DEVELOPMENTAL SCREENING AND COMMUNICATION DELAYS IN INFANTS: A SOUTH AFRICAN PRIMARY HEALTH CARE PERSPECTIVE

By

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Submitted in partial fulfilment of the requirements for the degree

D.Phil (Communication Pathology)

In the Department Speech-Language Pathology and Audiology

UNIVERSITY OF PRETORIA

FACULTY OF HUMANITIES

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August 2015

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ACKNOWLEDGEMENTS

I would like to acknowledge the Mellon foundation for funding the vulnerable children research theme of the Faculty of Humanities, University of Pretoria. I would also like to acknowledge the University of Pretoria COPC living laboratory, the National Research Foundation and Department of Statistics, University of Pretoria for their assistance in the data processing and analysis. Furthermore, I would also like to acknowledge the Vice Chancellor's Academic Development Grant for funding the research.

Personal acknowledgements:

Standing at the brink of completing this humbling, at times daunting, but also extremely fulfilling process I would like to acknowledge:

Abba, thank you for being my ability, my strength and courage. Philippians 4:13: "For I can do everything through Christ, who gives me strength" (NLT)

Bart I would like to thank you for your insight, mentoring and guidance. You always had a solution to a problem even when I didn't.

De Wet, thank you for your kind words and support. I appreciate your guidance. I have and will continue to learn a lot from you!

My loving family and friends (you know who you are), who always believed in me and supported me. Also, I thank you for supporting me by getting the children from school, babysitting and proof reading the manuscript. Dad and Moeks thank you for always being proud of me!

And last, but definitely not the least: Jacques-Louis, Anria and Janro Louis thank you for being the best husband and children in the whole world! Your support throughout this journey leaves me speechless. I love you!

ABSTRACT

The study examined developmental screening and communication delays in infants from underserved PHC contexts in South Africa. More specifically the Road to Health Booklet (RTHB) checklist was compared to a standardized international tool i.e. the PEDS tools, consisting of the PEDS and PEDS: DM. The relationship between psychosocial risks and communication delays was determined. The study also reported on the prevalence and nature of communication delays in these infants. Finally the study evaluated the accuracy of the PEDS tools to detect communication delays, against an internationally accepted diagnostic assessment tool, the Rossetti Infant Toddler Language Scale (RITLS).

A comparative cross-sectional within-subject design was employed. Parent interviews to obtain background information, the PEDS tools, the RTHB developmental checklist and Rossetti Infant Toddler Language Scales (RITLS) were used to collect data from caregivers of 201 infants, aged six to 12 months, selected through convenience sampling, at PHC facilities in the Tshwane district, South Africa.

Sensitivity of the RTHB developmental checklist was determined to be low (25%), but specificity values were high (86%-91%). The RTHB developmental checklist failed to identify more than half the infants at risk of delays or disorders. Hence, based on the results of this study, the nationally implemented developmental checklist was found to be ineffective in identifying at-risk infants. It is strongly recommended that the tool be adapted and validated or replaced in order to improve identification of at-risk infants.

Associations between communication delays and risks were determined using Chi-square and Fisher's exact non-parametric test statistics and a log linear model was built to model the simultaneous effect of significant risks on the probability of having communication delays.

Communication delays were present in 13% of infants. Association between three risk factors (i.e. housing status, age of mother and number of siblings) and language delays was established. Infants with two or more siblings, born from mothers aged 18-29 years who own their house have for example a 39% chance of presenting with communication delays. The impact of combined risk factors on language development

revealed that an infant was at greatest risk (27% probability) of developing a language delay when 1) mothers were between the ages of 19 to 34 years; 2) when parents owned their own home and; 3) when there were three or more children in the household.

The prevalence of communication delays in the sample population was high possibly due to the majority of infants being exposed to risks. The implementation of preventative measures, such as awareness campaigns and developmental screening and surveillance should be considered in the South African PHC context. This is especially relevant since a clear relationship has been established between three risks and communication delays in infants.

The PEDS tools had low to very low expressive- and receptive language sensitivity scores across all three screens (ranging between 14%-44%). However, high sensitivity (71%) and specificity (73%) ratings for the receptive and expressive language and social emotional domain in combination were calculated. The results of this study may indicate that the PEDS tools may be an appropriate developmental screening tool for the detection of communications delays in infants in the South African PHC context. Future research determining accuracy of the PEDS, PEDS: DM and PEDS tools for children aged two to five years in detecting communication delays should be prioritised.

ORIGINAL PAPERS

- Van der Linde, J., Swanepoel, D., Glascoe, F.G., Louw, E.M. & Vinck, B. (2015). Developmental screening in South Africa: Comparing the national developmental checklist to a standardized tool. *African Health Sciences, 15*(1), 188-196. Doi:10.4314/ahs.v15i1.25
- Van der Linde, J., Swanepoel, D., Glascoe, F.G., Louw, E.M., Hugo, J.F.M. & Vinck, B. (2015). Risks associated with communication delays in infants from underserved South African communities. *African Journal of Primary Health Care and Family Medicine, 7 (1):1-7. http://dx.doi.org/10.4102/phcfm.v7i1.841*
- Van der Linde, J., Swanepoel, D., Sommerville, J., Glascoe, F.G., Louw, E.M. & Vinck, B. Prevalence and nature of communication delays in a South African primary health care context. *South African Journal of Child Health [ACCEPTED]*
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ABBREVIATIONS

ASQ	Ages and Stages Questionnaire
CHW	Community Health Care Worker
COPC	Community Oriented Primary Health Care
DDST II	Denver developmental Screening Test II
PEDS	Parents' Evaluation of Developmental Status
PEDS: DM	Parents Evaluation of Developmental Status: Developmental Milestones
PHC	Primary Health Care
RITLS	Rossetti Infant-Toddler Language Scale
RTHB	Road to Health Booklet

1. INTRODUCTION

For optimal development of social, language, and other skills, young children need a warm, responsive, enriched, communicative environment (Glascoe & Leew, 2010). Infants and young children exposed to risk conditions may present with developmental delays or disorders that may ultimately impact socio-emotional, educational and vocational outcomes (Guralnick, 2013). These risks include any potential factors that affect a child's ability to interact with his or her environment (Paul & Roth, 2010; Rossetti, 2001), which in turn result in developmental delays or disorders. Communication delays in particular are most prevalent in children under the age of three years (Rossetti, 2001). If communication delays remain undetected later educational and social performance are negatively impacted, which in turn has long term financial implications, resulting in further delays or disorders (Eadie et al., 2010; Wankoff, 2011). In South Africa, the prevalence of communication delays or disorders are increasing as a result of environmental factors such as unemployment, limited medical resources, lack of educational services, violence, crime and HIV/AIDS (Guralnick, 2013).

Preventative strategies, such as developmental screening or surveillance and intervention, may be implemented from birth onwards for at risk populations with the aim of eliminating or reducing the resultant communication delays. The impact of prevention strategies may be strengthened by prioritising the identification of risk factors that may predispose communication delays or disorders in infants in underserved communities. Early intervention, including developmental screening and/or surveillance, in underserved communities is, however, hindered by financial constraints and by a lack of the necessary resources to implement family-centred services (Olusanya, Ruben, & Parving, 2006).

Early identification of developmental delays and disability, as a secondary prevention strategy, is widely acknowledged as the optimal way to minimize the adverse consequences hereof, and to maximize developmental outcomes (Feldman, 2004; Kritzinger & Louw, 2002; Slemming & Saloojee, 2013). Apart from benefitting at risk infants, early detection programs as a needs assessment enable government

agencies to determine the incidence of delays or disorders, facilitating appropriate planning.

1.1 RISK FACTORS AND COMMUNICATION DELAYS

In the UK an incidence for speech and language disability of 5,6% has been reported in children from birth to two years (Broomfield & Dodd, 2004). Similar findings have been reported in a systematic review where the median prevalence of speech and language delays in children two years of age was 5% (Law, Boyle, Harris, Harkness, & Nye, 2000). Although no prevalence data are available, it may be expected that the prevalence of communication delays in developing countries, such as South Africa, may be higher, due to greater exposure to environmental risks.

Elevated incidence of early biological and psychosocial risks in low and middle income countries, such as poverty, violence, nutritional deficiencies, HIV infections, and substance abuse are more likely to affect children (Samuels, Slemming, & Balton, 2012). In South Africa the risk factors associated with communication delays are pervasive (Samuels et al., 2012). These include advanced or very young maternal age (Beitchman et al., 2008), lack of parent-child interaction (Barwick, Cohen, & Horodezky, 2004), low parental educational levels, poor parental mental and physical health, insufficient parental coping strategies and confidence (Harrison & McLeod, 2010). These risk factors are likely to predispose infants to developmental delay.

Communication acquisition is also negatively impacted by limited parental education due to lack of knowledge and stimulation during the infant's early years (Hoff et al., 2013). Approximately 16% of adults (20 years or older) in South Africa are functionally illiterate, 34% have completed secondary levels of education only, and 29% have completed grade 12 (Statistics South Africa, 2011a). In addition, almost half of South Africans are deemed poor (45.5%) with 20% living in extreme poverty (Statistics South Africa, 2011b). Poor living conditions are known to restrict the quality and quantity of prenatal care, placing the unborn infant at risk of low birth weight and prematurity (Cone-Wesson, 2005). Risk factors such as poverty and low parental education can occur in isolation or concomitantly. It is generally accepted that an increase in the number of risk factors results in increased developmental risk to the infant (Paul & Roth, 2010).

In infants below two to three years of age, it is difficult to establish the impact of risk factors such as parental education below high school level, limited social support, poverty and more than three children in the home (Glascoe, 2000). However, the most important phase of communication acquisition and development occurs between eight and 24 months (Eadie et al., 2010; Reilly et al., 2006; Tomasello, 2003). Wide ranging prevalence of language delay with high rates of spontaneous resolution have been reported (Eadie et al., 2010; Law et al., 2000; Reilly et al., 2007). This illustrates the variability of the emergence of language skills, which in turn complicates the evaluation of communication development in infants and young children (Eadie et al., 2010). The first two years of life are crucial in communication acquisition and development, and since the emergence of communication skills reportedly varies between individuals (Eadie et al., 2010; Law et al., 2000; Reilly et al., 2007), identifying the link between early risk factors and communication delays may provide reliable indicators to improve early detection of communication delay. This may be especially informative in underserved or disadvantaged communities in countries like South Africa, where infants are exposed to multiple psychosocial risks along with health risks such as poverty, limited health care services and HIV/AIDS (Samuels et al., 2012).

In a previous study conducted across a spectrum of disadvantaged and advantaged urban communities in Melbourne, Australia, the presence of early risk factors could only explain 7% of the variation in language skills by the age of two years (Reilly et al., 2007). A few South African studies have reported on risk factors associated with communication delays, but this was done only in specific target populations, such as infants with cleft lip and palate, and babies with dysphagia (Groenewald, Kritzinger, & Viviers, 2013; Norman, Louw, & Kritzinger, 2007). However, the relationship between risk factors and communication delays is yet to be explored for infants in South Africa. More specifically, the relationship between the presence of risk factors and communication delays in underserved communities should be examined. These communities are deemed the poorest, most disadvantaged regions in the country, lacking adequate public health care services (Kon & Lackan, 2008).

1.2 PRIMARY HEALTH CARE (PHC) IN SOUTH AFRICA

PHC is one of the five health priorities for South Africa. The Minister of Health called for a renewed emphasis on prevention of disease instead of a curative approach to health care (South African Ministry of Health, 2011). Since the implementation of PHC in the South African health system, communities and individuals who previously did not have access to health services have reaped numerous benefits from the system. According to the PHC Facilities Survey of 1998 and 2000, better emergency vehicle response times, antenatal services, and daily immunization programs for infants and children provided evidence of significant improvement in health care services in rural and urban areas (van Rensburg, 2004).

Although improvements were noted on PHC level in some of the areas of service delivery, the reality is that tertiary hospitals are still overburdened. Every level of health care, viz. primary, secondary and tertiary, are still provided at tertiary hospitals as patients are not entering the health care system at a PHC level (Mohapi & Basu, 2012). The over-utilization of the tertiary level of care leads to poor quality of care for patients and over-expenditure of resources (Mohapi & Basu, 2012). Developmental screening may therefore be overlooked as part of the procedures followed during baby wellness visits. It may also be possible that patients lose confidence in PHC, which may result in them rather entering the health care system at a secondary or tertiary level. If PHC is, however, effectively utilized as the gateway into the health care system, the quality of care is likely to improve and other health care levels may be less burdened. In order to improve service delivery on all levels of health care the Department of Health is preparing the PHC Re-engineering Policy (Mohapi & Basu, 2012).

The PHC Package (Department of Health, 2000, 2001) was originally designed and implemented 15 years ago to adapt the previous health system through comprehensive and integrated services, and can therefore not be implemented through separate, vertical programmes (van Rensburg, 2004). Vertical programmes with a narrow focus often split services according to disciplines, hindering team work and referrals across different professions.

The PHC Package (Department of Health, 2000, 2001) is a standardized, comprehensive 'basket' of services, which includes preventive, promotive, basic curative and rehabilitative services delivered at community level. The package stipulates the quality standards required from each PHC service, standards that should be mutually supported by the health care professionals delivering the services (Department of Health, 2000). A 'one-stop' approach was facilitated where interventions are delivered in clusters which corresponds with the infrastructure and the model of care at district level (van Rensburg, 2004).

PHC facilities in South Africa have been identified by audiologists as viable platforms for the early identification of hearing loss (Swanepoel, 2009). In the USA, PHC personnel are generally considered the best-informed professionals with whom families have regular contact over the child's first five years of life. Furthermore well-child visits provide a platform for periodic evaluation of a child's development (Earls & Hay, 2006). In South Africa, however, PHC personnel lack both the knowledge and resources to identify developmental delays and disorders in infants and young children (van der Linde, Kritzinger, & Redelinghuys, 2009). The PHC context will therefore only be effective in the identification of infants at risk of developmental delays and/or disorders if the aforementioned limitations are addressed.

Research conducted in a rural PHC context in South Africa found the full-scale implementation of all early communication intervention functions at the PHC facilities was neither possible nor sustainable (van der Linde et al., 2009). The study found that the identification methods for infants at risk of communication delay were limited and unreliable, and that the referral system was ineffective (van der Linde et al., 2009). Although not fully utilized in South Africa, PHC should be considered the entry level through which the community obtains access to health care services (van Rensburg, 2004). As such PHC is invaluable as a potential context for developmental surveillance and screening.

Early childhood development must become a priority in the public health care sector where professional and political forces need to be mobilized to monitor, and where necessary, intervene to improve early childhood development (Dreyer, 2011). All levels and specialities of health care workers who provide medical treatment to

children in South Africa should be cognisant of children's development and behaviour by means of regular developmental surveillance, facilitating timely referral to allied health care professionals when delays in development are identified (Scherzer, 2011).

1.3 DEVELOPMENTAL SCREENING AND/OR SURVEILLANCE

Developmental surveillance refers to a flexible and continuous process with a broad scope, during which a child's development is longitudinally monitored (Thomas, Cotton, Pan, & Ratliff-Schaub, 2012). Developmental surveillance can be done by documenting familial concerns, maintaining an accurate history, and using observations, and can be conducted by a wide range of well-trained health care service providers (Pizur-Barnekow, 2010). Developmental surveillance in isolation is associated with poor sensitivity and is therefore not the most effective manner of detecting developmental delays (Pizur-Barnekow, 2010; Rydz, Shevell, Majnemer, & Oskoui, 2005). In contrast, developmental screening refers to testing populations of children at specific ages, using standardized tools, to detect those at high risk for unpredictable developmental problems (Thomas et al., 2012). Infants and young children at risk of developmental delays or disorders may be effectively identified and referred for early intervention services (Pizur-Barnekow, 2010) by means of effective surveillance and screening practices, as part of the baby wellness visits (Earls & Hay, 2006).

Policy statements in the USA support the use of an algorithm which combines both developmental surveillance and screening instruments (Disabilities, Pediatrics, Committee, & Committee, 2006). Recent research concluded that using both developmental surveillance and screening tools in PHC contexts in the USA are most effective method of identifying infants and young children who require comprehensive evaluation for developmental delays or disorders (Thomas et al., 2012). The combination of screening and surveillance procedures is necessary due to the difficulty of identification of delays in infants and young children in busy PHC contexts. Infants and young children should be monitored by means of developmental surveillance at each clinic visit and need only be screened at age intervals of 9, 18 and 24 months (Thomas et al., 2012).

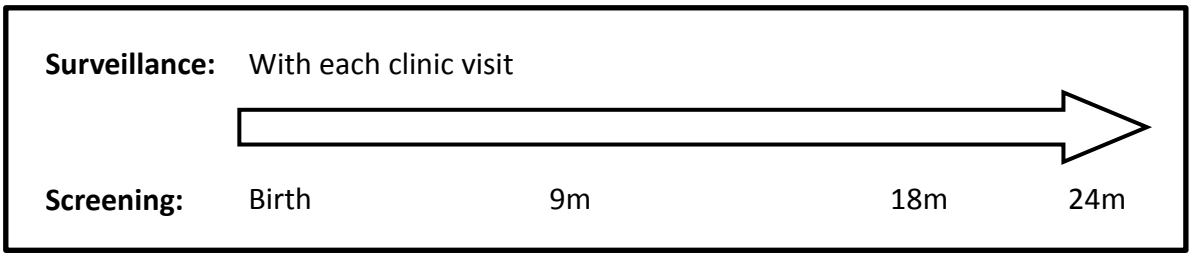

Figure 1.1 Intervals of developmental screening and surveillance (Thomas, et al., 2011)

Early identification strategies are strongly endorsed in many high-income countries where policy statements are in place (Disabilities et al., 2006; Scherzer, Chhagan, Kauchali, & Susser, 2012; Thomas et al., 2012). However, in South Africa and other low- and middle-income countries, early identification is often not prioritized due to the high burden of life-threatening health related priorities such as HIV/AIDS, infant mortality and tuberculosis (Scherzer et al., 2012). Ironically these same conditions are important causes of secondary developmental delays and disorders in infants and young children (Arunyanart et al., 2012; Slemming & Saloojee, 2013).

Limited research on the improvement of early detection of communication delays amongst infants and young children through developmental surveillance and screening tools, or of the implementation thereof, is currently available for lower to middle income countries like South Africa (Dekker, 2012; Scherzer, 2009; South to South team & International Center for AIDS Care and Treatment Programs, 2011). The only developmental surveillance or screening tool currently implemented nationally in South Africa, is integrated in *The Road to Health Booklet*/RTHB (South to South team & International Center for AIDS Care and Treatment Programs, 2011) (See Appendix A). The revised booklet was introduced in October 2010 as part of the Department of Health's initiative to improve service delivery to infants and young children. The RTHB is a parent-held record used to monitor and promote early child health, growth, and development (Harrison, Harker, Heese, & Mann, 2005; Western Cape Provincial Government, 2011). The Department of Health distributes the RTHB to all newborns at state and private facilities by the Department of Health to be checked periodically at well baby visits (Scherzer, 2011; Western Cape Provincial Government, 2011). The RTHB developmental checklist is the only tool available to health care workers in the public health care context to conduct screening for developmental delays or disorders. However, the accuracy of the booklet's checklist

for the identification of developmental disabilities is yet to be established (Donald, Hall, & Dawes, in press; Slemming & Saloojee, 2013). In addition, no clear referral criterion has been specified for use with the screening tool (Donald et al., in press). Guidelines are therefore sparse for health care workers making decisions regarding who should be referred, when they should be referred and to whom they should be referred. To date no evidence on the validation, reliability or accuracy of the RTHB screen is available in published literature. It is, therefore, important to compare the RTHB developmental checklist with a valid, reliable and accurate standardized screening instrument. Not only must the screening tool be validated and standardized, but the screening instrument must also be appropriate for use within the South African PHC context. For instance, a parent completed screening tool, instead of a clinician administered test, may be easier and more likely to be adopted since South Africa's public health care context is generally overburdened (van der Linde et al., 2009).

Many development screening tools have been developed and validated internationally (Macy, 2012). A systematic review on the evidence behind developmental screening instruments indicated the following: The Denver Developmental screening test/DENVER II (Frankenburg, Dodds, Archer, Shapiro, & Bresnick, 1992) with 58 research studies, the Ages and Stages Questionnaire / ASQ (Squires, Twombley, Bricker, & Potter, 2009) with 45 studies, the McCarthy Screening test (McCarthy, 1978) with 40 research studies, and the Parents' Evaluation of Developmental Status / PEDS (Glascoe, 1997) with 20 research studies, present with the largest body of supporting evidence of screening tools ranging from birth to kindergarten (Macy, 2012). Although the DENVER-II has been evaluated in the largest number of research studies (58 studies) between 1971 and 2010 (Macy, 2012), the sensitivity and specificity ratings of the PEDS are reportedly higher than those of the DENVER-II (Frankenburg et al., 1992). Furthermore the PEDS and ASQ are also the only parent administered tests, as the DENVER II, and the McCarthy Screening test are both clinician administered tests.

The McCarthy Screening test, developed 36 years ago, lacks current supporting evidence, as the most recent utility study conducted on this test was published 11 years ago (in 2004)(Macy, 2012). The ASQ on the other hand is well supported by current evidence, with 45 studies between 1998 and 2011 (Macy, 2012). Both the

PEDS and ASQ have reasonable test characteristics for developmental screening in PHC settings and ultimately the selection of the screening tool should be determined by the population served, the setting and the clinician's preference (Limbos & Joyce, 2011). When financial constraints are taken in consideration, the PEDS is deemed more appropriate within the South African context due to the cost of the materials required for the ASQ.

