text, and number them in that order. Each table should appear on a separate page and should include the table title, appropriate column heads, and explanatory legends (including definitions of any abbreviations used). Do not embed tables within the body of the manuscript. They should be self-explanatory and should supplement, rather than duplicate, the material in the text.

Tables should be on a separate page at the end of the manuscript. Number tables consecutively and supply a brief title for each. Include explanatory footnotes for all nonstandard abbreviations. For footnotes, use the following symbols, in this sequence: *, †, ‡, §, ||,**, ††, etc. Cite each table in the text in consecutive order. If you use data from another published or unpublished source, obtain permission and acknowledge fully. Type "Source: Author" on tables that you created.

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Return users: If you have received an E - mail from us with an assigned user ID and password, or if you are a repeat user, do not register again. Just log in. Once you have an assigned ID and password, you do not have to re-register, even if your status changes (that is, author, reviewer, or editor).

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Manuscript Review Process It is understood that articles are submitted solely to *JPNN* and have not been published previously. There are two stages of manuscript review prior to acceptance of the article.

First, the respective editor reviews manuscripts for relevance to the journal. Manuscripts that are considered appropriate and relevant by the editor are reviewed by at least two members and often three members of the Editorial Board. Members of the Board evaluate manuscripts based on the following criteria:

- concise, logical ordering of ideas;
- sound argument and defense of original ideas;
- accuracy of content;
- adequacy of documentation;
- consistency with the purpose of the journal.

Peer Review Manuscripts are reviewed by members of the perinatal and neonatal editorial boards, depending upon the content. Authors should not identify themselves or their institutions other than on the title page. The title page will not be seen by reviewers.

Manuscripts are sent to the reviewers guidelines for recording their evaluation according to criteria. The comments of reviewers are sent to the Journal Editor. The anonymous reviewer's comments and the Editor's summary, indicating the Editor's evaluation of the article, are returned to the author.

Second, the Editor makes a decision regarding acceptance of the article for publication based on the comments and recommendations of the Editorial Board reviewers. At least two reviewers must recommend the article for publication for the article to be accepted by the Editor. A rejection by one reviewer may eliminate that manuscript from further review.

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