The PEDS (Glascoe & Robertshaw, 2010) may also be used in combination with the Parents' Evaluation of Developmental Status: Developmental Milestones (PEDS: DM) which identifies parental concerns are identified as well as the presence/absence of domain specific developmental milestones (Glascoe & Robertshaw, 2010). The PEDS has been validated in eight studies with 12 additional utility studies, describing the application of the tool within specific populations between 2001 and 2010 (Macy, 2012). The participants of the aforementioned studies were aged between birth and six years, with a total of 7213 children assessed (Macy, 2012). The PEDS has proved to be a reliable tool that is highly consistent in test-retest reliability (88%) and inter-reliability measures (88%). Furthermore the PEDS test has demonstrated sensitivity of 75% and specificity of 80% for developmental delays in infants from birth to 18 months of age. The PEDS: DM has also demonstrated equally high sensitivity and specificity scores (respectively 82% and 83%) for infants aged between zero and 12 months.

The PEDS tools offer the addition of an algorithm of evidence-based support for health care personnel to aid in the decision making process (Glascoe & Robertshaw, 2010). The amount of time that it takes to conduct and score the test is less than 10 minutes (Glascoe & Robertshaw, 2010). Furthermore a recent study confirmed the accuracy of the PEDS tools in private health care in South Africa (Silva, 2010). Since the standardized PEDS tools present with a large body of evidence confirming the accuracy, validity and reliability of the tool, it was considered a suitable benchmark screening tool against which to compare the RTHB developmental checklist.

Infants receiving early intervention services make greater progress following early detection by means of developmental screening and/or surveillance as first point of access when the whole family is involved (Guralnick, 2013). Since parents are usually the first to identify their children's developmental difficulties, they are considered a

good resource by health care providers when conducting screening tests (Glascoe & Robertshaw, 2010). The resource-constrained public health care system in developing countries like South Africa (Mayosi & Benatar, 2014) requires time-efficient and accurate screening tools to ensure it is practically feasible with low false-positive rates to avoid over-referral. Parents can be used as a resource in identifying their child's strengths and weaknesses (Glascoe, 2013), hereby providing important information to professionals. A parent-administered test may therefore be appropriate for the South African context if it is sufficiently accurate and time efficient. Furthermore the selection of a comprehensive screening tool which accurately detects communication delays in addition to other developmental delays may be more suitable in the South African, resource-constrained public health care context than developmental domain specific screening tools.

While a recent study evaluated the accuracy of the PEDS and PEDS: DM for identification of developmental delays in the private health care sector in South Africa (Silva, 2010), the accuracy of the PEDS test in detecting communication delays or disorders in infants in the South African PHC context has not yet been established.

1.4 PROBLEM STATEMENT AND RATIONALE

It is well-established that developmental milestones allow prediction of developmental outcome (Brothers, Glascoe, & Robertshaw, 2008; Scherzer, 2009). Subsequently the importance of high-quality screening tests in the early identification of infants, toddlers and young children with developmental delays, are internationally recognized (Elbaum, Gattamorta, & Penfield, 2010; Glascoe, 2000). Developmental screening and surveillance are widely used in high-income countries, but little evidence is available on the extent to which this practice is part of the medical protocol in low and middle income countries, such as South Africa (Scherzer, 2009).

The evident lack of research supporting the RTHB as a developmental screening or surveillance tool is sufficient motivation to compare the outcome of the tool with a well validated tool, in this case the PEDS tools. Association between risks and communication delays as well as the prevalence and nature of communication delays should be investigated. Finally, the accuracy of the PEDS tools for detecting communication delays in infants in South Africa should be determined. The questions

to be answered are: How does the outcome of the RTHB screen compare to the PEDS tools? What are the prevalence and nature of communication delays in these infants and how do the risks that they are exposed to associate with the communication delays, and more specifically, with language delays? Do the PEDS tools accurately detect communication delays in infants in an underserved community?

2 METHOD

2.1 RESEARCH OBJECTIVES

Main Aim

To study the infant population in an underserved community by reporting on risks, communication delay and by evaluating screening tools that can be used to identify developmental risks in this population.

Sub aims

- To compare the RTHB screen with a well validated international screening tool in an underserved PHC context
- To determine association between risks and communication delays in infants from an underserved PHC context
- To describe the prevalence and nature of communication delays in infants from and underserved PHC context.
- To determine the accuracy of the PEDS tools in detecting communication delays in an underserved PHC context

2.2 RESEARCH STUDIES

Four research studies, each designed for submission to accredited peer-reviewed journals upon completion, are proposed. The four studies are summarised in Table 2.1 according to the titles, objectives, and journals.

2.3 RESEARCH CONTEXT

Three PHC clinics (Olievenhoutbosch clinic, Salvokop clinic and Daspoort Poli clinic) in underserved communities of the Tshwane district, Gauteng province of South Africa were utilized for data collection. Olievenhoutbosch is an area of 11.39 $km^{2,}$ situated in Centurion, with a population of 70 863 individuals and 23 777 households (Statistics South Africa, 2011a). Salvokop and Daspoort form part of the Pretoria sub-district. The clinic situated in Salvokop serves an area of 4,09 km^2 with a population of 7 123 and 1 685 households (Statistics South Africa, 2011a). Similarly Daspoort is an area

2,16km^2 with a population of 6 355 and 1 582 households (Statistics South Africa, 2011a).

Table 2.1 Summary of studies one to three indicating the topic, objectives and journal for submission

Study	**1**	**2**	**3**	**4**
Title	Developmental screening in South Africa: Comparing the national developmental checklist to a standardized tool	Risks associated with communication delays in infants from underserved South African communities	Prevalence and nature of communication delays in a South African PHC context	Accuracy of the PEDS Tools in detecting communication delays in at-risk South African infants
Objective	To investigate the screening outcomes on the PEDS tools and the RTHB in a representative South African population of infants.	To investigate the relationship of psychosocial risk in underserved South African communities and delays in early communication development.	To determine the prevalence and nature of communication delays in infants aged 6-12 months in underserved communities in South Africa.	To evaluate the accuracy of the PEDS tools in detecting communication delays in infants, aged six to twelve months, in a PHC context in South Africa
Journal	African Health Sciences	African Journal of PHC and Family Medicine	South African Journal of Child Health	South African Journal of Communication Disorders

2.4 RESEARCH DESIGN

Table 2.2 presents a summary of the study design, participant selection criteria, sampling method, sample size, equipment and apparatus, data collection material and procedures for each of the four studies.

A cross-sectional, comparative research design (Leedy & Ormrod, 2012) was selected for all the research studies. A single data collection period of three months, during which all the data for the four different studies were collected, commenced after ethical clearance was obtained.

2.5 MATERIALS

The Rossetti Infant-Toddler Language Scales or RITLS is a comprehensive, easy-to-administer and relevant tool to assess the preverbal and verbal communicative

abilities and interaction in infants and young children (Rossetti, 2006). Although this is a criterion referenced tool, it has been widely used and validated in the past (Desmarais, Sylvestre, Meyer, Bairati, & Rouleau, 2010; Dettman, Pinder, Briggs, Dowell, & Leigh, 2007; Groenewald et al., 2013; Rie, Mupuala, & Dow, 2008; Steiner, Goldsmith, Snow, & Chawarska, 2012; Sylvestre & Mérette, 2010). The tool is designed to assess the following domains: pragmatics, gesture, play, language comprehension, language expression and interaction attachment. The RITLS categorizes infant development into three month intervals, for instance zero to three months and three to six months. At each interval developmental milestones under each of the domains are presented. When an infant at a specific age interval has one or more unmet milestone(s) in a specific developmental domain (such as language expression), the milestones of the previous interval are evaluated until the infant has met all the milestones at that age interval. The infant's developmental level is therefore defined as the interval at which he/she obtained all the milestones within a developmental domain. It is therefore possible that the infant's developmental level is different for each of the evaluated domains. An infant's communication ability is classified as delayed when domain specific developmental levels differed by six months or more from the chronological age (for instance when a 12 month old infant's language expression scored on a 3-6 month developmental level; Rossetti, 2006). The RITLS was completed by observing and eliciting infant behaviour, and by making use of parental responses.

The RTHB developmental checklist forms part of the RTHB (see Appendix A). The screen consists of 21 questions in total. The first three questions must be asked to caregivers at every visit, and in addition to these questions, there are three questions that must be asked when infants are 14 weeks, six months, nine months, 18 months, three years and five to six years of age. The developmental domains include sensory functioning such as sight and hearing, communication, and gross motor and fine motor development. However these developmental domains are not all represented at the different age intervals. The tool suggests referral to allied health care professionals if milestones are not met.

The PEDS tools, i.e. the PEDS and PEDS: DM, consists of questions posed to the parent/caregiver. The PEDS identifies parental/caregiver concerns by means of 10

open-ended questions, regarding the infants' development in the following areas: global/cognitive; expressive language and articulation; receptive language; fine motor; gross motor; behaviour; social-emotional; and self-help skills. Each of these areas is represented irrespective of the child's age. The PEDS has a clear score guide and referral algorithm (Glascoe, 1997). The algorithm consists of five paths, namely Path A - E.

Path A - When two or more predictive concerns about self-help, social, school, or receptive language skills are present, refer for audiological and speech-language testing. Use professional judgment to decide if referrals are needed for other services such as occupational therapy, social work etc.
Path B - When one predictive concern is present, administer a second stage developmental screen. If the screen is failed, refer for testing in areas of difficulty.
Path C - When non-predictive concerns are present, counsel in areas of difficulty, and follow-up in several weeks.
Path D - When parental communicative difficulties due to language barrier are present, use a translator at the second screen.
Path E - When no concerns are present, conduct developmental surveillance at next visit.

Furthermore, in Path B distinction is made between development-related predictive concerns and health related concerns. The PEDS were interpreted in one of two ways. Firstly, Paths A and B were considered a fail, whereas Path C, D and E represented a pass. Alternatively, Path A to D was considered a fail and Path E a pass. Two different interpretations of the PEDS was decided on as Paths A and B represent the predictive concerns only (a more stringent interpretation), while Path A to D includes all concerns (a more inclusive interpretation).

The PEDS: DM consists of six questions posed to parents regarding their infants or children's developmental milestones. The six questions differ in each of the age intervals and represent the following developmental domains: fine motor skills, receptive language, expressive language, gross motor skills, self-help and social-emotional skills.

If an infant had one or more unmet milestone in the PEDS:DM the outcome of the test is considered a fail (Glascoe & Robertshaw, 2010). The interpretation of the PEDS tools started with the PEDS, where Path A represented a fail irrespective of the PEDS: DM result, or, with Path B to E, the PEDS: DM results determined the actual pass or fail.

Table 2.2 Research design and methods summary for study 1 to 4

Study	**1**	**2**	**3**	**4**
Title/Topic	Developmental screening in South Africa: Comparing the national developmental checklist to a standardized tool	Risks associated with communication delays in infants from underserved South African communities	Prevalence and nature of communication delays in a South African PHC context	Accuracy of the PEDS Tools in detecting communication delays in at-risk South African infants
Study design	Cross-sectional research design			
Participant selection criteria	Informed consent were obtained from the parents/caregivers of the infants Parents/Caregivers of infants between the ages of six to 12 months Parents/ Caregivers had to be proficient in Afrikaans or English			
Participant sampling	Convenience sampling			
Sample size	201 participants			
Equipment and apparatus	Pens, clipboards and laptop computer to enter and store data in an Excel spread sheet, assessment instruments and developmentally appropriate toys to elicit communication behaviour from infant participants			
Data collection material	Informed consent form (Appendix B) Road to Health booklet screen (Appendix A) Demographic information questionnaire (Appendix A) PEDS tools (Appendix C)	Informed consent form (Appendix B) Demographic information questionnaire (Appendix A) RITLS (Appendix D)	Informed consent form (Appendix B) Demographic information questionnaire (Appendix A) RITLS (Appendix D)	Informed consent form (Appendix B) Demographic information questionnaire (Appendix A) RITLS (Appendix D) PEDS tools (Appendix C)
Cross-sectional data collection procedure	Acquire informed consent from caregivers of participants Conduct case history interview and complete high risk register form Ask the required questions to the caregiver to complete the Road to Health booklet screen Ask the required questions to the caregiver to complete the PEDS combined Conduct RITLS Follow up and/or refer if necessary			
Statistical analysis	Quantitative data analysis was conducted using a commercially available software package, namely SAS. Descriptive and inferential statistics such as log-linear analyses were used.			

2.6 ETHICAL CONSIDERATIONS

Ethical clearance was obtained from the following institutions:

- Gauteng Department of Health (Appendix E)
- Faculty of Humanities, University of Pretoria (Appendix F)
- Faculty of Health Sciences, University of Pretoria (Appendix G)

Permission was also obtained from Prof Jannie Hugo, head of the community orientated- primary care initiative, to conduct the current research project at the COPC sites (Appendix H).

The research ethics guidelines in *Ethics in Health Research: Principles, Structures and Processes* (Department of Health, 2004) were utilized. Compliance with these standards and with other national and international guidelines reassured the public that the rights, safety and well-being of the participants were protected (Department of Health, 2004). The guiding principles are listed and discussed below in Table 2.3 as they were applied to the current study.

Table 2.3 Ethical principles applied in participant selection, data collection and analysis (Department of Health, 2004)

Principle	Application to study
Respect and dignity: *Respect for the dignity, safety and well-being of participants should be the primary concern in health research involving human participants. Culture, language, beliefs, perceptions and customs must all be considered.*	The researcher first and foremost treated each participant and their caregivers with respect and dignity. The researcher received training on cultural competency. Furthermore health care personnel who share the culture and language of many of the participants assisted the researcher during the data collection procedures.
Relevance: *Researchers in South Africa have ethical responsibility to ensure that their research is relevant both to the broad health and development needs of the country and to the individual needs of those who suffer from the diseases and developmental concerns under study. The findings of the research must be translatable into mechanisms for improving the health status of South Africans.*	The researcher aimed to evaluate developmental screening tools as part of the foundation to establish an effective developmental screening programme as part of COPC, so that such a programme can contribute to valid developmental screening practices in the PHC context in South Africa.
Scientific integrity: *In addition to fulfilling a need and being of value, the research proposed must demonstrate a sound methodology and a high probability of providing answers to the research questions posed. The research protocol must show knowledge of relevant literature. Moreover, research methods and results must be open to peer review and scrutiny*	The scientific integrity was scrutinized by the ethics committees of the University of Pretoria and the Gauteng Department of Health. Additionally the researcher conducted an in depth literature review and consulted with researchers familiar with research in similar health care contexts. The studies were presented as articles, which have been reviewed by local and international scholars before publication.
Investigator competence: *A suitably qualified investigator should conduct the study. The investigator's competence is assessed mainly by technical competence, which includes research competence, and is itself assessed in terms of education, knowledge, certification and experience. Compassion and empathy are among the characteristics required and a proper clinical and research environment with adequate research mentoring should be established. The principal investigator must be a South African–based researcher*	The researcher is a South African qualified professional Speech-Language Pathologist who has completed a master's degree in the same field of interest. The researcher is furthermore familiar with the context and is collaborating with other experts in the field.
Principal investigator responsibilities: *The principal investigator must submit an application to the appropriate and accredited local ethics committee/s. The principal investigator bears full responsibility for the scientific and ethical aspects of the study and forms the means of communication with the ethics committee while obtaining approval.*	The researcher takes full responsibility for the scientific and ethical aspects of the study, and submitted this proposal to the appropriate ethics committees. Research only commenced after approval have been granted by the Research Ethics Committees of the Faculty of Humanities and Health Sciences of the University of Pretoria.

Principle	Application to study
Informed consent: *Informed consent must be obtained from research participants before the research commences. Both written and verbal informed consent must be obtained. Verbal consent, where the participant is illiterate, should be obtained in the presence of a literate witness who should verify in writing, duly signed, that informed verbal consent was obtained. Informed consent means that a participant was informed about the risks and benefits of the research, understands such risks and benefits and is able to give consent to participation, without coercion, undue influence or inappropriate incentives*	Freely given informed consent was obtained from every participant through use of the informed consent form (Appendix B). Written consent was obtained from each participant prior to data collection. All caregivers with infants 6-12 months visiting the clinic were approached, but prospective participants who do not understand Afrikaans or English were not included in the study.
Privacy and confidentiality: *A participant's right to both privacy and confidentiality must be protected. The researcher must ensure that where personal information about participants is collected, stored, used or destroyed , this is done in ways that respect the privacy and confidentiality of the participants and any agreements made with the participants*	Participant confidentiality was ensured as data for each individual were reported using a numeric code. No identifying information was obtained from participants. The data will be safely stored for 15 years at the University of Pretoria.
Inclusion and exclusion criteria: *The selection, recruitment, exclusion and inclusion of research participants must be just and fair, based on sound scientific and ethical principles. No person may be inappropriately or unjustly excluded on the basis of race, age, sex, sexual orientation, disability, education, religious beliefs, pregnancy, marital status, ethnic or social origin, conscience, belief or language*	All caregivers of infants aged 6-12 months were asked to participate in the study. In no way did the researcher discriminate or unjustly exclude a possible participant from the research.
Risk and benefits: *A risk/benefit analysis of the study should precede the research itself. With the analysis full notice of benefits and harms beyond the duration of the research should be noted.*	No risks were involved in the participation of the research and the only benefit was that parents were referred for early intervention where necessary. Referrals to allied health care professionals were made to the respective health care facilities in accordance to the Gauteng Department of Health's referral system.
Publication of results: *Investigator has an obligation to disseminate research results, whether positive or negative, in a timely and competent manner.*	The research results were submitted in 4 articles for publication in peer-reviewed accredited journals.
Ethical review: *All health research conducted in South Africa must be reviewed by a research ethics committee and should not commence until the ethics committee has granted approval.*	Clearance was obtained from the Research Ethics Committees of the Faculties of Humanities and Health Sciences of the University of Pretoria and from the Department of Health.
Distributive justice: *Research proposals should provide sufficient information to determine whether there is a reasonable likelihood that the population on whom research is to be carried out will benefit from the research and its results*	The benefit from the research for the target population was clear.

3 DEVELOPMENTAL SCREENING IN SOUTH AFRICA: COMPARING THE NATIONAL DEVELOPMENTAL CHECKLIST TO A STANDARDIZED TOOL

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Journal: African Health Sciences

Publication: March 2015, Vol 15 Issue 1, pp 188-196

3.1 ABSTRACT:

Background. Worldwide, more than 200 million children in low- and middle-income countries have developmental delays and/or disabilities. In South Africa the only nationally implemented developmental 'screening' tool is integrated as part of 'The Road to Health Booklet' (RTHB). **Method.** The study employed a comparative cross-sectional within-subject design to evaluate the accuracy of the RTHB developmental checklist against a standardized international tool i.e. the PEDS tools, consisting of the PEDS and PEDS:DM. A total of 201 participants were included through purposive sampling at PHC facilities in Tshwane, South Africa. **Results.** Sensitivity of the RTHB developmental checklist is low, but specificity is high. The RTHB developmental checklist failed to identify more than half the infants at risk of delays or disorders. The nationally implemented developmental checklist is ineffective to identify at-risk infants. It should be adapted and validated or replaced in order to improve identification of at-risk infants.

Key words: developmental screening, early identification, developmental delays or disorders, at-risk infants

3.2 INTRODUCTION

Worldwide, more than 200 million children in low- and middle-income countries have developmental delays and/or disabilities with an increasing prevalence due to medical advances that markedly reduce mortality among children under 5 years of age (Scherzer et al., 2012). The true prevalence and early detection and intervention

strategies for this population in low- and middle-income countries, such as South Africa, must still be established (Scherzer et al., 2012). Early identification of developmental delays and disability, as a secondary prevention strategy, is widely acknowledged as the optimal way to minimize adverse consequences and maximize developmental outcomes (Feldman, 2004; Kritzinger & Louw, 2002; Slemming & Saloojee, 2013). Apart from benefitting at risk infants, early detection programs as a needs assessment enable government agencies to determine the incidence of delays or disorders towards appropriate planning.

Early identification strategies are strongly endorsed in many high-income countries such as the USA where policy statements are in place (Disabilities et al., 2006; Scherzer et al., 2012; Thomas et al., 2012). However, in South Africa and other low- and middle-income countries, early identification is often not prioritized due to the high burden of life-threatening health related priorities such as HIV/AIDS, infant mortality and tuberculosis (Scherzer et al., 2012). Ironically these same conditions are important causes of secondary developmental delays and disorders in infants and young children (Arunyanart et al., 2012; Slemming & Saloojee, 2013).

Limited research on improving early detection of infants and young children through developmental surveillance or screening tools and the implementation thereof is currently available for lower to middle income countries like South Africa (Dekker, 2012; Scherzer, 2009; South to South team & International Center for AIDS Care and Treatment Programs, 2011). The only developmental surveillance or screening tool, currently implemented nationally in South Africa, is integrated as part of *The Road to Health Booklet*/RTHB (South to South team & International Center for AIDS Care and Treatment Programs, 2011) (See Attachment A). The revised booklet was introduced in October 2010 as part of the Department of Health's initiative to improve service delivery to infants and young children. The RTHB is a parent-held record used to monitor and promote early child health, growth, and development (Harrison et al., 2005; Western Cape Provincial Government, 2011) and is distributed to all newborns at state and private facilities by the Department of Health to be checked periodically at well baby visits (Scherzer, 2011; Western Cape Provincial Government, 2011). The RTHB developmental checklist is, therefore, the only tool available to all health care workers in the public health care context to conduct screening for developmental delays or disorders. However, the accuracy of the

booklet's checklist in the identification of developmental disabilities is yet to be established (Donald et al., in press; Slemming & Saloojee, 2013). Also, no clear referral strategy has been specified for the screening tool (Donald et al., in press). Consequently few guidelines are provided for the health care worker to aid the decision making process of who should be referred, when they should be referred and to whom they should be referred. To date no evidence on the validation, reliability or accuracy of the RTHB screen is available in published literature. It is, therefore, important to compare the RTHB developmental checklist against a valid, reliable and accurate standardized screening instrument.

Apart from selecting a validated standardized screening instrument against which the RTHB screen can be compared, the tool must also be appropriate for use within the South African PHC context. For instance, since South Africa's public health care context is generally overburdened (van der Linde et al., 2009) a parent completed screening tool, instead of a clinician administered test, may be easier and more likely to be adopted.

Many development screening tools have been developed and validated internationally (Macy, 2012). A systematic review on the evidence behind developmental screening instruments rendered the following: The Denver Developmental screening test/DENVER II (Frankenburg et al., 1992) with 58 research studies, the Ages and Stages Questionnaire/ASQ (Squires et al., 2009) with 45 studies, the McCarthy Screening test (McCarthy, 1978) with 40 research studies, and the Parents' Evaluation of Developmental Status/PEDS (Glascoe, 1997) with 20 research studies have the largest body of supporting evidence of screening tools that ranges from birth to kindergarten (Macy, 2012). Although the DENVER-II has been evaluated in 58 research studies between 1971 and 2010 (Macy, 2012), the reported sensitivity and specificity ratings of the PEDS are higher than those of the DENVER-II (Frankenburg et al., 1992). Furthermore the PEDS and ASQ are the only parent administered tests, as the DENVER II, and the McCarthy Screening test are both clinician administered tests.

The McCarthy Screening test, developed 36 years ago, lacks current supporting evidence, as the most recent utility study conducted on this test was published 10 years ago (in 2004) (Macy, 2012). The ASQ on the other hand is well supported by

current evidence, i.e. 45 studies between 1998 and 2011 (Macy, 2012). Both the PEDS and ASQ have reasonable test characteristics for developmental screening in primary care settings and ultimately the selection of the test should be determined by the population served, the setting and the clinician's preference (Limbos & Joyce, 2011). Since the ASQ includes an expensive materials kit, whereas the PEDS only has the questionnaires, the PEDS was deemed more appropriate for the current study as financial constraints within the South African PHC context had to be considered.

The PEDS (Glascoe & Robertshaw, 2010) can also be applied in combination with the Parents' Evaluation of Developmental Status: Developmental Milestones (PEDS: DM) with which parental concerns are identified as well as the presence/absence of domain specific developmental milestones (Glascoe & Robertshaw, 2010). The PEDS has been validated in 8 studies during 2001 to 2010 with 12 additional utility studies, i.e. the application of the tool on specific populations, has been conducted during the same time period (Macy, 2012). Across these studies the participants were aged between birth and six years with a total of 7213 children assessed (Macy, 2012). The PEDS has proven to be a reliable tool that is highly consistent in test-retest reliability (88%) and inter-reliability measures (88%). Furthermore the PEDS test has demonstrated sensitivity of 75% and specificity of 80% for developmental delays in infants from birth to 18 months of age. The PEDS: DM has also demonstrated high sensitivity and specificity scores (respectively 82% and 83%) for infants aged between 0-12 months.

The PEDS tools offers an algorithm of evidence based support for health care personnel in the decision making process (Glascoe & Robertshaw, 2010). The amount of time that it takes to conduct and score the test is less than 10 minutes (Glascoe & Robertshaw, 2010). Furthermore a recent study confirmed the accuracy of the PEDS tools for gross motor development in South Africa (Silva, 2010). Since the standardized PEDS tools have a large body of evidence confirming the accuracy, validity and reliability of the tool, it was considered a suitable benchmark screening tool against which to compare the RTHB developmental checklist. The current study therefore investigated the screening outcomes on the PEDS tools and the RTHB in a representative South African population of infants.

3.3 METHOD

A comparative cross-sectional within-subject design was employed to evaluate the accuracy of the RTHB developmental checklist against the PEDS tools, consisting of the PEDS and PEDS: DM, in a sample of representative infants in South Africa. Three PHC clinics (Olievenhoutbosch clinic, Salvokop clinic and Daspoort Poli clinic) in underserved communities of the Tshwane district, Gauteng province of South Africa were utilized for data collection. Olievenhoutbosch is an area of 11.39 $km^{2,}$ situated in centurion, with a population of 70 863 individuals and 23 777 households (Statistics South Africa, 2011a). Salvokop and Daspoort form part of the Pretoria sub-district.

The clinic situated in Salvokop serves an area of 4,09 km^2 with a population of 7123 and 1685 households (Statistics South Africa, 2011a). Similarly Daspoort is an area 2,16km^2 with a population of 6355 and 1582 households (Statistics South Africa, 2011a). Permission and ethical clearance was obtained prior to data collection from the Tshwane district research committee, Department of Health as well as from the Faculty of Health Sciences and Humanities, University of Pretoria.

3.3.1 Participants

Purposive sampling was used as all parents or caregivers of infants aged 6-12 months, who can speak English or Afrikaans, visiting the PHC clinics, were asked to participate in the research study. As the age range, i.e. 6-12 month old infants, limited the number of participants available, a random sampling technique could not be utilized. Consequently all parents or caregivers of infants aged 6-12 months were asked to volunteer. Data was collected three times per week over a period of 4 months (May-Sept 2013). A total of 201 participants were included in the research study. Gender was evenly distributed (45% female). Home language distribution was Sepedi (33%), followed by Zulu (16%), Shona (11%), Ndebele (10%), Xhosa (6%), Southern Sotho (5%), Setswana (5%), Venda (4%), Tsonga (3%), Tsumbuga (2%), Afrikaans (2%), Shangaan (1%), Siswati (1%), Swahili (0,5%) and Sesotho (0,5%). While none of the participants reported English as their home language, all participants were proficient in either Afrikaans or English as an additional language. The majority of the participants resided in the Olievenhoutbosch area (94%), with the

remainder from other areas such as Salvokop (2%) and Mamelodi (0.5%). Most participants (98.5%) were Black and the remaining 1.5% was other ethnicities.

Only six infants (out of 201) were born prematurely and also seven infants were from teenage pregnancies. 62% of parents or caregivers left the educational system at Grade 10 or less and 71% reported a household income of less than R3000 (US$300) a month. 32% of the infants have two or more siblings. In general 16.5% of South Africans (20 years or older) are functionally illiterate, 34% completed some secondary levels of education and 29% completed grade 12 (Statistics South Africa, 2011a). Furthermore 45.5% of the South African population is deemed poor and 20% live in extreme poverty (Statistics South Africa, 2011b).

3.3.2 Material

The RTHB developmental checklist forms part of the Road to Health Booklet (See Appendix A). The screen consists of 21 questions in total. The first three questions must be asked to caregivers with every visit, and in addition to these questions there are three questions that must be asked when infants are 14 weeks, six months, nine months, 18 months, 3 years and 5-6 years of age. The developmental domains include sensory functioning such as sight and hearing, communication and gross motor and fine motor development. However all these developmental domains are not represented at the different age intervals. The tool suggests referral to allied health care professionals if milestones are not met.

The PEDS tools, i.e. the PEDS and PEDS: DM, consists of questions posed to the parent/caregiver. The PEDS identifies parental/caregiver concerns, by means of 10 open-ended questions, regarding the infants' development on the following areas, global/cognitive, expressive language and articulation, receptive language, fine-motor, gross motor, behavior, social-emotional, self-help skills. Each of these areas is represented irrespective of the child's age. The PEDS has a clear score guide and algorithm for referral (Glascoe, 1997). The algorithm consists of five paths, namely Path A - E.

Path A - When two or more predictive concerns about self-help, social, school, or receptive language skills are present, refer for audiological and speech-language

testing. Use professional judgment to decide if referrals are needed for other services such as occupational therapy, social work etc.

Path B - When one predictive concern is present administer second stage developmental screen, if screen is failed refer for testing in areas of difficulty

Path C - When non-predictive concerns are present, counsel in areas of difficulty and follow-up in several weeks.

Path D - When parental difficulties communicating due to foreign language barrier are present, use translator in second screen.

Path E - When no concerns are present, elicit concerns at next visit.

Furthermore in Path B distinction is made between development-related predictive concerns and health related concerns.

The PEDS: DM consists of six questions posed to parents regarding their infants or children's developmental milestones. The six questions differ in each of the age intervals and represent the following developmental domains: fine-motor, receptive language, expressive language, gross motor, self-help and social-emotional.

3.3.3 Procedures and data processing

Data was collected by a qualified speech-language pathologist, registered at the Health Professions Council of South Africa, with 8 years of experience in the assessment of infants and young children. Parental/caregiver informed consent was required before data collection commenced. The RTHB screen was conducted first as the parents/caregivers are familiar with the screening test. After the RTHB screen, the PEDS tools were conducted on each participant. The PEDS and PEDS: DM questions were asked as an interview to parents or caregivers.

In order to be able to determine sensitivity and specificity the data had to be processed into a pass or fail. One or more unmet milestones in the RTHB developmental checklist, was deemed a fail. The results of the PEDS were interpreted in two different ways: i.e. Path A and B was considered a fail, whereas Path C, D and E represented a pass. Alternatively Path A-D was considered a fail and Path E a pass. Two different interpretations of the PEDS was decided on as Path A and B represents the predictive concerns only (a more stringent interpretation), while Path A-D includes all concerns (a more inclusive interpretation).

If an infant had one or more unmet milestone in the PEDS:DM the outcome of the test is a fail (Glascoe & Robertshaw, 2010). The interpretation of the PEDS tools started with the PEDS, where Path A represented a fail irrespective of the PEDS: DM result, but with Path B-E the PEDS: DM results determined the actual pass or fail (see Table 3.1).

Table 3.1 Summary of the pass/fail criteria of the tools

	RTHB	PEDS	PEDS (Path A and B as fail)	PEDS:DM	PEDS tools
Pass	0 unmet milestones	Path E	Path C,D and E	0 unmet milestones	Path B-E if 0 unmet milestones on the PEDS:DM
Fail	≥1 unmet milestone	Path A-D	Path A and B	≥1 unmet milestone	Path A or Path B-E if ≥1 unmet milestone on the PEDS:DM

3.4 RESULTS

Outcomes of the PEDS: tools and RTHB developmental checklist (Table 3.2) indicate that 52% of the sample (104 infants) failed the PEDS tools, 49% (98 infants) failed the PEDS: DM and 47% (94 infants) failed the PEDS. The RTHB developmental checklist failed 17% (35 infants) of the sample, and the PEDS (path A and B) failed 30% (61 infants) of the sample.

Table 3.2 Pass/Fail distribution of the RTHB developmental checklist, PEDS tools and PEDS

	RTHB developmental checklist	PEDS tools	PEDS:DM	PEDS	PEDS (Path A and B as fail)
Pass	166	97	103	107	140
Fail	35	104	98	94	61
Referral rate	17% (35/201)	52% (104/201)	49% (98/201)	47% (94/201)	30% (61/201)

There were numerous ways to compare the RTHB's outcomes with the gold standard. The RTHB developmental checklist identified 26 of the 104 participants who failed the PEDS tools. The sensitivity of the RTHB developmental checklist was limited, 25%, but the specificity was high, 91% (Table 3.3). Twenty-six of the 35 infants who failed the RTHB also failed the PEDS tools. Table 3.3 also reports the RTHB and PEDS comparison with a stricter PEDS fail criterion applied. Sensitivity and specificity of the RTHB developmental checklist in comparison to the PEDS

tools was similar to the RTHB developmental checklist and PEDS (Path A and B) comparison. However, the positive predictive value was lower and the negative predictive value higher in the PEDS (Path A and B) comparison than with the PEDS tools.

Table 3.3 Performance of the RTHB developmental checklist screen

	PEDS tools	**PEDS: Path A and B indicating fail**
Sensitivity	25% (26/104)	25% (15/61)
Specificity	91% (88/97)	86% (120/140)
Positive predictive value	74% (26/35)	43% (15/35)
Negative predictive value	53% (88/166)	72% (120/166)
Overall hit rate	57% (114/201)	67% (135/201)

Since the RTHB screen appears to evaluate developmental domains inconsistently across ages (see Appendix A) the accuracy of the tool for gross motor, fine motor, receptive language and expressive language was determined. The RTHB developmental checklist identified a total of 1 out of 20 infants who failed the PEDS tools on their gross motor development (Table 3.4). A lack of test items for gross motor development in each of the age intervals of the RTHB developmental checklist resulted in a missing value of 96 participants. Sensitivity of the RTHB developmental checklist for gross motor development was limited (5%) with perfect (100%) specificity (Table 3.5). Similar results were evident for fine motor, receptive and expressive language.

Table 3.4 Developmental domain specific pass/fail distribution of the RTHB developmental checklist and PEDS tools

		Gross motor	**Receptive language**	**Expressive language**	**Fine motor**
	Frequency missing*	47% (96/201)	4% (8/201)	0% (0/201)	56% (113/201)
RTHB developmental screen	Pass	104	191	199	83
	Fail	1	2	2	5
	Referral rate	0,9% (1/105)	1% (2/193)	1% (2/201)	6% (5/88)
PEDS tools	Pass	85	174	180	69
	Fail	20	19	21	19
	Referral rate	19% (20/105)	10% (19/193)	10% (21/201)	22% (19/88)

***Due to lack of test items in the RTHB developmental checklist a number of participants had to be excluded in the different developmental domains**

Table 3.5: Developmental domain specific results of the RTHB developmental checklist (using PEDS tools)

	Gross motor	Receptive language	Expressive language	Fine motor
Sensitivity	5% (1/20)	5% (1/20)	5% (1/21)	21% (4/19)
Specificity	100% (85/85)	99% (173/174)	99% (179/180)	99% (68/69)
Positive predictive value	100% (1/1)	50% (1/2)	50% (1/2)	80% (4/5)
Negative predictive value	82% (85/104)	91% (173/191)	90% (179/199)	82% (68/83)

Developmental domains that do not form part of the RTHB developmental checklist include self-help and social-emotional skills. The PEDS tools identified two infants who failed both on their self-help skills and on their social emotional developmental domain, four who failed on their self-help skills, and 11 who failed on their social-emotional developmental domain. All of these infants (17 in total) passed the RTHB developmental checklist. Therefore 8% of participants were not detected by the RTHB developmental checklist due to the absence of self-help skills and social-emotional development screening in this early detection tool.

3.5 DISCUSSION

Prematurity, limited education of parents, poverty and teenage pregnancies have been described, among others, as factors placing infants at risk of developmental delays or disorders (Guralnick, 2013; Rossetti, 2001). Multiple risk factors increase the likelihood that development will be delayed and high-risk children are 24 times more likely to have IQs below 85 than low-risk children (Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987). Therefore a higher percentage of failed developmental screenings in the current study was expected. Similar pass/fail distributions as found in the current study were reported in a previous study in which at risk populations were targeted (Glascoe, 2010). Since an at-risk population was selected it was expected that the incidence of delays and disorders would be elevated in comparison to a low risk population.

An accurate screening tool should have a high sensitivity (between 70-80%) and high specificity (between 70-80%) (Glascoe, 2013). Similar to the results where the RTHB screen and the PEDS tools are compared, the accuracy of the RTHB against the PEDS test (Path A and B) is low. Therefore even when a more stringent interpretation of the PEDS was used the accuracy of the RTHB was still poor. Low

sensitivity of the RTHB screen is a great concern, as it clearly illustrates the failure of the screen to detect developmental delays in infants, which will result in the majority of infants in need of early intervention services remaining unidentified. Some developmental areas such as social- emotional and self-help skills are not included in the RTHB screen, and the inconsistency of the other developmental domains across the ages is problematic.

Some questions can be raised by the above findings, such as whether it is realistic to compare the RTHB developmental checklist to another broad ranging developmental screening tool. Screening tools, such as the PEDS tools, measure multiple developmental aspects ranging from mild and 'difficult to identify' developmental problems to severe problems such as mental retardation (Glascoe et al., 1992). Consequently such a broad ranging instrument ensures that the strengths and limitations of the RTHB developmental checklist may be established. A limitation in the current study, however, is the limited age range (6-12 months of age). Consequently future research on infants and young children older than a year is recommended. Although the accuracy of the PEDS tools have been confirmed for gross motor development in South Africa (Silva, 2010), the possibility of a Western cultural bias had to be taken into consideration. However, as a previous study has demonstrated that the accuracy of the outcome of the PEDS tools were similar to previous research conducted in underserved communities in America (Glascoe, 2010), it can be assumed that cultural differences probably did not influence the outcome of the tools greatly.

Findings suggest that additional development of the RTHB screen is needed. Test items at each age interval should represent all the developmental domains i.e. receptive language, expressive language, gross motor, fine motor, social-emotional, self-help and global-cognitive skills and the test should be extended to the pre-school years. Age intervals should also be used consistently throughout the RTHB, for instance 0-3, 4-6, 7-9 months and so forth. Scoring guidelines and a clear referral framework should also be developed. The tool should then be validated and standardized for the South African context. The fact that these aspects were omitted during the development of the test may explain why the test lacks accuracy in identifying risk of developmental delay. It is recommended that since the accuracy of the RTHB developmental checklist is poor, alternative screening tools should be

considered or integrated to ensure a validated screening tool to be used nationally in South Africa. Because this study compared the RTHB to a combination of screens, future research should involve replication of this study using diagnostic developmental tests as benchmark.

Finally, the utilization of an early developmental screening tool provides opportunity for other preventative strategies such parental education (van der Linde et al., 2009). Consequently the implementation of an accurate screening tool in PHC in South Africa also has educational value for the families, which in turn may improve infants' development as awareness was created.

3.6 CONCLUSION

The RTHB developmental checklist failed to identify more than half of infants at risk of developmental delays or disorders within the PHC context. The nationally implemented developmental screening tool requires adaption with subsequent validation or replacement by existing tools appropriate for the context to ensure timely identification of at-risk infants towards improved outcomes. In addition developmental screening provides a platform for other preventative strategies such as parental training.

3.7 ACKNOWLEDGEMENTS

The authors would like to acknowledge the Mellon Foundation for funding the vulnerable children program of the Faculty of Humanities, University of Pretoria, the UP COPC living laboratory, the National Research Foundation and Department of Statistics, University of Pretoria for their assistance in the data processing and analysis.

4 RISKS ASSOCIATED WITH COMMUNICATION DELAYS IN INFANTS FROM UNDERSERVED SOUTH AFRICAN COMMUNITIES

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Journal: African Journal of Primary Health Care and Family Medicine

Publication: 2015, 7 (1):1-7

4.1 ABSTRACT

Background: For optimal development, young children need warm, responsive, enriched and communicative environments for learning social, language, and other skills. Infants and toddlers exposed to psychosocial risk, lack enriched environments and may present with communication delays. **Aim:** To investigate the relationship between psychosocial risks and communication delays in infants, from underserved communities in South Africa. **Setting:** Primary health care (PHC) facilities in Tshwane district, South Africa. **Methods:** A parent interview and Rossetti Infant Toddler Language Scales were used to collect data from caregivers of 201 infants aged 6-12 months, selected through convenience sampling. Associations between communication delays and risks were determined (Chi-square and Fisher's exact tests). A log linear model analysis was used to model the simultaneous effect of significant risks on the probability of having communication delays. **Results:** Communication delays were present in 13% of infants. Infants with two or more siblings, born from mothers aged 18-29 years who own their house have a 39% chance of presenting with communication delays. **Conclusion:** Developmental screening and early intervention is important in PHC contexts in South Africa, as a clear relationship has been established between three risk factors and communication delays in infants.

Keywords*:* Psychosocial risks, communication delays, at-risk infants, underserved communities, South Africa

4.2 INTRODUCTION

For optimal development young children need a warm, responsive, enriched and communicative environment for learning social, language and other skills (Glascoe & Leew, 2010). Infants and young children exposed to risk conditions may present with developmental delays or disorders that may ultimately impact socio-emotional, educational and vocational outcomes (Guralnick, 2013). These risks include any potential factors that affect a child's ability to interact with his or her environment (Paul & Roth, 2010; Rossetti, 2001), which in turn results in developmental delays or disorders.

Communication delays are most prevalent in children under the age of three years (Rossetti, 2001). If communication delays remain undetected, this negatively impacts later educational and social performance, has long-term financial implications, and results in future delays or disorders (Eadie et al., 2010; Wankoff, 2011). As a result of environmental factors such as unemployment, limited medical resources, lack of educational services, violence, crime and HIV infection and AIDS (Guralnick, 2013), the prevalence of communication delays or disorders is increasing.

In the United Kingdom an incidence of speech and language disability of 5.6% has been reported in children aged 0-2years (Broomfield & Dodd, 2004). Similar findings reported in a systematic review which included several countries indicated a median prevalence of 5% for speech and language delays in children of two years of age (Law et al., 2000). In developing countries such as South Africa the prevalence of communication delays will probably be higher, due to more biological and psychosocial risks such as poverty, violence, nutritional deficiencies, HIV infection and substance abuse (Samuels et al., 2012). Advanced or very young maternal age (Beitchman et al., 2008), lack of parent-child interaction (Barwick et al., 2004), low parental educational levels, poor parental mental and physical health, insufficient parental coping strategies and confidence (Harrison & McLeod, 2010) are pervasive risk factors characteristic of South Africa (Samuels et al., 2012). These risks are likely to predispose infants to developmental delay.

Limited parental education negatively impacts communication acquisition in infants and young children due to a lack of parental knowledge and stimulation during the infants' early years (Hoff et al., 2013). Approximately 16% of adults (20 years or

older) in South Africa are functionally illiterate, 34% have completed secondary levels of education only and 29% have completed Grade 12 (Statistics South Africa, 2011a). Almost half of South Africans are deemed poor (45.5%) with 20% living in extreme poverty (Statistics South Africa, 2011b). Living in poor conditions restricts the quality and quantity of prenatal care, placing the unborn infant at risk of low birth-weight and prematurity (Cone-Wesson, 2005). Risk factors such as poverty and low parental education can occur in isolation or in combination, and it is generally accepted that an increase in the number of risk factors result in an increase in developmental risk to the infant (Paul & Roth, 2010).

The impact of risk factors such as parental education at a level less than high school, limited social support, poverty and more than three children in the home is difficult to establish in infants before the ages of 2 to 3 years (Glascoe, 2000). Still, the most important phase of communication acquisition and development occurs between 8 and 24 months (Eadie et al., 2010; Reilly et al., 2006; Tomasello, 2003). Wide-ranging prevalence of language delay with high rates of spontaneous resolution have been reported (Eadie et al., 2010; Law et al., 2000; Reilly et al., 2007). This illustrates the variability in the emergence of language skills, which in turn complicates the evaluation of infants' and young children's communication development (Eadie et al., 2010).

The first two years of life are crucial in communication acquisition and development and since the emergence of communication skills reportedly varies between individuals (Eadie et al., 2010; Law et al., 2000; Reilly et al., 2007), the link between early risk factors and communication delays may provide reliable indicators to improve early detection. This might be especially informative in underserved or disadvantaged communities in countries like South Africa, where infants are exposed to multiple psychosocial risks along with health risks such as poverty, limited health care services and HIV infection and AIDS (Samuels et al., 2012).

In a previous study conducted across a spectrum of disadvantaged and advantaged urban communities in Melbourne, Australia, early risk factors could only explain 7% of the variation in language skills at the age of two years (Reilly et al., 2007). A few South African studies have reported on risks and communication delays but only in specific target populations such as infants with cleft lip and palate and babies with

dysphagia (Groenewald et al., 2013; Norman et al., 2007). However, the relationships between risk factors and communication delays still need to be explored for infants in South Africa. More specifically, the relationships between risks and communication delays should be explored in underserved communities, which are deemed the poorest, most disadvantaged in the country, lack adequate public health care services and represent almost 50% of the population (Kon & Lackan, 2008; Statistics South Africa, 2011b).

Preventative strategies such as developmental screening or surveillance and intervention can be implemented from birth onwards to compensate for the risks to eliminate or reduce the resultant communication delays. Early intervention in underserved communities is, however, hindered by financial constraints and a lack of resources to implement family-centred services (Olusanya et al., 2006). Identifying risk factors that may predispose to communication delays or disorders in infants in underserved communities is an important priority to strengthen primary prevention strategies. The objective of the current study was therefore to investigate the relationship of certain environmental risks in an underserved South African community with delays in early communication development.

The research question was 'What is the relationship between certain environmental risks and communication delays in infants from an underserved community?'

4.3 METHODS AND DESIGN

A cross-sectional research design was used to explore the relationship between risks and communication delays in infants.

4.3.1 Setting

Three clinics situated in underserved communities of the Tshwane district in the Gauteng province of South Africa (Olievenhoutbosch, Salvokop and Daspoort Poli clinic) were utilised for data collection. Olievenhoutbosch clinic serves a population of 70 863 individuals residing in an area of 11.39 km^2 (Statistics South Africa, 2011a). Both Salvokop and Daspoort form part of the Pretoria sub-district. The clinic situated in Salvokop area serves a population of 7123 and Daspoort clinic a population of 6355 individuals (Statistics South Africa, 2011a).

4.3.2 Participants

Convenience sampling was used as all of the parents or caregivers who visited the PHC clinics for immunisation and health-related reasons over a three-month period were approached. The following inclusion and exclusion criteria were used: Only caregivers of infants aged between six and 12 months, who were proficient in Afrikaans or English, were asked to participate.

Two hundred and one infants were recruited (45% female), with similar age distributions for male (mean = 8.68 months; standard deviation (SD) = 1.86) and female infants (mean = 8.73 months; SD = 1.94). Ninety-four per cent of the participants resided in Olievenhoutbosch, whereas the remainder were from other areas such as Salvokop (2%), Daspoort (0.05%) and Mamelodi (0.5%). The majority of participants (98.5%) were black persons, with 1.5% of other ethnicities. Home language distribution in the study sample was as follows: Sepedi (33%), Zulu (16%), Shona (11%), isiNdebele (10%), isiXhosa (6%), Southern Sotho (5%), Setswana (5%) and other (14%).

One-third (33%; n=66) of mothers exited the educational system at Grade 10 or less, and 40% earned a monthly household income of less than R1500 (US$150). One-third of the infants (33%, n=66) had two or more siblings. Both parents were unemployed in 14% (n = 28) of cases and 77% (n = 154) lived in informal housing or stayed with others.

4.3.3 Data collection tools and procedures

Data collection material included a structured interview schedule used to gain information from parents/caregivers, and a diagnostic communication assessment, used to identify communication delays in infants. A structured interview schedule that consisted of closed- ended questions was developed to obtain participant background information, i.e. date of birth, duration of pregnancy, and gender, as well as the risk factors. Environmental risk factors that were investigated in the study were: level of education (Glascoe, 2000; Guralnick, 2013; Hoff et al., 2013; Rossetti, 2001), housing status (Guralnick, 2013; Rossetti, 2001; Samuels et al., 2012), age of mother at birth of infant (Beitchman et al., 2008; Glascoe, 2000; R. Paul & Roth, 2010; Rossetti, 2001; Samuels et al., 2012), number of children (Glascoe & Leew,

2010; Glascoe, 2000; Rossetti, 2001), unemployment (Cone-Wesson, 2005; Glascoe, 2000; Samuels et al., 2012), and average household income (Cone-Wesson, 2005; Glascoe, 2000; Samuels et al., 2012), and gender of the infant (Eadie et al., 2010; Reilly et al., 2007; Rossetti, 2001).

The Rossetti Infant Toddler Language Scale (RITLS) was used for the diagnostic communication assessment. The RITLS is a comprehensive, easy-to-administer and relevant tool to assess preverbal and verbal communicative abilities and interaction in infants and young children (Rossetti, 2006). Although this is a criterion-referenced tool, it has been widely used and validated in the past (Desmarais et al., 2010; Dettman et al., 2007; Groenewald et al., 2013; Rie et al., 2008; Steiner et al., 2012; Sylvestre & Mérette, 2010). The tool is designed to assess the following domains: pragmatics, gesture, play, language comprehension, language expression and interaction attachment.

The RITLS classifies infant development into three-month intervals, for instance 0-3 months and 3-6 months. At each interval developmental milestones under each of the domains are presented. When an infant at a specific age interval has one or more unmet milestone(s) in a specific developmental domain (such as language expression), the milestones of the previous interval are evaluated until the infant has met all the milestones at that age interval. The infant's developmental level is therefore the interval at which he/she obtained all the milestones within a developmental domain. It is therefore possible that the infant's developmental level is different for each of the evaluated domains for example an infant may present with a delay in expressive language and pragmatics while the receptive language, interaction attachment and play skills are age appropriate. An infant is classified as delayed when one or more of the communication domains' specific developmental levels differed by six months or more from the chronological age (for instance when a 12 month old infant's language expression scores on a 3-6 month developmental level, the infant presents with a communication delay) (Rossetti, 2006).

The first items in the 'gesture' sub domain only start at 9-12 months. Hence, infants can only present with delays when they are 15 months or older. Since participants in the current study were all between six and 12 months of age and their development

of gestures could not be classified as delayed this subdomain was excluded from the results.

Prior to data collection ethical clearance was obtained from the Tshwane district research committee, Department of Health and the Faculty of Health Sciences and Humanities at the University of Pretoria. Parental/caregiver informed consent was obtained before data collection commenced. Both the interview and RITLS were carried out by the same speech-language pathologist, who has more than 10 years' experience in the field. The structured interview with the parents/caregivers was conducted first. After the background information was obtained and the risks were identified by means of the interview schedule, the RITLS was completed by observing the infant during interaction with the parent and free play. If aspects of communication behaviour under investigation were not observed, the behaviour was elicited by the speech-language pathologist or the parent/caregiver's report on their infant's communicative behaviours was utilised to complete the RITLS.

Since the RITLS is a validated tool, administration and scoring of the assessment was done by the same experienced speech-language pathologist to ensure reliability of data. Inter-rater reliability was also established, as independent raters observed 14% of the assessments and the outcomes of the tests were deemed similar to what the researcher obtained.

4.3.4 Data analysis

To determine the existence of a significant association between risk factors and the outcome of the RITLS (indicating a communication delay or not) the Chi-square and Fisher's exact test statistics were used with a significance level of $p \leq 0.05$.

Only risk factors significantly associated with communication delays ($p \leq 0.05$) were included in the second phase of the statistical analysis. Here a log-linear model analysis was used to model the probabilities of developing communication delays, taking into account both single and simultaneous effects of the relevant risk factors. As the data (age of mother) were too limited to be added into the model in the categories <18years (n=7), 19-34years (n=165) and >35years (n=27), they were re-categorised into two groups, namely 18-29years and 35 years and older. Although a

maternal age of 18-29 years is not an environmental risk, the effect of the age of the mother still needed to be explored.

For ease of interpretation, the outcomes of the model were expressed as indices and converted into odds of communication delays for this specific combination of categories. Based on the odds the estimated probability of having a communication delay for a specific set of risk factors was calculated using the following formula: $prob = \frac{odds}{1+odds}$.

4.4 RESULTS

A communication delay, as determined by the outcome of the RITLS, was present in 13% (n=26/201) of the infants. The association of communication delay with each of the seven risk factors constituted the first phase of the statistical analysis (Table 4.1). Three risk factors were found to be significantly associated with the prevalence of communication delays in the study population: (1) infants of mothers having three or more children show a significantly higher prevalence of delays (sample percentage of 20%) than those of mothers having less than three children (10%) (Chi-square, *p*=0.046); (2) having an informal housing status or staying with others is related to a marginally significantly lower prevalence in communication delays (10%) compared to when mothers have their own house (21%) (Chi-square, *p*=0.052); and (3) the prevalence of communication delays in infants born of mothers aged 18 years or younger (43%) and 35 years or older (19%) was significantly higher than amongst those born off mothers between the ages of 19 and 34 years (11%) (Fisher's exact test, *p*=0.04).

Table 4.1 Association of communication delay with psychosocial risk factors

RISK FACTORS	Delayed (%)	Significance (*p*-value)	Test statistic
Gender (n=201):			
Male (n=111)	13	0.8797	Chi-square
Female (n=90)	13		
Level of education (n=200):**			
Grade 10 or less (n=66)	18	0.1262	Chi-square
Grade 11-12, and/or tertiary (n=134)	10		
Number of children (n=201):			
2 or less (n=135)	10	0.0458*	Chi-square
3 or more (n=66)	20		

Employment (n=201):			
Yes (n=173)	12	0.2187	Fisher's exact
No (n= 28)	21		
Housing status (n=201):			
Home owners (n=47)	21	0.0516*	Chi-square
Informal housing or staying with others (n=154)	10		
Average household income (n=199)**:			
Less than R1500 (n=80)	11	0.6468	Chi-square
R1500 or more (n=119)	13		
Age of mother at birth of youngest infant (n=199):**	43*		
18 years and less (n=7)	11*	0.0397*	Fisher's exact
19-34 years (n=165)	19*		
35 years and older (n=27)			

***Statistically significant association (p ≤ 0.05)**
**** Numbers differ due to missing data**

The outcome of the log linear analysis in terms of indices and odds is shown in table 4.2 with the three significant risk factors presented as combined factors. The indices were used to calculate the probabilities of both individual and combined risk factors by multiplying the overall main effect (index of the intercept) with one or more indices of the individual categories.

Table 4.2 Associated probability of single and combined risk factors predisposing to communication delay

Parameter	Categories	Index	odds	probability
Overall effect		0.22		
Housing status	Home owners	1.55	0.341	0.25 (25%)
	Informal housing/ staying with others	0.64	0.140	0.12 (12%)
Age of mother and number of children	18-29yrs, ≧3 children	1.90	0.418	0.30 (30%)
	≧18yrs, <3 children	0.49	0.107	0.097 (10%)
	≧30yrs, ≧3 children	1.07	0.235	0.19 (19%)
Age of mother and number of children and housing status	18-29yrs, ≧3 children	1.90	0.647	0.39 (39%)
	Home owners	1.55		
	18-29yrs, ≧3 children	1.90	0.267	0.21 (21%)
	Informal housing/ staying with others	0.64		
	≧18yrs, <3 children	0.49	0.167	0.14 (14%)
	Home owners	1.55		
	≧18yrs, <3 children	0.49	0.068	0.06 (6%)
	Informal housing/ staying with others	0.64		
	≧30yrs, ≧3 children	1.07	0.364	0.267 (27%)
	Home owners	1.55		
	≧30yrs, ≧3 children	1.07	0.150	0.13 (13%)
	Informal housing/ staying with others	0.64		

There was a probability of 39% of having a communication delay for infants with two or more siblings, born off a mother aged 18-29 years who owns their own house. In

contrast, when infants have none or only one sibling, and their caregivers own their house, irrespective of the age of the mother at birth, those infants had only a 14% risk of presenting with a communication delay (see Table 4.2). Table 4.2 summarises the associated probability for single and combined risk factors.

4.5 DISCUSSION

Prevalence of communication delay for infants aged 6-12 months (13%) in this study was high in comparison to the incidence of reported speech and language disability (5,6%) in children aged 0-2years in the United Kingdom (Broomfield & Dodd, 2004). The median prevalence of speech and language delays in children two years of age, reported in a systematic review was 5% (Law et al., 2000). Variability in prevalence studies may be attributed to methodological differences and confounding factors such as risk exposure in study populations (Law et al., 2000; McLeod & McKinnon, 2007)

The adverse impact of risks, specifically the number of siblings, on communication development in infants was demonstrated in the current study. This finding is in accordance with previous research that also confirmed that children with two or more siblings are at risk of communication delays (Harrison & McLeod, 2010; Stanton-Chapman, Chapman, Bainbridge, & Scott, 2002; Zubrick, Taylor, & Rice, 2007). One of the possible reasons for younger siblings being delayed may be the fact that the older sibling are more verbal and may be speaking on behalf of the younger siblings (Harrison & McLeod, 2010). Also larger families imply that parental interaction and attention are more divided between the children, which may result in less attention and interaction than when there are only one or two children in the home. In 2006 the average fertility rate of black South African women was 2.9; as a result an average household will have approximately three children (Statistics South Africa., 2010). In the current study one-third of the infants had two siblings or more, and it may be expected that these mothers will have another child in future as 85% of the mothers were 34 years of age or younger. This is in line with the fertility rate of 1.4 for 35-39-year-old black South African women (Statistics South Africa., 2010). Developmental surveillance of infants who have two or more siblings may therefore be warranted in underserved communities.

Interestingly, infants living in homes owned by their parents had a higher probability (25%) of communication delay than those who lived in informal housing or with others (12%). Recent findings have demonstrated that the diversity of neighbourhoods in which infants live shapes their social learning independently of their caregiver and/or family interaction (Howard, Carrazza, & Woodward, 2014). The diverse neighbourhood of informal settlements or living in close proximity to others seemingly may aid social and communication development in infants. Consequently what was deemed a risk factor in the past (Samuels et al., 2012), may facilitate more opportunities for communication interactions and be conducive to social learning.

The impact of combined risk factors on communication development revealed that an infant was at greatest risk (39% probability) of developing a communication delay when: 1) mothers were between the ages of 18 and 29 years; 2) the parents own their own home and; 3) there are three or more children in the household. This information might allow PHC workers, on the platform of community oriented primary care (Bam, Marcus, Hugo, & Kinkel, 2013), to identify infants at highest risk of communication delays in underserved communities in South Africa.

Considering that one in three infants were at risk of communication delay, the need for early communication intervention services, including developmental screening and comprehensive assessment and intervention, is evident. Completing a risk profile and conducting communication screening for infants could enable health care workers to identify at-risk infants and refer them for the required services. Such services may include creating awareness amongst parents on communication development and stimulation, and/or clinic and/or home-based early intervention. Internationally early intervention is becoming more prevention-orientated, encouraging individualising of children's learning experiences using evidence-based practices (Greenwood, Walker, et al., 2013). Therefore implementing preventative strategies in at-risk populations in South Africa is well in line with the international focus of prevention-orientated early intervention services.

A study in the United States of America reported that 13% of infants were identified with developmental delays, but that only 10% of these infants received services by 24 months of age (Rosenberg, Zhang, & Robinson, 2008). Furthermore black children were less likely to receive services than those from other ethnic and racial

groups (Rosenberg et al., 2008). It therefore appears that service delivery to at risk infants is not only a local but also an international quandary, where disparities in service delivery to different ethnic and racial groups exist. Eradicating the gap in service delivery to improve availability of services to *all* infants at risk of communication delay should be advocated for in South Africa.

4.5.1 Limitations

A limitation in the current study was that only caregivers or parents who were proficient in Afrikaans or English were included in the study. However, increased use of English in public administration, business and schools demonstrates the prominence of English in a variety of multilingual settings (De Klerk, 2002). Even though it is the first language of only 8.6% of South Africans, its wide demographic dispersal has resulted in English being the preferred medium for use within economic and social spheres (De Klerk, 2002). Still, since participants with limited or no verbal English or Afrikaans proficiency were excluded, the sample might not be entirely representative of the population sampled. It is therefore recommended that future research should be conducted on a randomised sample, including all languages, in underserved communities in South Africa.

4.6 CONCLUSION

A clear relationship has been established in the current study between communication delay and three risk factors (i.e. age of the mother, number of children and housing status) in infants aged 6-12 months from these underserved communities. Furthermore a combined effect of these risks accounted for a 39% probability of communication delay. As 13% of infants had a communication delay and more than one-third are at risk of developing communication delays in future, preventative strategies such as the implementation of a risk profile and a communication development screen should be implemented. This may ensure early identification of at-risk infants and assist health-care workers in decision-making with regard to referral and also preventative parental counselling.

4.7 ACKNOWLEDGEMENTS

The authors would like to acknowledge the Mellon Foundation for funding the vulnerable children program of the Faculty of Humanities, University of Pretoria, the University of Pretoria COPC living laboratory, the National Research Foundation and Department of Statistics, University of Pretoria for their assistance in the data processing and analysis.

4.8 COMPETING INTERESTS

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

5 PREVALENCE AND NATURE OF COMMUNICATION DELAYS IN A SOUTH AFRICAN PRIMARY HEALTH CARE CONTEXT

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Journal: South African Journal of Child Health

Accepted: 25-08-2015

5.1 ABSTRACT

Introduction Communication delays are the most common impairment in early childhood and negatively impact long-term academic, psychological and social development. Baseline prevalence of communication delays or disorders enables adequate planning of service delivery and successful implementation of intervention strategies, to reduce disorder prevalence. The objective of this study was to determine the prevalence and describe the nature of communication delays in infants aged 6-12 months in underserved communities in South Africa. **Method** A parent interview and the Rossetti Infant Toddler Language Scales (RITLS) were used to collect data from the caregivers of 201 infants aged 6-12 months through convenience sampling at PHC facilities in the Tshwane district. **Results** 13% (n =26) of infants were diagnosed with communication delay. Association between three risk factors (i.e. housing status, age of mother and number of siblings) and language delays was established. The impact of combined risk factors on language development revealed that an infant was at greatest risk (27% probability) of developing a language delay when 1) mothers were between the ages of 19 to 34 years; 2) when parents owned their own home and; 3) when there were three or more children in the household. **Conclusion** The prevalence of communication delays in the sample population was high possibly due to the majority of infants being exposed to risks. The implementation of preventative measures such as awareness campaigns, developmental screening and surveillance should be considered in the South African PHC context.

Keywords: prevalence, communication disorders, primary health care, risks, infants

5.2 INTRODUCTION

Communication delays are the most common impairment in early childhood (Broomfield & Dodd, 2004) and negatively impact long term academic, psychological and social development (Eadie et al., 2010; Young et al., 2002). Early identification of, and early intervention for communication delays in infants minimize the impact of the delay on educational and social outcomes (Eadie et al., 2010). Reported prevalence of communication delays vary significantly within countries and internationally (Eadie et al., 2010; Hawa & Spanoudis, 2014; Law et al., 2000). In the UK a communication delay prevalence of 16.3% in children has been reported (Broomfield & Dodd, 2004). Similar findings (prevalence of 16,47% and 11,59%) were reported in school going children in Sydney, Australia (McLeod & McKinnon, 2007). In contrast other studies have reported much lower figures such as 1,35% (Paul, Desai, & Thorburn, 1992) and 8% (Harasty & Reed, 1994). More specifically, a systematic review reported that 15% of two year olds presented with expressive language delays (Evans, 2006; Samuels et al., 2012). Possible reasons for the variability is the presence of risk factors, difficulty assessing infants and toddlers and the limited availability of well-developed assessment tools (Eadie et al., 2010; Law et al., 2000).

Risk factors such as poverty, lack of stable residence, limited prenatal care and inadequate health care facilities contribute to communication delays in infants (Samuels et al., 2012). People living in underserved communities, for instance in informal settlements in South Africa, experience a double burden of poverty and ill health as the environment they live in influences child development (Samuels et al., 2012). Residential density, living in crowded homes and poor quality housing leads to parents being less interactive with their children, which in turn negatively impacts communication development (Evans, 2006). Also a gender bias exists with males more likely to present with communication delays than females (Broomfield & Dodd, 2004; Law et al., 2000).

Apart from risks, identification of communication delays in infants are difficult as development occurs over time, resulting in varied prevalence rates (Broomfield & Dodd, 2004; Law et al., 2000). Most parents only discover their child's communication delays when he or she fails to meet typical developmental milestones (Eadie et al., 2010). Ironically, the most important period of

communication acquisition and development is between eight months and two years (Eadie et al., 2010). Studies reporting the prevalence of communication delays in infants younger than two years are limited (Eadie et al., 2010; Law et al., 2000). This is problematic as prevalence rates vary across the ages of infants and young children (Broomfield & Dodd, 2004).

Establishing the prevalence of communication delays or disorders enables appropriate planning for service delivery and successful implementation of intervention strategies, which may ultimately result in a decline in the prevalence of the disorder (Law et al., 2000). Despite previous efforts (van der Linde et al., 2009) to improve early identification of infants with delayed communication development in PHC settings of South Africa, this practice remains uncommon (Kathard & Pillay, 2013). Establishing the prevalence of communication delays in infants from underserved communities in South Africa will however advocate the implementation of early identification and intervention services.

An adequate understanding of the prevalence and nature of communication delays in a specific population improves classification of communication delays (Broomfield & Dodd, 2004). Previous research has focused only on speech and receptive and expressive language delays and has not evaluated all the aspects of communication development such as pragmatics and interaction-attachment (Law et al., 2000). Most large scale prevalence studies used a broad classification of communication delays, and as a result the true nature of these delays were obscured (Broomfield & Dodd, 2004). Understanding the nature of communication delays allows predictions that are of clinical and research significance, i.e. early use of gestures predicts later vocabulary development and early word use predicts later social-emotional development (Greenwood, Buzhardt, Walker, McCune, & Howard, 2013). Since there is a dearth of information on the prevalence and nature of communication delays in infants 12 months and younger, the objective of this study was to determine the prevalence and nature of communication delays in infants aged 6-12 months in underserved communities in South Africa.

5.3 METHOD

A prospective cross-sectional study was employed to determine the prevalence and nature of communication delays in infants from underserved South African communities. Prior to data collection permission and ethical clearance was obtained from the Tshwane district research committee, Department of Health and the Faculties of Health Sciences and Humanities, University of Pretoria.

5.3.1 Setting

Three clinics (Olievenhoutbosch clinic, Salvokop clinic and Daspoort Poli clinic), situated in underserved communities of the Tshwane district, Gauteng province of South Africa were utilized for data collection. Olievenhoutbosch clinic serves a population of 70 863 individuals residing in an area of 11.39 km^2 (Statistics South Africa, 2011a). Both Salvokop and Daspoort form part of the Pretoria sub-district. The clinic situated in Salvokop area serves a population of 7123 and Daspoort clinic a population of 6355 individuals (Statistics South Africa, 2011a).

5.3.2 Participants

Two-hundred-and-one participants were included in the study by means of convenience sampling. All the parents or caregivers of infants aged between 6 and 12 months, who were proficient in Afrikaans or English, were asked to participate during their visit to the Primary Health Care Clinics (PHC). A similar gender distribution was obtained (55% male). The home languages spoken most was Sepedi (33%), Zulu (16%), Shona (11%) and Ndebele (10%). Ninety-four per cent of the participants resided in the Olievenhoutbosch area, whereas the remainder were from other areas such as Salvokop (2%) and Mamelodi (0.5%). The majority of participants (98.5%) were Black, with 1.5% from other ethnicities.

Seven infants (from 201 participants) were from teenage pregnancies. 62% of parents or caregivers left the educational system at Grade 10 or less and 71% reported a household income of less than R3000 a month. 32% of the infants have two or more siblings. In general 16.5% of South Africans (20 years or older) are functionally illiterate, 34% completed some secondary levels of education and 29% completed grade 12 (Statistics South Africa, 2011a). Furthermore 45.5% of the

South African population is deemed poor (Mayosi & Benatar, 2014; Statistics South Africa, 2011b).

5.3.3 Material

A structured interview schedule was developed to obtain participant background information, i.e. date of birth, duration of pregnancy, and gender.

The RITLS is a comprehensive, easy-to-administer and relevant tool to assess the preverbal and verbal communicative abilities and interaction in infants and young children (Rossetti, 2006). Although this is a criterion referenced tool, it has been used and validated in the past (Desmarais et al., 2010; Dettman et al., 2007; Steiner et al., 2012; Sylvestre & Mérette, 2010). The tool assesses the following domains: Pragmatics, gesture, play, language comprehension, language expression and interaction attachment. When an infant has one or more unmet milestone(s) in a specific developmental domain (such as language expression) at a specific age interval, the milestones of the previous interval are evaluated until the infant has met all the milestones at that age interval. The infant's developmental level is therefore the interval at which he/she obtained all the milestones within a domain. An infant is classified as delayed when domain specific developmental levels differed six months or more from the chronological age (for instance when a 12 month old infant's language expression scored on a 3-6 month developmental level) (Rossetti, 2006).

As the first items in the gesture sub domain only starts at 9-12 months, an infant can only present with a delay when he/she is 15 months or older. Since participants in the study were all between 6-12 months of age and their development of gestures could not be classified as delayed this subdomain was excluded from the results.

5.3.4 Procedures

An experienced speech-language pathologist collected all the data. Parental/caregiver informed consent was obtained before data collection commenced. First the parent interview, then the RITLS was conducted on each participant. The RITLS was completed by observing and eliciting infant behaviour and also by making use of parental responses.

5.3.5 Data analysis

A statistical software programme, SAS (version 9.3), was used to conduct the data analysis. Descriptive statistics were used to describe the prevalence and nature of communication delays in a group of infants. To determine the existence of a significant association between risks and the delayed outcome of the receptive and/or expressive language domains of the RITLS, the Chi-square and Fisher's exact test statistics were used with a significance level of $p \leq 0.05$.

Only risk factors significantly associated with receptive and/or expressive language delays ($p \leq 0.05$) were included in the second phase of the statistical analysis where a log linear model analysis was used to model the probabilities of developing language delays, taking into account both single and simultaneous effects of the relevant risks. Since only three factors were significant at 5% probability, a probability of 10% was used to add additional factors into the model. Maternal education was included as the fourth factor with a 10% probability ($p=0.095$). Since the data on the age of the mother were too limited in the category <18 years (n=7), this category had to be excluded in the log linear analysis. Although a maternal age of 19–34 years is not considered an environmental risk, the effect of age for mothers aged 35< had to be explored alongside the low risk group.

The outcomes of the model were expressed as indices and converted into odds of language delays for a specific combination of categories of risk factors. Based on the odds the estimated probability to have a language (receptive and/or expressive) delay for a specific combination of risks was calculated using the following formula: $prob = \frac{odds}{1+odds}$.

5.4 RESULTS

Of the 201 participants, 13% (n =26) were diagnosed with communication delay i.e. a delay in one or more of the communication domains of the RITLS. Gender of the delayed infants is evenly distributed (54% male and 46% female). The majority of delayed infants (58%) presented with a delay in one communication domain (see Figure 5.1).

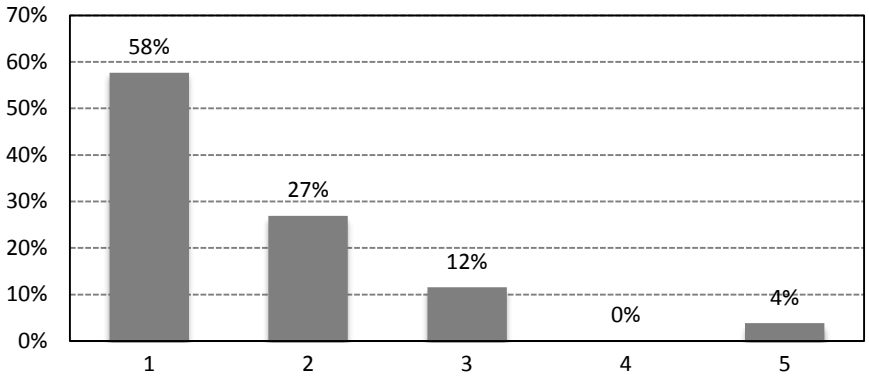

Figure 5.1 Distribution of the number of delayed communication domains within participants with delays (n=26)

Only 4% of infants with a positive diagnosis presented with delays in five of the domains. The prevalence rates for the domain specific outcomes of the RITLS are presented in Table 5.1.

Table 5.1 Domain specific outcomes of the RITLS for all participants (n=201)

Domains	No delay (%)	Delay (%)
Pragmatics	197 (98)	4 (2)
Play	195 (97)	6 (3)
Interaction-Attachment	199 (99)	2 (1)
Language Expression	179 (89)	22 (11)
Language Comprehension	192 (95.5)	9 (4.5)

Most participants with a positive diagnosis (22/26; 85%) presented with delayed language expression. Nine of the delayed participants (9/26; 35%) presented with delayed language comprehension and only two participants (2/26; 8%) had a delay in their interaction attachment skills.

Table 5.2 Association of language delays with risk factors

RISK FACTORS	Delayed (%)	Significance (*p*-value)	Test statistic
Level of education (n=200):			
grade 10 or less (n=66)	17	0.095	Chi-Square
grade 11-12, and/or tertiary education (n=134)	10		
Number of children (n=201):			
2 or less (n=135)	9	0.0564*	Chi-Square
3 or more (n=66)	18		
Prematurity (n=201):			
0-2 months premature *(n=195)*	12	0.5385	Fisher's Exact
3+ months premature *(n=6)*	17		
Employment (n=201):			
Yes (n=173)	12	0.7524	Fisher's Exact
No (n= 28)	14		

Housing status (n=201):			
Home owners (n=47)	21	0.0241*	Chi-Square
Informal housing or staying with others (n=154)	10		
Gender (n=201):			
Male (n=111)	11	0.5834	Chi-Square
Female (n=90)	13		
Average household income (n=199):			
Less than R1500 (n=80)	9	0.3097	Chi-Square
R1500 or more (n=119)	13		
Age of mother at birth of youngest infant (n=199):	43		
18 years and less (n=7)	10	0.0357*	Fisher's Exact
19-34 years (n=165)	15		
35 years and older (n=27)			

***Statistically significant association (p ≤ 0.05)**
****Statistically significant association (p≤0.1)**

Association between risks and delays in language expression and/or comprehension are presented in Table 5.2. Three risks were found to be significantly associated with language delays in the study population: (1) Mothers having three or more children showed a significantly higher prevalence of delays (sample percentage of 20%) than mothers having less than three children (10%) (Chi-Square, *p*=0.054); (2) Living in informal housing or staying with others showed a significantly lower prevalence in language delays (10%) compared to when caregivers have their own house (21%; Chi-Square, *p*=0.024); (3) Language delays in infants born from mothers who were 18 years or younger (43%) and mothers aged 35 years or older (15%) was significantly higher than those born from mothers between the ages of 19 to 34 years (10%; Fisher's Exact test, *p*=0.035).

The outcome of the log linear analysis is shown in table 5.3 with the four risk factors with the strongest association with language delay presented as combined risk factors. The indices were used to calculate the probabilities of combined risk factors by multiplying the overall mean effect (value of the intercept of the log linear model) with the index of the combination of categories of risk factors under consideration.

Table 5.3 Associated probability of combined risk factors predisposing language delay

Parameter	Combination of categories	Index	odds	probability
Overall mean effect		0.14(intercept)		
Age of mother and number of children	19-34 years, <3 children, Grade 11-12 and/or tertiary education, informal housing/staying with others	0.42	0.059	0.056 (6%)
and education level	19-34 years, <3 children, Grade 10 or less, informal housing/staying with others	0.27	0.038	0.037 (4%)
and housing status	19-34 years, <3 children, all education levels, home owners	1.46	0.204	0.169 (17%)
	19-34 years, >=3 children, Grade 10 or less, informal housing/staying with others	1.89	0.264	0.209 (21%)
	19-34 years, >=3 children, Grade 11-12 and/or tertiary education, informal housing/staying with others	0.82	0.115	0.103 (10%)
	19-34 years, >=3 children, all education levels, home owners	2.60	0.364	0.267 (27%)
	≧35 years, any nr of children, all education levels, informal housing/staying with others	0.99	0.139	0.122 (12%)
	≧35 years, any nr of children, all education levels, home owners	1.54	0.216	0.178 (18%)

A probability of 21% was associated with language delay in infants with two or more siblings, born from a mother aged 19 to 34 years with limited education who lives in informal housing or with others. In contrast, infants with two or more siblings born from a mother aged 19 to 34 years with a Grade 11-12 and/or tertiary education living in informal housing or with others, only had a 10% risk to present with a language delay (see Table 3). Table 3 summarizes the associated probability for combined risk factors.

5.5 DISCUSSION

Few studies have reported prevalence of communication disorders under the age of two years (Broomfield & Dodd, 2004; Law et al., 2000). The prevalence (13%) of communication disorders in the sample population is higher than the prevalence rates (5.6%) reported in previous research conducted in UK for infants aged 0-2

years (Broomfield & Dodd, 2004). A median prevalence of 5% for speech and language delays in two year olds was also reported in a systematic review conducted in 2000 (Law et al., 2000).

A study conducted in the UK reported that 20% of referrals (during 1999-2000) of children of all ages was for receptive language difficulties, 17% was for expressive language difficulties and 29% was for speech difficulties (Broomfield & Dodd, 2004). Of the 20% of children with receptive language delays 6% were aged between 0-2years, and of the 17% of all children with expressive language delays 13% was from the same cohort (Broomfield & Dodd, 2004). Similar results were yielded by two other studies, one conducted in the USA, and the other a systematic review where 15% of two year olds presented with expressive language delays (Desmarais, Sylvestre, Meyer, Bairati, & Rouleau, 2008; Horwitz et al., 2003). Of the current sample population (n=201) 11% of infants, aged 6-12 months, presented with delays in expressive language, which is similar to previous research findings for a slightly older cohort (Desmarais et al., 2008; Horwitz et al., 2003).

High prevalence rates for communication and more specifically language delays, reported in the current study, may be ascribed to multiple risks present in the target population that may influence their communication development. Language delay was significantly associated with three risk factors namely: housing status (p=0.0241); age of the mother (p=0.035) and number of children in the home (p=0.054). Infants with parents who are home owners were more at risk of language delays than those who stayed with others or in informal housing. The diversity of neighbourhoods in which infants live shape their social learning independent of their caregiver and or family interaction (Howard et al., 2014). The diverse neighbourhood of informal settlements or living with others appears to aid language development in infants. Consequently what was deemed a risk factor in the past (Samuels et al., 2012), may facilitate more opportunities for communication interactions and may be conducive to social language learning. Investigation into this complex interaction is however needed.

The impact of combined risk factors on language development revealed that infants in the current study were at greatest risk (27% probability) of developing a language delay when 1) mothers were between the ages of 19 to 34 years; 2) when the

parents own their own home and; 3) when there are three or more children in the household.

Although high rates of spontaneous resolution of the language delays have been reported in the past (Eadie et al., 2010; Reilly et al., 2007), association between language outcomes of children with delayed expressive language onset have been established (Hawa & Spanoudis, 2014; Rice, Taylor, & Zubrick, 2008). Making a definitive diagnosis of a social-communication delay is difficult at young ages (Ben-Sasson, Habib, & Tirosh, 2014). Nevertheless the most important phase of communication acquisition and development takes place between 8 and 24 months (Eadie et al., 2010; Reilly et al., 2006). As a result early detection of developmental risks is important regardless of the final diagnosis especially since a variety of developmental problems can lead to language delays (Ben-Sasson et al., 2014).

After the identification of risk factors collaboration among PHC workers, social services and community early intervention providers is crucial (Glascoe & Leew, 2010). Clinicians should regularly advise on, and make parents aware of the value of talking frequently with their children, modelling and expanding their child's utterances and actively teaching new words (Glascoe & Leew, 2010). However challenged families, who are exposed to multiple risks, may not respond well to brief advice (Glascoe & Leew, 2010). Therefore collaboration with community health care workers as part of community oriented PHC in South Africa may improve responsiveness of these families as continued support will be provided (Bam et al., 2013). Future research should evaluate the implementation of preventative measures such as awareness campaigns and developmental screening and surveillance as part of the community oriented PHC initiative.

5.6 CONCLUSION

In the current study 13% of infants between 6 and 12 months from an underserved PHC context presented with communication delays. Specifically expressive language delays were most commonly detected in these infants. Association between three risk factors (i.e. housing status, age of mother and number of siblings) and language delays was established for this age cohort of infants. Furthermore the probability of language delay when exposed to these risks in combination have demonstrated that

infants were at greatest risk when mothers were between the ages of 19 to 34 years, when the parents own their own home and when there are three or more children in the household. Since many infants are exposed to these risks in South Africa the implementation of preventative measures such as awareness campaigns and developmental screening and surveillance should be prioritised.

5.7 ACKNOWLEDGEMENTS

The authors would like to acknowledge the Mellon Foundation for funding the vulnerable children program of the Faculty of Humanities, University of Pretoria, the COPC living laboratory, the National Research Foundation and Department of Statistics, University of Pretoria for their assistance in the data processing and analysis. Mrs T Ahmed and Mrs J Bogatsu are also acknowledged for their contribution.

6 EARLY DETECTION OF COMMUNICATION DELAYS WITH THE PEDS TOOLS IN AT-RISK SOUTH AFRICAN INFANTS

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Journal: African Journal of Disability

Accepted: 11-11-2015

6.1 ABSTRACT

Background: Prevalence of communication delays or disorders is increasing possibly due to various environmental risk factors. Selection and implementation of effective screening tools is important to detect at-risk infants as early as possible. This study aimed to evaluate the accuracy of the Parents' Evaluation of Developmental Status (PEDS), PEDS: DM and PEDS tools to detect communication delays in infants (6 – 12 months) in a South African PHC context. **Method:** A comparative study design compared the accuracy of the PEDS tools to detect communication delays, against an internationally accepted diagnostic assessment tool, the Rossetti Infant Toddler Language Scale (RITLS). A convenience sample of 201 infants was selected at PHC clinics. **Results:** Expressive language and receptive language sensitivity scores were low across all three screens (ranging between 14%-44%). The PEDS tools had high sensitivity (71%) and specificity (73%) ratings for the receptive and expressive language and social emotional domain in combination. **Conclusion:** In the sample population the PEDS tools did not accurately detect receptive and expressive language delays, however communication delays in general were identified. Future research determining accuracy of the PEDS, PEDS: DM and PEDS tools for children aged 2-5 years in detecting communication delays should be prioritised.

Keywords: Communication delays, developmental screening, PHC, early intervention

6.2 INTRODUCTION

The prevalence of communication delays or disorders is increasing and may be ascribed to environmental factors such as unemployment, limited medical resources, lack of educational services, violence, crime and HIV/AIDS (Guralnick, 2013). Paediatric HIV/AIDS, for instance, is a challenging condition as it not only influences the well-being of infants but also results in prematurity and low birth weight, and later attention difficulties and speech and language delays (Rossetti, 2001; Samuels et al., 2012). South African infants and children are particularly vulnerable due to the high prevalence of predisposing environmental factors such as these (Mayosi & Benatar, 2014; Samuels et al., 2012).

The high prevalence of developmental delays or disorders among infants in South Africa (Samuels et al., 2012) necessitates selection and implementation of effective screening or developmental surveillance tools to identify at-risk infants as early as possible (van der Linde, Swanepoel, Glascoe, Louw, & Vinck, 2015). If communication delays remain undetected until primary school years, a child is at greater risk for behavioural problems, academic failure and socio-emotional disturbances (Squires et al., 2009; Yew & O'Kearney, 2013). With a direct link between school performance, communication skills, and the role that communication plays in general development and emotional and behavioural outcomes, the importance of early identification of communication delays is obvious (Rossetti, 2001; Wankoff, 2011; Yew & O'Kearney, 2013). Early identification of and early intervention for infants at-risk can prevent or reduce future developmental difficulties and academic failure whilst improving quality of life for the infant and family (Samuels et al., 2012). Furthermore these services can prevent or lessen developmental and communication difficulties (Hawa & Spanoudis, 2014) which implies less future financial expenditure for parents with regard to medical costs, transport fees to medical centres and/or speech therapy expenses.

Infants receiving early intervention services, including early detection by means of developmental screening and/or surveillance as first point of access, make greater progress when the whole family is involved (Guralnick, 2013). Since parents are usually the first to identify their children's developmental difficulties, they are considered a good resource by health care providers when conducting screening tests (Glascoe, 2013). The resource-constrained public health care system in

developing countries like South Africa (Mayosi & Benatar, 2014) requires time-efficient and accurate screening tools to ensure it is practically feasible with low false-positive rates that do not result in over-referral. Parents can be used as a resource in identifying their child's strengths and weaknesses (Glascoe, 2013), and thus providing important information to professionals. A parent-administered test may therefore be appropriate for the South African context if it is sufficiently accurate and time efficient. Furthermore selecting a comprehensive screening tool accurately detecting communication delays in addition to other developmental delays may be more suitable than developmental domain specific screening tools in the South African, resource-constrained public health care context.

Early identification of developmental delays, including communication delays, can be facilitated by a variety of valid standardised tools. In South Africa, developmental screening is implemented nationally as part of the Road to Health Booklet (Tarwa & Villiers, 2007). However the Road to Health Booklet has not been validated and its accuracy for developmental screening has been questioned (van der Linde et al., 2015). The Ages and Stages Questionnaire or ASQ (Squires et al., 2009), Denver Developmental Screening Test II or DDST-II (Frankenburg et al., 1992) and the Parents' Evaluation of Developmental Status or PEDS (Glascoe, 1997) are all well validated and standardized screening tools with large bodies of supporting evidence (Macy, 2012). All three tools include infants from birth, however the DDST-II is a clinician administered test whereas the ASQ and PEDS Tools are parent administered tools (Macy, 2012).

The ASQ and the PEDS elicit parental concerns regarding their children's development and behaviour. In a comparison study conducted in Canada, both the ASQ and PEDS rendered similar outcomes and it was concluded that either one can be selected for implementation (Limbos & Joyce, 2011). Taking into consideration the cost of the tools and administration time, the PEDS tools has been deemed more appropriate for use in the South African PHC context.

While a recent study evaluated the accuracy of the PEDS and PEDS: Developmental Milestones (PEDS: DM) for developmental delays in the private health care sector in South Africa (Silva, 2010), the accuracy of the PEDS test detecting communication delays or disorders in infants in the South African PHC context has not yet been

established. This study therefore evaluated the accuracy of the PEDS tools in detecting communication delays in infants, aged six to twelve months, in a PHC context in South Africa.

6.3 METHOD

A comparative cross-sectional within-subject design was employed to evaluate the accuracy of the PEDS tools in detecting communication delays using the Rossetti Infant-Toddler Language Scales (Rossetti, 2006) as a gold standard.

6.3.1 Setting

Data was collected at three PHC clinics, namely Olievenhoutbosch Clinic, Salvokop Clinic and Daspoort Polyclinic. These clinics are situated in underserved communities in the Tshwane District, Gauteng Province, South Africa. The community in Olievenhoutbosch consists of 70 863 individuals and 23 777 households. The clinic serves an area of 11.39 km² and is situated in Centurion (Statistics South Africa, 2011a). Daspoort covers an area of 2.16 km², with 6 355 individuals and 1 582 households (Statistics South Africa, 2011a). Salvokop has a population of 7 123 individuals and 1 685 households within an area of 4.09 km² (Statistics South Africa, 2011a).

6.3.2 Participants

As this study focused on early identification, infants between 6 and 12 months of age was targeted. Convenience sampling was used as all caregivers of infants between 6-12 months proficient to communicate in English or Afrikaans were asked to participate. The sample consisted of 201 infants and the caregiver of each was interviewed.

6.3.3 Material

Since the current study aimed at evaluating the accuracy of the PEDS, PEDS:DM and PEDS tools in detecting communication delays, the Rossetti Infant Toddler Language Scales or RITLS (Rossetti, 2006) were used as the gold standard reference. It is a comprehensive, easy-to-administer and relevant tool that was designed to assess the preverbal and verbal aspects of interaction and communication in the young child (Rossetti, 2006). Although this is a criterion

referenced tool, it has been used and validated in previous studies (Desmarais et al., 2010; Dettman et al., 2007; Groenewald et al., 2013; Rie et al., 2008; Steiner et al., 2012; Sylvestre & Mérette, 2010). The RITLS assesses interaction-attachment, pragmatics, gestures, play and language comprehension and expression of infants from birth to three years (Rossetti, 2006).

The PEDS tools, i.e. the PEDS and PEDS: DM, consists of questions posed to the parent/caregiver. The PEDS consists of ten questions which address parental concerns about their infant's development. The tool can be conducted either as a questionnaire, in which parents write down their responses, or as an interview, where the health care professional asks the questions. It includes the following domains: cognition, expressive and receptive language, gross and fine motor, self-help, academic, health, social-emotional/mental status and behaviour (Glascoe, 2013). Each of these areas is represented irrespective of the child's age (birth to 7 years 11 months) and is time- and cost- effective (Glascoe, 2013). The tool takes approximately 5 minutes for parents to complete and approximately 1 to 2 minutes for the health care professional to score (Glascoe, 2013) with a clear score guide and algorithm for referral (Glascoe, 1997). The referral algorithm consists of five paths, namely Path A – E.

Path A - When two or more predictive concerns about self-help, social, school, or receptive language skills are present, refer to the respective allied health care professional
Path B - When one predictive concern is present administer second stage developmental screen, if second screen is failed refer
Path C - When non-predictive concerns are present, counsel in areas of difficulty and follow-up
Path D - When parental difficulties communicating due to foreign language barriers are present, use translator in second screen
Path E - When no concerns are present, re screen at next visit
Furthermore in Path B distinction is made between development-related predictive concerns and health related concerns.

The PEDS: DM consists of six questions posed to parents regarding their infants or children's developmental milestones. The six questions differ in each age interval

and represent the following areas of development: fine-motor, receptive language, expressive language, gross motor, self-help and social-emotional.

6.3.4 Procedures

The PEDS tools and RITLS were administered by an experienced speech-language therapist in a screening environment that was secluded, had limited distractions and low noise levels. The procedure entailed fetching the caregiver and infant from the clinic, obtaining informed consent, completing the assessment and interview, and providing feedback. The infants were assessed according to their chronological age. Referral letters for follow-up services were provided when necessary. This process took approximately 30 to 45 minutes to complete. Appreciation for participating in the study was shown by providing a meal for the infant.

6.3.5 Data processing and interpretation

RITLS

Information obtained through elicitation, observation and by report from caregivers, carried equal weight when scoring the RITLS (Rossetti, 2006). If a specific behaviour was not elicited, observed or reported, it indicated that the infant had not yet reached the expected age level. The subtests are divided into three-month intervals for e.g. 0-3 months, 4-6 months and 7-9 months. When the developmental level is two intervals or more below the infant's chronological age, the infant is considered delayed (Rossetti, 2006). For example, if an infant is 10 months of age, but scores on a 0 to 3 month old level in the Play subsection. It is important to note that the Gesture subsection only starts at the 9 to 12 months interval. Therefore none of the infants could present with a delay in this developmental area.

PEDS tools

The PEDS was interpreted in the following manner: Path A-D was deemed a fail and Path E was deemed a pass (Glascoe, 2013). If an infant had one or more unmet milestone in the PEDS: DM the outcome of the test is a fail. The interpretation of the PEDS tools started with the PEDS, where Path A represented a fail irrespective of the PEDS: DM result, but with Path B-E the PEDS: DM results determined the actual pass or fail.

6.3.6 Data Analysis

The SAS version 9.3 was used to conduct the data analysis. The pass/fail and delayed/not delayed distributions and percentages were calculated. The pass/fail distribution of the PEDS, PEDS:DM and PEDS tools and the delayed/not delayed distribution of the RITLS were presented separately in two-way tables for each domain, i.e. receptive language, expressive language and social-emotional. The social-emotional outcomes of the PEDS, PEDS:DM and PEDS tools were compared against the interaction attachment subtest of the RITLS. The domain specific sensitivity, specificity, positive and negative predictive values of the PEDS, PEDS:DM and PEDS tools were then calculated.

6.4 RESULTS

6.4.1 Participants' profile

The average age of the 201 infants (45% female) was 8.7 months (SD 1.9; Range 6-12m). Fifteen different home languages were reported of which Sepedi (33%), Zulu (16%) and Shona (11%) had the largest representation. All participants were proficient in either English or Afrikaans as an additional language, but none reported either of these as their home language. Most of the individuals resided in Olievenhoutbosch (94%). The remaining 6% were from other areas in Tshwane such as Mamelodi and Salvokop. The majority of the participants were Black (98.5%). Seven of the 201 infants were from teenage pregnancies, and six infants were born prematurely. Of the total sample 62% of the parents did not complete their high school education, 71% of the households had a monthly income of R3000 or less and 32% had three or more children in the home.

6.4.2 Fail rates of the PEDS screening tools and RITLS

A positive diagnosis of communication delay was made for 13% (n=26) of the entire sample (see Table 1). Almost half (47%; n=94) of the sample failed the PEDS on one or more of the general developmental domains. 65% (n=17) of these failed screens were also identified as having a communication delay on the RITLS. Similar fail rates were obtained with the PEDS:DM (49%; n=98) and PEDS tools (52%; n=104). Domain specific fail rates are also presented in Table 6.1.

Table 6.1 Fail rates of the screening tools and RITLS

	PEDS	PEDS: DM	PEDS tools	RITLS
Overall	47% (94/201)	49% (98/201)	52% (104/201)	13% (26/201)
Receptive language	3% (6/201)	8% (16/201)	10% (20/201)	4% (9/201)
Expressive language	3% (7/201)	7% (15/201)	10% (21/201)	11% (22/201)
Social emotional	9% (19/201)	11% (22/201)	19% (38/201)	1% (2/201)
Combined*	12% (25/201)	22% (45/201)	32% (65/201)	12% (24/201)

***Receptive and expressive language and social-emotional skills**

6.4.3 Accuracy of the screens in detecting communication delays

Since the PEDS, PEDS:DM and the PEDS tools are developmental screening tools that include various developmental aspects, domain-specific results were compared to the RITLS; focusing only on the accuracy of the tools in detecting communication delays (see Table 6.2).

Table 6.2 Developmental domain specific performance of the PEDS tools in comparison to the RITLS

		PEDS	PEDS:DM	PEDS TOOLS
Receptive language	Sensitivity	22% (2/9)	33% (3/9)	44% (4/9)
	Specificity	98% (188/192)	93% (179/192)	92% (176/192)
	Positive predictive values	33% (2/6)	19% (3/16)	20% (4/20)
	Negative predictive values	96% (188/195)	97% (179/185)	97% (176/181)
Expressive language	Sensitivity	5% (1/22)	23% (5/22)	23% (5/22)
	Specificity	97% (173/179)	94% (169/179)	91% (163/179)
	Positive predictive values	14% (1/7)	33% (5/15)	24% (5/21)
	Negative predictive values	89% (173/194)	91% (169/186)	91% (163/180)
Social-emotional	Sensitivity	100% (2/2)	50% (1/2)	100% (2/2)
	Specificity	91% (182/199)	89% (178/199)	82% (163/199)
	Positive predictive values	11% (2/19)	5% (1/22)	5% (2/38)
	Negative predictive values	100% (182/182)	99% (178/179)	100% (163/163)
Combined*	Sensitivity	25% (6/24)	58% (14/24)	71% (17/24)
	Specificity	90% (158/177)	82% (146/177)	73% (129/177)
	Positive predictive values	24% (6/25)	31% (14/45)	26% (17/65)
	Negative predictive values	90% (158/176)	94% (146/156)	95% (129/136)

***Receptive and expressive language and social-emotional skills**

The sensitivity of both the receptive and expressive developmental domains was poor in the PEDS (22% and 5%), PEDS:DM (33% and 23%) and the PEDS tools (44% and 23%). Receptive language sensitivity was higher than expressive

language sensitivity in all three tests. The specificity, however, in both domains were high (between 89% and 98%). Similarly, the positive predictive value was poor (between 14% and 33%), in contrast to a high negative predictive value (between 89% and 97%). The PEDS tools' combined sensitivity, i.e. receptive and expressive language and social-emotional domains, was 71% with the combined specificity being 73%.

6.5 DISCUSSION

The fail rate of the PEDS, PEDS: DM and PEDS tools were high (47-52%). This was to be expected as an at-risk population was utilized. Several high risk factors for developmental delay were present in the study population. The majority of participants had one or more risk factor/s for developmental delays such as poverty (71%), three or more children in a home (32%), and limited parental education (62%). An estimated 45% of the South African population is poor, while 20% live in extreme poverty (Statistics South Africa, 2011). Multiple risk factors increase the probability that development will be delayed (Glascoe & Leew, 2010) and high-risk children are 24 times more prone to have IQs below 85 than low-risk children (Sameroff et al., 1987).

Specificity and sensitivity values of an accurate screening tool should fall between 70-80% (Glascoe, 2013). The results in this study demonstrated domain specific (i.e. expressive language and receptive language) sensitivity scores that were low to very low across the PEDS, PEDS: DM and PEDS tools. Such low sensitivity values may result in a failure to identify a large number of infants who require early communication intervention services. The PEDS tools, on the other hand, did show an accurate sensitivity (71%) and specificity (73%) rating for receptive and expressive language and social emotional domains in combination. High sensitivity and specificity for social emotional developmental delays indicated that the infant delays in the study sample were accurately identified by means of the PEDS and PEDS tools. Autism spectrum disorders, for example, are characterized by such impairments in social interaction, communication and behaviour which are ostensible before the age of 3 years (Baio, 2012). Since the results of this study indicated that PEDS and PEDS tools are able to accurately detect social emotional developmental

delays in infants, these tools may possibly aid in the early diagnosis of autism spectrum disorders in PHC.

The lack of parental concern regarding their infants' communication development in the current study population, as illustrated by the fail rate of the PEDS for receptive- (3%) and expressive language (3%), were similar to previous research findings. A study performed by Glascoe (2013) revealed that parents of infants, 11 months or younger, do not have many communication related concerns. However when there are concerns, it usually pertains to their children's motor, health, behavioural, self-help and social-emotional skills (Glascoe, 2013). This is possibly due to gross motor milestones, such as sitting and crawling, being more observable than infant's speech sounds and language comprehension (Glascoe, 2013).

The low sensitivity and specificity ratings of the screening tools for receptive (22%-44%) and expressive language (5%-23%) reported in the current study, is likely due to the difficulty to identify communication delays before the age of 12 months (Eadie et al., 2010). It can be expected that parents' awareness of their child's communication development might be better at a later stage when the child is older and more communicative (Eadie et al., 2010). It is therefore recommended that future research should evaluate the accuracy of the PEDS tools for communication delays in two to five year old children within the South African PHC context. Since the interviews and assessments were not conducted in the home-languages of the sample population, it may be deemed a limitation of the current study. Future research should explore the accuracy of translated tools in detecting communication delays in infants and young children. Preventative strategies such as developmental surveillance and awareness campaigns should be considered as a way to support underserved communities where the majority of infants are at risk of communication and/or other developmental delays.

6.6 CONCLUSION

The PEDS tools demonstrate limited sensitivity scores for receptive and expressive language domains' in young infants although sensitivity for the social emotional domain was high. Obtained values for the PEDS tools did demonstrate a high degree of accuracy when considering a combination of receptive and expressive

language and social-emotional domains with sensitivity and specificity of 71% and 73% respectively. Future research determining accuracy of the PEDS, PEDS: DM and PEDS tools for children aged 2-5years in detecting communication delays should be explored.

7 GENERAL DISCUSSION, CLINICAL IMPLICATIONS AND CONCLUSION

The importance of high-quality screening tests in the early identification of infants, toddlers and young children with developmental delays, are recognized internationally (Elbaum, Gattamorta, & Penfield, 2010; Glascoe, 2000). The lack of research supporting the RTHB as a developmental screening or surveillance tool was sufficient motivation to compare the outcome of the tool with a well validated tool, in this case the PEDS tools. Also, the association between risks and communication delays as well as the prevalence and nature of communication delays were investigated. Finally, the accuracy of the PEDS tools for detecting communication delays in infants in South Africa was determined.

7.1 COMPARISON OF RTHB DEVELOPMENTAL SCREEN AND PEDS TOOLS

The fail rate of the PEDS, PEDS: DM and PEDS tools was high (47%-52%). A previous study, in which at risk populations were targeted, reported similar pass/fail distributions to the current study (Glascoe, 2010).

The accuracy of the RTHB compared to the PEDS test (Path A and B) was low. Even when a more stringent interpretation of the PEDS was used the accuracy of the RTHB remained poor. Low sensitivity of the RTHB screen is a concern, as it clearly illustrates the failure of the screen to detect developmental delays in infants, resulting in the majority of infants in need of early intervention services continuing to be unidentified. Some developmental areas such as social- emotional and self-help skills were not included in the RTHB screen, and the inconsistency of test items across age groups of the other developmental domains was problematic.

Screening tools, such as the PEDS tools, measure multiple developmental aspects ranging from mild and ‘difficult to identify’ developmental problems, to severe problems such as mental retardation (Glascoe et al., 1992). Consequently such a broad ranging instrument ensures that the strengths and limitations of the RTHB developmental checklist may be established. As a previous study, conducted in

South Africa, reported the PEDS tools to be accurate (Silva, 2010), it was assumed that cultural differences were unlikely to have influenced the outcome of the tools.

Findings suggested that further development of the RTHB screen is required. Test items at each age interval should represent all the developmental domains i.e. receptive language, expressive language, gross motor, fine motor, social-emotional, self-help and global-cognitive skills, and the test should be extended to include the pre-school years. Age intervals should also be used consistently throughout the RTHB, for instance zero-three, four-six, seven-nine months and so forth. Scoring guidelines and a clear referral framework should also be developed. The tool should then be validated and standardized for the South African context. The fact that these aspects were omitted during the development of the test may explain why the test lacks accuracy in identifying risk of developmental delay. It is recommended that since the accuracy of the RTHB developmental checklist is poor, alternative screening tools should be considered or integrated to ensure the screening tool used nationally in South Africa is validated.

The utilization of an early developmental screening tool facilitates the provision of other preventative strategies such parental education (van der Linde et al., 2009). Consequently the implementation of an accurate screening tool in PHC in South Africa also has educational value for the families, which in turn may improve infants' development due to the awareness created.

7.2 PREVALENCE AND NATURE OF COMMUNICATION DELAYS

Few studies have reported prevalence of communication disorders under the age of two years (Broomfield & Dodd, 2004; Law et al., 2000). The prevalence (13%) of communication disorders in the sample population is higher than the prevalence rates (5.6%) reported in previous research conducted in the UK for infants aged 0-2 years (Broomfield & Dodd, 2004). A median prevalence of 5% for speech and language delays in two year olds was also reported in a systematic review conducted in 2000 (Law et al., 2000).

More specifically, 20% of referrals in the UK (during 1999-2000) of children of various ages in the UK was due to receptive language difficulties, 17% was due to expressive language difficulties, and 29% for speech difficulties (Broomfield & Dodd,

2004). Of the 20% of children with receptive language delays, 6% were aged between zero and two years. Of the 17% of children with expressive language delays, 13% was from the same cohort (Broomfield & Dodd, 2004). Similar results were reported by two other studies, one conducted in the USA, and the other a systematic review where 15% of two year olds presented with expressive language delays (Desmarais et al., 2008; Horwitz et al., 2003).

Of the current sample population (n=201) 11% of infants, aged six and 12 months, presented with delays in expressive language, which is similar to previous research findings for a slightly older cohort (Desmarais et al., 2008; Horwitz et al., 2003). High prevalence rates as were reported in the current study may be ascribed to the presence of multiple risks in the target population that may have influenced their communication development.

Although high rates of spontaneous resolution of language delays have been reported in the past (Eadie et al., 2010; Reilly et al., 2007), association between language outcomes of children with delayed onset of expressive language have been established (Hawa & Spanoudis, 2014; Rice et al., 2008). Making a definitive diagnosis of a social-communication delay is difficult at young ages (Ben-Sasson et al., 2014). Nevertheless the most important phase of communication acquisition and development takes place between 8 and 24 months (Eadie et al., 2010; Reilly et al., 2006). As a result early detection of developmental risks is important regardless of the final diagnosis, especially since a variety of developmental problems may lead to language delays (Ben-Sasson et al., 2014).

7.3 RISKS AND COMMUNICATION DELAYS

The adverse impact of risks on communication development in infants was demonstrated in the current study, especially with regard to the number of siblings. This finding is in accordance with previous research that also confirmed that children with two or more siblings are at risk of communication delays (Harrison & McLeod, 2010; Stanton-Chapman et al., 2002; Zubrick et al., 2007). One of the possible reasons for younger siblings presenting with delayed communication may be the fact that the older sibling are more verbal and may speak on behalf of the younger siblings (Harrison & McLeod, 2010). Also larger families imply that parental

interaction and attention are divided between the children, and may result in less attention and interaction than when there are only one or two children in the home. In 2006 the average fertility rate of Black South African women was 2.9, indicating that an average household will have approximately three children (Statistics South Africa., 2010). In the current study, one-third of the infants with communication delays had two siblings or more and it is possible that these mothers will have another child in future as 85% of the mothers were 34 years or younger. This is in line with the fertility rate of 1.4 for 35 to 39 year old Black South African women (Statistics South Africa., 2010). Developmental surveillance of infants with two or more siblings may therefore be warranted in underserved communities.

Interestingly, infants living in homes owned by their parents had a higher probability (25%) for communication delay than those who live in informal housing or with others (12%). Recent findings have demonstrated that the diversity of neighbourhoods in which infants live shape their social learning independently of their caregiver and/or family interaction (Howard et al., 2014). The diverse neighbourhood of informal settlements or the close proximity to others may seemingly aid social and communication development in infants. Consequently what was deemed a risk factor in the past (Samuels et al., 2012), may facilitate more opportunities for communication interactions and may be more conducive to social learning.

The impact of combined risk factors on communication development revealed that an infant was at greatest risk (39% probability) of developing a communication delay when 1) mothers were between the ages of 18 and 29 years; 2) when the parents owned their own home and; 3) when there were three or more children in the household. This information might allow PHC workers, working from the platform of community oriented primary care (Bam et al., 2013), to identify infants at greatest risk of communication delays in underserved communities in South Africa.

7.4 DETECTION OF COMMUNICATION DELAYS BY MEANS OF THE PEDS TOOLS

The study demonstrated domain specific (i.e. expressive language and receptive language) sensitivity scores that were low to very low across the PEDS, PEDS: DM and PEDS tools. Such low sensitivity values may result in a failure to identify a large

number of infants who require early communication intervention services. The PEDS tools, on the other hand, did show an accurate sensitivity (71%) and specificity (73%) rating for delays in the combined domains of receptive and expressive language, and social emotional development.

High sensitivity and specificity for social emotional developmental delays indicated that the infants' delays in the study sample were accurately identified by means of the PEDS and PEDS tools. Autism spectrum disorders, for example, are characterized by such impairments which are apparent in social interaction, communication and behaviour before the age of three years (Baio, 2012). Since the results of this study indicated that PEDS and PEDS tools are able to accurately detect social emotional developmental delays in infants, these tools may possibly aid in the early diagnosis of social, behavioural and communication delays associated with autism spectrum disorders in PHC.

The lack of parental concern regarding their infants' communication development in the current study population, as illustrated by the fail rate of the PEDS for receptive (3%) and expressive language (3%), were similar to previous research findings. A study performed by Glascoe (2013) revealed that parents of infants of 11 months or younger, did not have many communication related concerns. However when there were concerns, it usually pertained to their children's motor, health, behavioural, self-help and social-emotional skills (Glascoe, 2013). This is possibly due to gross motor milestones, such as sitting and crawling, being more obvious than infant's speech sounds and language comprehension (Glascoe, 2013).

The low sensitivity and specificity ratings of the screening tools for receptive (22%-44%) and expressive language delays (5%-23%) reported in the current study, is likely due to the difficulty in identifying communication delays before the age of 12 months (Eadie et al., 2010). It may be expected that parents' awareness of their child's communication development may improve at a later stage when the child is older and more communicative (Eadie et al., 2010).

7.5 CLINICAL IMPLICATIONS

Considering that one in three infants were at risk of communication delay, the need for early communication intervention services, including developmental screening

and comprehensive assessment and intervention, is clear. Completing a risk profile and conducting developmental screening, such as that offered by the PEDS tools for infants, could enable health care workers to identify at-risk infants and refer them for the required services. Such services may include awareness creation amongst parents of early communication development and stimulation, and/or clinic and/or home-based early intervention. Internationally early intervention is becoming more prevention-orientated, encouraging individualized child learning experiences using evidence-based practices (Greenwood, Walker, et al., 2013). Clinicians should regularly advise on, and make parents aware of the value of talking frequently with their children, modelling and expanding their child's utterances, and actively teaching new words (Glascoe & Leew, 2010). However challenged families, who are exposed to multiple risks, may not respond well to brief advice (Glascoe & Leew, 2010). Collaboration with community health care workers as part of community oriented PHC in South Africa may therefore improve responsiveness of the aforementioned families, as continued support will be provided (Bam et al., 2013).

The early identification and routine care of children may be enhanced by utilizing community oriented PHC, with CHWs forming an integral part of service delivery (Bam et al., 2013). CHWs who are well trained, equipped and well supported are in an ideal position to identify potential risks to communication development in infants and young children, and to conduct developmental screening (Tulenko et al., 2013). The PEDS tools provide the CHW with a clear algorithm enabling the CHW to determine whether the infant or young child should be referred, rescreened, or merely monitored. When an infant requires referral, families need to be supported by staff at their nearest PHC clinic or second level of care, depending on the availability of the professionals. If a rescreen is recommended, a basic information booklet may be provided to parents, and CHW may then conduct the rescreen at the next home visit. Awareness of the importance of developmental stimulation should be created during home visits as well as during PHC clinic visits.

At the PHC clinic transdisciplinary support and therapy groups should be introduced to the parents or caregivers whose infants were referred after the screen. The allied health care professionals such as occupational therapists, speech-language therapists, audiologists, physiotherapists, social workers and psychologists would then need to decide if comprehensive assessment and intervention is necessary.

7.6 STUDY STRENGTHS AND LIMITATIONS

7.6.1 Study strengths

- Since early identification and early intervention practices for communication delays and disorders are lacking in PHC in South Africa (Samuels et al., 2012; van der Linde et al., 2009) the target population in the current study, being infants and caregivers visiting PHC clinics in underserved communities, contributed to the body of evidence supporting early identification in these communities. Establishing the risk factors within this population, determining the prevalence and describing the nature of communication delays advocates the implementation of services on a PHC level (Law et al., 2000).
- Since no validation studies have been published on the nationally implemented RTHB developmental checklist, the aim of Study 1 to compare the RTHB and an internationally validated tool enabled the checklist to be recognised as ineffective and recommendations were made to adapt or replace the tool.
- Few studies (Silva, 2010) have evaluated existing developmental screening tools in South Africa, and no South African studies have evaluated the ability of developmental screening tools to detect communication delays in infants in South Africa. Therefore the evaluation of the accuracy of the PEDS tools in detecting communication delays in underserved infants in South Africa has never been completed.

7.6.2 Study limitations

Limitations of the current study included the following:

- Only caregivers or parents who were proficient in Afrikaans or English were included in the study. However increased use of English in public administration, business and schools demonstrates the prominence of English in a variety of multilingual settings (De Klerk, 2002). Even though it is the first language of only 8.6% of South Africans, its wide demographic dispersal has resulted in English being the preferred medium for use within economic and social spheres (De Klerk, 2002). Still, since participants with limited or no verbal English or Afrikaans proficiency were excluded, the sample may not be

entirely representative of the population sampled. It is therefore recommended that future research be conducted on a randomized sample, including all languages, in underserved communities in South Africa.

- Since the study aimed at evaluating developmental screening and communication delays in infants, the sample population's age ranged from six to 12 months. Nevertheless the need for research exploring communication delays in young children from underserved communities in South Africa persists. Consequently future research on infants and young children older than a year of age is recommended.
- A convenience sampling method was used despite the initial intention being to collect data from a randomized sample. Home-based visits to a random sample, selected from the database of the COPC living laboratory, would have been conducted. However, due to various constraints including unrest in the community and potential participants relocating, clinic based data collection was more feasible. During clinic visits all caregivers of infants aged six to 12 months, who were proficient in Afrikaans or English, were asked to participate in the study.
- As RITLS is a criterion referenced test and has not been standardized as norm referenced tests, the validity may be questioned. Yet the tool has been validated and used extensively in previous research (Desmarais et al., 2010; Dettman et al., 2007; Groenewald et al., 2013; Rie et al., 2008; Steiner et al., 2012; Sylvestre & Mérette, 2010). In South Africa assessment material is limited, and no standardization or validation of early communication assessment tools has been completed. The RITLS have been used with great success in other multilingual developing countries, such as the Democratic Republic of Congo (Rie et al., 2008). Also, in South Africa, have researchers used the tool with great success in the past (Groenewald et al., 2013).

7.7 RECOMMENDATIONS FOR FUTURE RESEARCH

The following recommendations for future research were made:

- Since this study compared the RTHB to a combination of screening tools, future studies should involve replication of this study using diagnostic developmental tests as a benchmark.

- The adaption and validation, or the replacement of the RTHB developmental screen should be explored to ensure timely identification of at-risk infants.
- Implementation of preventative measures such as awareness campaigns and developmental screening and surveillance as part of the community oriented PHC initiative should be explored to investigate the effectiveness hereof.
- Previous studies have indicated that mHealth initiatives could improve health care in low and middle income countries by enabling PHC to reach underserved communities (Leon & Schneider, 2012). Therefore the use of mHealth approaches should be explored as a viable medium of service delivery in PHC in South Africa. Developing and validating a developmental screening smartphone application should be explored. Such a tool may enable CHWs to conduct developmental screening as part of home based care.
- The referral and follow-up of at-risk infants who were identified also needs to be investigated in order to establish effective referral systems within the public health care context.
- A longitudinal study investigating infants with communication delays at intervals, possibly at three years and five years of age, to determine if the delays were resolved, and if not, what the extent of the delays are.
- Since parental concerns regarding their children's communication development generally increases as their children grow older (Glascoe, 2013), the accuracy of the PEDS tools for communication delays in children of two to five years of age within the South African PHC context should be evaluated.

7.8 CONCLUSION

The RTHB developmental checklist failed to identify more than half of infants at risk of developmental delays or disorders within the PHC context. A clear relationship has been established in the current study between communication delay and three risk factors (viz. age of the mother, number of children and housing status) in infants aged six to 12 months from these underserved communities. Furthermore, the combined effect of these risks accounted for a 39% probability for communication delay. As 13% of infants presented with a communication delay and more than a third were at risk of developing communication delays in future, preventative

strategies such as the implementation of a risk profile and a communication development screen should be implemented. This may ensure early identification of at risk infants and assist health care workers in decision-making with regard to timely referral and also in preventative parental counselling.

The PEDS tools demonstrate limited sensitivity scores for the identification of delays in receptive and expressive language domains' in young infants although sensitivity for the social emotional domain was high. The PEDS tools did demonstrate a high degree of accuracy when considering a combination of receptive and expressive language and social-emotional domains, with sensitivity and specificity of 71% and 73% respectively. These values may indicate that this test is appropriate for the screening of communication delays in infants in a South African PHC context. Preventative strategies such as developmental surveillance and awareness campaigns should be considered as a way to support underserved communities where the majority of infants are at risk of communication and/or other developmental delays.

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APPENDIX A: Data sheet of the background information and Road to health Booklet screen

For Office Use

QUESTIONNAIRE: ***PARTICIPANT AND FAMILY INFORMATION AND INFANT DEVELOPMENTAL SCREENING (Road to Health Booklet Screen)***

Please answer the questions by drawing a circle around an appropriate number in a shaded box or by writing your answer in the shaded space provided

Infant code — V1 | | | | | 1

SECTION A: ***Background information***

1. What is the **date** of the **test series**? ***(Please use dd/mm/yy)***

V2 | | | | | | 5

2. What is the **date of birth** of the infant? ***(Please use dd/mm/yy)***

V3 | | | | | | 12

3. What is the **gender** of the infant?

Male	**1**
Female	**2**

V4 | | 19

4. How many weeks **premature** was the infant? ***(Whole weeks only)***

V5 | | | 21

5. Which **ward** do you live in?

V6 | | | 24

6. What is your **status**?

Mother of the infant	**1**
Father of the infant	**2**
Family member of the infant	**3**
Non-family caregiver of the infant	**4**

V7 | | 27

Question 7 follows on the next page ...

For Office Use

7. What is your **age** as of your last birthday?

	V8		29

8. What is your **home** language ***(Indicate those applicable)***?

Setswana	**1**	V9		32
Sepedi	**2**	V10		35
Zulu	**3**	V11		38
Shangaan	**4**	V12		41
English	**5**	V13		44
Afrikaans	**6**	V14		47
Venda	**7**	V15		50
Ndebele	**8**	V16		53
Xhosa	**9**	V17		56
Southern Sotho	**10**	V18		59
SiSwati	**11**	V19		62
Tsonga	**12**	V20		65
Other (specify):		V21		68

9. What other **languages** do you **speak**? ***(Indicate those applicable)***

Setswana	**1**	V22		71
Sepedi	**2**	V23		74
Zulu	**3**	V24		77
Shangaan	**4**	V25		80
English	**5**	V26		83
Afrikaans	**6**	V27		86
Venda	**7**	V28		89
Ndebele	**8**	V29		92
Xhosa	**9**	V30		95
Southern Sotho	**10**	V31		98
SiSwati	**11**	V32		101
Tsonga	**12**	V33		104
Other (specify):		V34		107

10. In terms of the Employment Equity Act, to which **population group** do you belong?

Black	**1**	V35		110
Coloured	**2**			
White	**3**			
Asian	**4**			
Other (specify):				

Question 11 follows on the next page ...

For Office Use

11. Who is the **primary caregiver** of the infant?

Mother	**1**	V36	112
Father	**2**		
Both parents	**3**		
Grandparents	**4**		
Extended family members	**5**		
Foster parents	**6**		
Other (specify):			

12. What is the **highest educational qualification** of the **Mother** of the infant?

I do not know	**1**	V37	115
No formal schooling	**2**		
Less than Grade 8	**3**		
Grade 8 to Grade 10	**4**		
Grade 11 to Grade 12	**5**		
Diploma/Degree	**6**		
Postgraduate	**7**		

13. What is the **highest educational qualification** of the **Father** of the infant?

I do not know	**1**	V38	117
No formal schooling	**2**		
Less than Grade 8	**3**		
Grade 8 to Grade 10	**4**		
Grade 11 to Grade 12	**5**		
Diploma/Degree	**6**		
Postgraduate	**7**		

14. What is the **highest educational qualification** of the **Caregiver** of the infant?

I do not know	**1**	V39	119
No formal schooling	**2**		
Less than Grade 8	**3**		
Grade 8 to Grade 10	**4**		
Grade 11 to Grade 12	**5**		
Diploma/Degree	**6**		
Postgraduate	**7**		

15. What is the **average** household **income** per month?

	V40		121

Question 16 ***follows on the next page ...***

For Office Use

16. What is the **age** of the infant's mother?

V41 [ ][ ] 128

17. How many **children** has the Mother **given birth** to?

V42 [ ][ ] 131

18. How many **living children** does the Mother have?

V43 [ ][ ] 134

19. What is the **marital** status of the Mother of the infant?

I do not know	**1**
Never married	**2**
Living together	**3**
Married	**4**
Widowed	**5**
Separated	**6**
Divorced	**7**

V44 [ ] 137

20. What is the **marital** status of the Father of the infant?

I do not know	**1**
Never married	**2**
Living together	**3**
Married	**4**
Widowed	**5**
Separated	**6**
Divorced	**7**

V45 [ ] 139

21. What is the **marital** status of the caregiver of the infant?

I do not know	**1**
Never married	**2**
Living together	**3**
Married	**4**
Widowed	**5**
Separated	**6**
Divorced	**7**

V46 [ ] 141

Question 22 follows on the next page ...

For Office Use

22. What is your **housing status**?

Own my house	**1**	V47	143
Own my flat	**2**		
Informal housing	**3**		
I am renting	**4**		
I stay with others	**5**		

23. Do you make use of **day-care** for your infant?

Yes	**1**	V48	145
No	**2**		

24. How many people are **living** in the household?

		V49	147

25. Is the primary caregiver **employed**?

Yes	**1**	V50	150
No	**2**		

SECTION B: ***Developmental Screening***

26. Can your child see?

Yes	**1**	V51	152
No	**2**		
I do not know	**3**		

27. Can your child hear and communicate as other children?

Yes	**1**	V52	154
Sometimes	**2**		
No	**3**		
I do not know	**4**		

28. Does your child do the same things as other children of the same age?

Yes	**1**	V53	156
Sometimes	**2**		
No	**3**		
I do not know	**4**		

Question 29 follows on the next page ...

For Office Use

29. 14 WEEKS: Baby follows close objects with eyes.

Yes	**1**	V54		158
Sometimes	**2**			
No	**3**			
I do not know	**4**			

30. 14 WEEKS: Baby responds to sound by stopping sucking, blinking or turning

Yes	**1**	V55		160
Sometimes	**2**			
No	**3**			
I do not know	**4**			

31. 14 WEEKS: Child lifts head when held against shoulder

Yes	**1**	V56		162
Sometimes	**2**			
No	**3**			
I do not know	**4**			

32. 6 MONTHS: Baby recognises familiar faces

Yes	**1**	V57		164
Sometimes	**2**			
No	**3**			

33. 6 MONTHS: Child turns head to look for sound

Yes	**1**	V58		166
Sometimes	**2**			
No	**3**			
I do not know	**4**			

34. 6 MONTHS: Child holds a toy in each hand

Yes	**1**	V59		168
Sometimes	**2**			
No	**3**			

35. 9 MONTHS: Child's eyes focus on far objects. Eyes move well together (No squint)

Yes	**1**	V60		170
Sometimes	**2**			
No	**3**			

Question 36 follows on the next page ...

For Office Use

36. **9 MONTHS:** Child turns when called

Yes	**1**	V61	172
Sometimes	**2**		
No	**3**		
I do not know	**4**		

37. **9 MONTHS:** Child sits and plays without support

Yes	**1**	V62	174
Sometimes	**2**		
No	**3**		
I do not know	**4**		

38. Result of Developmental Screening

Pass	**1**	V63	176
Fail	**0**		

Thank you for your time and co-operation

APPENDIX B: Information leaflet and informed consent form

UNIVERSITEIT VAN PRETORIA
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YUNIBESITHI YA PRETORIA
Denkleiers • Leading Minds • Dikgopolo tša Dihlalefi

Faculty of Humanities
Department of Communication Pathology

01 March 2013

Dear parent/guardian

PARENT/GUARDIAN INFORMATION LEAFLET & INFORMED CONSENT FORM

Title of the research study: Screening for developmental delays in at-risk infants in primary health care in South Africa for therapeutic referral

INTRODUCTION

You are invited to volunteer your child for a research study. This information leaflet is to help you to decide if your child would like to participate. Before you agree to take part in this study you should fully understand what is involved. If you have any questions, which are not fully explained in this leaflet, do not hesitate to ask the researcher. You should not agree for your child to take part unless you are completely happy about all the procedures involved.

WHAT IS THE PURPOSE OF THIS RESEARCH STUDY?

It is important to find babies with developmental difficulties as early as possible in South Africa so that they and their families can get help. By administering the *Road to Health booklet screen*, the *PEDS combined test* and a comprehensive assessment on your baby we hope to find the best developmental screening tests for the South African context. Parents with babies from birth to 12 months, who are supported by community orientated health care in the city of Tshwane, will be asked to participate in the research study.

WHAT IS THE DURATION OF THIS RESEARCH STUDY?

If you decide to allow your child take part he/she will be one of approximately 200 participants. The study will be conducted during the whole of 2013. The researcher and fieldworkers will visit you once at your home. The testing time will not take more than 60 minutes of you and your child's time.

EXPLANATION OF PROCEDURES TO BE FOLLOWED

This study involves answering some questions with regard to your child's development and background history. The researcher will also ask some demographical information such as the languages that you speak, race, marital status etc. Furthermore, the researcher and fieldworkers will play with your child a bit while you are present. The *Road to Health Booklet screen,* the *PEDS Combined* screening test as well as the *Developmental Assessment Schema* and the *Rossetti Infant-Toddler Language Scale* will be completed. The play-based assessment, during which the above mentioned tests will be conducted, is not stressful in any way. Toys will be used to elicit the responses. You are welcome to participate and to hold your baby if he/she cries.

HAS THE STUDY RECEIVED ETHICAL APPROVAL?

This research study Protocol was submitted to the Faculty of Health Sciences Research Ethics Committee as well as the Faculty of Humanities' Research Ethics Committee, University of Pretoria. Written approval has been granted by these committees. The study has been structured in accordance to the Declaration of Helsinki (last update: October 2008), which deals with the recommendations guiding doctors and allied health care professionals in biomedical research involving participants. A copy of the Declaration may be obtained from the researcher should you wish to review it.

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jeannie.vanderlinde@up.ac.za
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WHAT ARE YOUR CHILD'S RIGHTS AS A PARTICIPANT IN THIS RESEARCH STUDY?
Your child's participation in this research study is entirely voluntary and you can refuse for him/her to participate or stop at any time without stating any reason. Your withdrawal will not affect your child's access to other medical care. The researcher retains the right to withdraw your child from the study if it is considered to be in your best interest.

MAY ANY OF THESE PROCEDURES RESULT IN DISCOMFORT OR INCONVENIENCE?
Since the screen and assessment forms part of a routine home visit, no discomfort or inconvenience will be caused by the research study. Your baby's safety and security will by no means be compromised if you allow participation in the research study.

WHAT ARE THE RISKS INVOLVED IN THIS RESEARCH STUDY?
No risks are involved when participating in the research study. The benefit in participating in the study is that you will receive feedback on your baby's general development and therefore, if necessary, you will be referred for the specialized services.

CONFIDENTIALITY
All information obtained during the course of this research study is strictly confidential. Data that may be reported in scientific journals will not include any information which identifies your child as a participant in this research study. Your baby's name will not be used and the results will be kept confidential. Data will be securely stored, electronically and on hardcopy, for a minimum of 15 years at the University of Pretoria.

If you are willing to allow your baby to participate in our research study, please sign the attached consent form. If you have any further questions, please feel free to contact me at (012) 420 2948.

Kind regards

Mrs J. van der Linde
Researcher

Prof A. Kritzinger
Promotor

Prof B. Vinck
CO-PROMOTOR and HEAD: Department of Communication Pathology

INFORMED CONSENT FOR PARENTS / GUARDIANS (on behalf of minors under 18 years old)

I hereby confirm that I have been informed by the researcher, Ms Jeannie van der Linde about the nature, conduct, benefits and risks of the research study titled: "Screening for developmental delays in at-risk infants in primary health care in South Africa for therapeutic referral". I have also received, read and understood the above written information (Participant Information Leaflet and Informed Consent) regarding the research study.

I am aware that the results of the study, including my child's personal details regarding date of birth, initials and diagnosis will be anonymously processed into a research report.

I may, at any stage, without prejudice, withdraw my consent for my child's participation in the research study. I have had sufficient opportunity to ask questions and (of my own free will) declare my child prepared to participate in the trial.

Please indicate whether you give permission that the data may be used for future research. Herewith I give consent that the data obtained in the current study may be used for future research as well:

Yes ☐ No ☐

(Please tick the relevant block)

Parent/Guardian(s) Name _____
(Please print)

Parent/Guardian(s) Signature_____ Date_____

Participant's Name _____
(Please print)

Researcher's Name Jeannie van der Linde

Researcher's Signature _____ Date_____

Witness's Name_____ Witness's Signature_____ Date_____
(Please print)

VERBAL PARTICIPANT INFORMED CONSENT

I, the undersigned, Ms Jeannie van der Linde, have read and have explained fully to the parent, named ..... and/or his/her relative, the participant information leaflet, which has indicated the nature and purpose of the research in which I have asked the parent and child to participate. The explanation I have given has mentioned both the possible risks and benefits of the research study. The parent indicated that he/she understands that his/her child will be free to withdraw from the research at any time for any reason.

I hereby certify that the parent has agreed to participate in this trial.

Parent's Name _____
(Please print)

Researcher's Name Jeannie van der Linde

Researcher's Signature _____ Date_____

Witness's Name_____ Witness's Signature_____ Date_____
(Please print)

APPENDIX C: Data sheet of the PEDS tools

For Office Use

PEDS TOOLS

with acknowledgement to Frances Glascoe
e-Mail: Frances.Page.Glascoe@pedstest.org

Please answer by drawing a circle around an appropriate number in a shaded box or by writing your answer in the shaded space provided

Infant code V1 [ ][ ][ ] 1

SECTION A: ***PEDS***

1. Please list any concerns about your child's learning, development, and behaviour.

	Yes	No			
Global/Cognitive	**1**	**2**	V2	[ ]	5
Expressive Language and Articulation	**1**	**2**	V3	[ ]	7
Receptive Language	**1**	**2**	V4	[ ]	9
Fine-Motor	**1**	**2**	V5	[ ]	11
Gross Motor	**1**	**2**	V6	[ ]	13
Behaviour	**1**	**2**	V7	[ ]	15
Social-emotional	**1**	**2**	V8	[ ]	17
Self-help	**1**	**2**	V9	[ ]	19
School	**1**	**2**	V10	[ ]	21
Other (specify):			V11	[ ][ ]	23

Question 2 ***follows on the next page ...***

For Office Use

2. Do you have any concerns about how your child talks and makes speech sounds?

Yes	**1**	V12		26
No	**2**	V13		28
A little	**3**			
Comment:				

3. Do you have any concerns about how your child understands what you say?

Yes	**1**	V14		30
No	**2**	V15		32
A little	**3**			
Comment:				

4. Do you have any concerns about how your child uses his or her hands and fingers to do things?

Yes	**1**	V16		34
No	**2**	V17		36
A little	**3**			
Comment:				

5. Do you have any concerns about how your child uses his or her arms and legs?

Yes	**1**	V18		38
No	**2**	V19		40
A little	**3**			
Comment:				

Question 6 ***follows on the next page ...***

For Office Use

6. Do you have any concerns about how your child behaves?

Yes	**1**	V20		42
No	**2**	V21		44
A little	**3**			
Comment:				

7. Do you have any concerns about how your child gets along with others?

Yes	**1**	V22		46
No	**2**	V23		48
A little	**3**			
Comment:				

8. Do you have any concerns about how your child is learning to do things for himself/herself?

Yes	**1**	V24		50
No	**2**	V25		52
A little	**3**			
Comment:				

9. Do you have any concerns about how your child is learning preschool or school skills?

Yes	**1**	V26		54
No	**2**	V27		56
A little	**3**			
Comment:				

10. Other concerns ***follows on the next page ...***

For Office Use

10. Please list any other concerns

	Yes	No			
Global/Cognitive	**1**	**2**	V28		58
Expressive Language and Articulation	**1**	**2**	V29		60
Receptive Language	**1**	**2**	V30		62
Fine-Motor	**1**	**2**	V31		64
Gross Motor	**1**	**2**	V32		66
Behaviour	**1**	**2**	V33		68
Social-emotional	**1**	**2**	V34		70
Self-help	**1**	**2**	V35		72
School	**1**	**2**	V36		74
Other (specify):			V37		76

SECTION B: ***PDS DM***

FORM A (0-2 months)

11. Does your baby look at his or her hands?

No	**1**	V38	79
A little	**2**		
Yes	**3**		

12. When you face your baby, does he or she look at you, even if only for a little while?

No	**1**	V39	81
A little	**2**		
Yes	**3**		

Question 13 ***follows on the next page ...***

For Office Use

13. Does your baby make sounds other than crying?

No	**1**	V40		83
A little	**2**			
Yes	**3**			

14. Does your baby try to keep his or her head steady?

No	**1**	V41		85
A little	**2**			
Yes	**3**			

15. Does your baby open his mouth when he sees a bottle, breast, or pacifier?

No	**1**	V42		87
Sometimes	**2**			
Yes	**3**			

16. When you smile at your baby does he or she smile back?

No	**1**	V43		89
Sometimes	**2**			
Most of the time	**3**			

FORM B (3-4 months)

17. Are your baby's hands open most of the time, not in a fist?

No	**1**	V44		91
A little	**2**			
Yes	**3**			

18. Does your baby seem excited when seeing a bottle or breast?

No	**1**	V45		93
Sometimes	**2**			
Yes	**3**			

19. Does your baby make special sounds when he or she is happy?

No	**1**	V46		95
Sometimes	**2**			
Yes	**3**			

Question 20 ***follows on the next page ...***

For Office Use

20. Does your baby roll from her back to her side?

No	**1**	V47		97
Sometimes	**2**			
Yes	**3**			

21. Does your baby open his mouth when he sees a bottle, breast, or pacifier?

No	**1**	V48		99
Sometimes	**2**			
Yes	**3**			

22. Does your baby smile or make speech sounds as a way to get your attention?

No	**1**	V49		101
Sometimes	**2**			
Most of the time	**3**			

FORM C (5-7 months)

23. When your baby is holding a toy in each hand, does he or she look from one hand to the other?

No	**1**	V50		103
A little	**2**			
Yes	**3**			

24. When you say things like, **"Come here"**, does your baby hold out his or her arms?

No	**1**	V51		105
Sometimes	**2**			
Yes	**3**			

25. Does your baby "talk" or make sounds when he or she holds a toy or sees a pet?

No	**1**	V52		107
Sometimes	**2**			
Yes	**3**			

26. If your baby is lying on her back can she pass a toy from one hand to the other?

No	**1**	V53		109
Sometimes	**2**			
Yes	**3**			

Question 27 ***follows on the next page ...***

For Office Use

27. If you try to give more food than your baby wants, does he keep his lips closed or turn away?

No	**1**	V54	111
A litttle	**2**		
Yes	**3**		

28. When you play gentle tickling games with your baby, does he or she enjoy this?

No/Haven't tried	**1**	V55	113
Sometimes	**2**		
Most of the time	**3**		

FORM D (8-10 months)

29. Can your baby poke at things with just his or her first finger?

No	**1**	V56	115
A little	**2**		
Yes	**3**		

30. When you say your baby's name, does he or she stop and look at you?

No	**1**	V57	117
Sometimes	**2**		
Most of the time	**3**		

31. How many different sounds such as "muh", "bah", "duh" or "guh" does your baby say?

None	**1**	V58	119
1	**2**		
2 or more	**3**		

32. Can your baby get around on hands and knees or by scooting on his or her bottom?

No	**1**	V59	121
Sometimes	**2**		
Yes	**3**		

33. Does your baby try to get to toys that are out of reach?

No	**1**	V60	123
A little	**2**		
Yes	**3**		

Question 34 ***follows on the next page ...***

For Office Use

34. Does your baby like to play peek-a-boo?

No/Never tried	**1**	V61		125
A little	**2**			
Yes	**3**			

FORM E (11-13 months)

35. Can your baby make a squeeze toy squeak – or try to?

No	**1**	V62		127
A little	**2**			
Yes	**3**			

36. When you say things like, **"Where's your bottle?"** does your baby look around for his bottle?

No	**1**	V63		129
A little	**2**			
Most of the time	**3**			

37. Does your baby put lots of sounds together that sound like talking?

No	**1**	V64		131
Sometimes	**2**			
Yes	**3**			

38. If you hold **only one** of your baby's hands, can he or she take a few steps?

No	**1**	V65		133
A little	**2**			
Yes	**3**			

39. Can your baby drink (not suck) from a cup?

No/Don't know	**1**	V66		135
A little	**2**			
Yes	**3**			

40. Does your baby look for new things to play with and try to figure out how they work – like busy boxes or squeaking toys?

No	**1**	V67		137
A little	**2**			
Often	**3**			

FORM F (14-16 months) ***follows on the nest page ...***

For Office Use

FORM F (14-16 months)

41. Can your child unwrap food or a toy that has been loosely wrapped?

No	**1**	V68		139
Sometimes	**2**			
Most of the time	**3**			

42. If you hold out your hand and ask your child to give you something, does he or she give you something even if it is not the right thing?

No	**1**	V69		141
Sometimes	**2**			
Most of the time	**3**			

43. If you offer your child something she likes, does she nod or say "yes"?

No	**1**	V70		143
Sometimes	**2**			
Most of the time	**3**			

44. Can your child walk without falling much?

No	**1**	V71		145
Falls a lot	**2**			
Doesn't fall often	**3**			

45. Can your child take off his or her own shoes if you undo the laces or buckles?

No	**1**	V72		147
Sometimes	**2**			
Most of the time	**3**			

46. Does your child watch other children do things and then try to copy them?

No/Don't know	**1**	V73		149
Not very often	**2**			
Often	**3**			

Thank you for your time and co-operation

APPENDIX D: Data sheet of the Rossetti Infant Toddler Language Scale

For Office Use

THE ROSETTI INFANT-TODDLER LANGUAGE SCALE:

A MEASURE OF COMMUNICATION AND INTERACTION

with acknowledgement to Louis Rossetti, East Moline, IL: LinguiSystems, 2006.

Infant code V1 | | | | 1

Please indicate your answer by circling an appropriate number in a shaded box or by writing your answer in the shaded space provided

SECTION A: *0 to 3 months*

1. Interaction-Attachment

	O	E	R			
Maintains brief eye contact during feeding	1	2	3	V2		5
Shows differing responses to caregiver's vocalization	1	2	3	V3		7
Crying diminishes with adult eye contact	1	2	3	V4		9
Smiles purposefully in response to caregiver's face or voice	1	2	3	V5		11
Caregiver appears relaxed and comfortable in handling the child	1	2	3	V6		13
Caregiver smiles frequently while interacting with the child	1	2	3	V7		15

2. Pragmatics

	O	E	R			
Responds to adult interaction	1	2	3	V8		17
Seeks to make eye contact with an adult	1	2	3	V9		19
Laughs at amusing activities	1	2	3	V10		21
Shows interest in people, not objects	1	2	3	V11		23
Cries to get attention	1	2	3	V12		25

3. Gesture

No items at this age level

4. Play

	O	E	R			
Play with rattle	1	2	3	V13		27
Momentarily looks at objects	1	2	3	V14		29
Attempts to imitate facial expressions	1	2	3	V15		31

5. Language Comprehension

	O	E	R			
Quiets to a familiar voice	1	2	3	V16		33
Moves in response to a voice	1	2	3	V17		35
Shows awareness of a speaker	1	2	3	V18		37
Attends to other voices	1	2	3	V19		39
Attends to a speaker's mouth or eyes	1	2	3	V20		41
Discriminates between harsh and soothing voices	1	2	3	V21		43

Item 6 ***follows on the next page ...***

For Office Use

6. Language Expression

	O	E	R			
Vocalizes to caregiver's smile and voice	1	2	3	V22		45
Vocalizes two different sounds	1	2	3	V23		47
Coos	1	2	3	V24		49
Vocalizes sounds other than crying or cooing	1	2	3	V25		51
Produces a hunger cry	1	2	3	V26		53
Repeats a syllable while crying	1	2	3	V27		55
Vocalizes to express pleasure	1	2	3	V28		57
Cries to get attention	1	2	3	V29		59
Makes sounds in the back of the throat	1	2	3	V30		61

SECTION B: ***3 to 6 months***

7. Interaction-Attachment

	O	E	R			
Smiles spontaneously to human contact	1	2	3	V31		63
Smiles when playing alone	1	2	3	V32		65
Smiles at faces of several family members	1	2	3	V33		67
Stop crying when spoken to	1	2	3	V34		69
Shows different responses to family members	1	2	3	V35		71

8. Pragmatics

	O	E	R			
Produces different cries for different reasons	1	2	3	V36		73
Maintains eye contact	1	2	3	V37		75
Vocalizes in response to vocalization	1	2	3	V38		77
Imitates facial expressions	1	2	3	V39		79

9. Gesture

No items at this age level

10. Play

	O	E	R			
Enjoys frolic play	1	2	3	V40		81
Smiles at self in a mirror	1	2	3	V41		83
Reaches for objects	1	2	3	V42		85
Bangs objects in play	1	2	3	V43		87

Item 11 ***follows on the next page ...***

For Office Use

11. Language Comprehension

	O	E	R			
Turns head toward a voice	1	2	3	V44		89
Searches for the speaker	1	2	3	V45		91
Responds to sounds other than voices	1	2	3	V46		93
Recognizes own name	1	2	3	V47		95
Stops crying when spoken to	1	2	3	V48		97
Responds to “no” half of the time	1	2	3	V49		99
Discriminates between threatening and friendly voices	1	2	3	V50		101
Anticipates feeding	1	2	3	V51		103
Cries at an angry tone of voice	1	2	3	V52		105

12. Language Expression

	O	E	R			
Vocalizes in response to singing	1	2	3	V53		107
Vocalizes feelings through intonation	1	2	3	V54		109
Takes turns vocalizing	1	2	3	V55		111
Laughs	1	2	3	V56		113
Babbles	1	2	3	V57		115
Vocalizes to express displeasure	1	2	3	V58		117
Stops babbling when another person vocalizes	1	2	3	V59		119
Initiates “talking”	1	2	3	V60		121
Demonstrates sound play when alone or with others	1	2	3	V61		123
Whines with a manipulative purpose	1	2	3	V62		125
Attempts to interact with an adult	1	2	3	V63		127
Interrupts another person’s vocalizations	1	2	3	V64		129

SECTION C: ***6 to 9 months***

13. Interaction-Attachment

	O	E	R			
Responds to a request to “come here”	1	2	3	V65		131
Becomes more lively with familiar people	1	2	3	V66		133
Shows some initial separation fear	1	2	3	V67		135
Shows a desire to be with people	1	2	3	V68		137

14. Pragmatics

	O	E	R			
Exchanges gestures with an adult	1	2	3	V69		139
Uses gesture and vocalization to protest	1	2	3	V70		141
Shouts or vocalizes to gain attention	1	2	3	V71		143

15. Gesture

No items at this age level

Item 16 ***follows on the next page ...***

For Office Use

16. Play

	O	E	R			
Smiles and laughs during games	1	2	3	V72		145
Participates in games with adults	1	2	3	V73		147
Demonstrates anticipation of play activities	1	2	3	V74		149
Searches for hidden objects	1	2	3	V75		151
Reaches for self in a mirror	1	2	3	V76		153
Interacts with objects without mouthing or banging	1	2	3	V77		155

17. Language Comprehension

	O	E	R			
Recognizes family members' names	1	2	3	V78		157
Responds with gesture to "come up" or "want up?"	1	2	3	V79		159
Attends to music or singing	1	2	3	V80		161
Responds to "no" most of the time	1	2	3	V81		163
Maintains attention to a speaker	1	2	3	V82		165
Responds to sounds when the source is not visible	1	2	3	V83		167
Stops when name is called	1	2	3	V84		169
Attends to pictures	1	2	3	V85		171
Waves in response to "bye-bye"	1	2	3	V86		173

18. Language Expression

	O	E	R			
Vocalizes four different syllables	1	2	3	V87		175
Vocalizes a two-syllable combination	1	2	3	V88		177
Vocalizes in response to objects that move	1	2	3	V89		179
Imitates duplicated syllables	1	2	3	V90		181
Vocalizes during games	1	2	3	V91		183
Sings along with a familiar song	1	2	3	V92		185
Shouts or vocalizes to gain attention	1	2	3	V93		187

SECTION D: ***9 to12 months***

19. Interaction-Attachment

	O	E	R			
Shows sensitivity to others' moods	1	2	3	V94		189
Displays fear of strangers	1	2	3	V95		191
Allows release of contact in new situations	1	2	3	V96		193
Performs for social attention	1	2	3	V97		195

20. Pragmatics

	O	E	R			
Vocalizes to call others	1	2	3	V98		197
Indicates a desire for a change in activities	1	2	3	V99		199
Vocalizes when another person calls	1	2	3	V100		201

Item 21 ***follows on the next page ...***

For Office Use

21. Gesture

	O	E	R			
Covers and uncovers face during “Peek-a-boo”	1	2	3	V101		203
Reaches upward as a request to be picked up	1	2	3	V102		205
Waves “hi” and ”bye”	1	2	3	V103		207
Extends arm to show an object	1	2	3	V104		209
Points to objects to indicate awareness	1	2	3	V105		211

22. Play

	O	E	R			
Participates in speech-routine games	1	2	3	V106		213
Covers face with towel during “Peek-a-boo”	1	2	3	V107		215
Resists removal of a toy	1	2	3	V108		217
Tries to secure an object out of reach	1	2	3	V109		219
Imitates stirring with a spoon	1	2	3	V110		221
Pushes a toy car	1	2	3	V111		223

23. Language Comprehension

	O	E	R			
Attends to new words	1	2	3	V112		225
Gives objects upon verbal request	1	2	3	V113		227
Looks at person saying child’s name	1	2	3	V114		229
Performs a routine activity upon verbal request	1	2	3	V115		231
Looks at familiar objects and people when named	1	2	3	V116		233
Attends to objects mentioned during conversation	1	2	3	V117		235
Follows simple commands occasionally	1	2	3	V118		237
Understands simple questions	1	2	3	V119		239
Gestures in response to verbal requests	1	2	3	V120		241
Verbalizes or vocalizes in response to verbal requests	1	2	3	V121		243
Participates in speech-routines games	1	2	3	V122		245
Identifies two body parts on self	1	2	3	V123		247

24. Language Expression

	O	E	R			
Says “mama” or “dada” meaningfully	1	2	3	V124		249
Imitates consonant and vowel combinations	1	2	3	V125		251
Imitates non-speech sounds	1	2	3	V126		253
Vocalizes with intent frequently	1	2	3	V127		355
Uses a word to call a person	1	2	3	V128		257
Says one to two words spontaneously	1	2	3	V129		259
Vocalizes a desire for a change in activities	1	2	3	V130		261
Imitates the name of familiar objects	1	2	3	V131		263

SECTION E: ***12 to15 months***

25. Interaction-Attachment

Items resume at the 15 – 18 months level

Item 26 ***follows on the next page ...***

For Office Use

26. Pragmatics

	O	E	R			
Imitates other children	1	2	3	V132		265
Responds to other children's vocalizations	1	2	3	V133		267
Initiates turn-taking routine	1	2	3	V134		269
Uses vocalizations more frequently during interactions	1	2	3	V135		271
Uses more words during turn taking	1	2	3	V136		273

27. Gesture

	O	E	R			
Feeds others	1	2	3	V137		275
Combs or brushes hair	1	2	3	V138		277
Brushes teeth	1	2	3	V139		279
Hugs dolls, animals, or people	1	2	3	V140		281
Shakes head "no"	1	2	3	V141		283

28. Play

	O	E	R			
Play fetching game with caregiver	1	2	3	V142		285
Imitates patting a doll	1	2	3	V143		287
Shows shoes or clothing during play	1	2	3	V144		289
Demonstrates functional use of objects	1	2	3	V145		291
Shows symbolic use of objects	1	2	3	V146		293
Explores toys	1	2	3	V147		295

29. Language Comprehension

	O	E	R			
Follows one-step commands during play	1	2	3	V148		297
Responds to requests to say words	1	2	3	V149		299
Maintains attention to pictures	1	2	3	V150		301
Enjoys rhymes and finger plays	1	2	3	V151		303
Responds to "give me" command	1	2	3	V152		305
Points to two action words in pictures	1	2	3	V153		307
Understands some prepositions	1	2	3	V154		309
Understands new words	1	2	3	V155		311
Identifies three body parts on self or a doll	1	2	3	V156		313

30. Language Expression

	O	E	R			
Shakes head "no"	1	2	3	V157		315
Says or imitates eight to ten words spontaneously	1	2	3	V158		317
Names one object frequently	1	2	3	V159		319
Varies pitch when vocalizing	1	2	3	V160		321
Imitates new words spontaneously	1	2	3	V161		323
Combines vocalization and gesture to obtain a desired object	1	2	3	V162		325
Uses true words within jargon-like utterances	1	2	3	V163		327
Produces three animal sounds	1	2	3	V164		329
Wakes with a communicative call	1	2	3	V165		331

Item 30 ***continues on the next page ...***

For Office Use

30. (cont.) Language Expression

	O	E	R			
Sings independently	1	2	3	V166		333
Takes turns vocalizing with children	1	2	3	V167		335
Expresses early developing modifiers	1	2	3	V168		337
Asks to have needs met	1	2	3	V169		339

SECTION F: ***15 to18 months***

31. Interaction-Attachment

	O	E	R			
Plays away from familiar people	1	2	3	V170		341
Requests assistance from an adult	1	2	3	V171		343
Retreats to caregiver when an unfamiliar adult approaches	1	2	3	V172		345

32. Pragmatics

	O	E	R			
Points to, shows, or gives objects	1	2	3	V173		347
Controls the behaviour of self and others	1	2	3	V174		349
Uses words to protest	1	2	3	V175		351

33. Gesture

Items resume at the 18-21 month level

34. Play

	O	E	R			
Plays with a toy in different ways	1	2	3	V176		353
Plays ball with adults	1	2	3	V177		355
Places one object inside another	1	2	3	V178		357
Hands a toy to an adult for assistance	1	2	3	V179		359

35. Language Comprehension

	O	E	R			
Identifies six body parts or clothing items on a doll	1	2	3	V180		361
Finds familiar objects not in sight	1	2	3	V181		363
Completes two requests with one object	1	2	3	V182		365
Chooses two familiar objects upon request	1	2	3	V183		367
Identifies objects by category	1	2	3	V184		369
Understands 50 words	1	2	3	V185		371

Item 36 ***follows on the next page ...***

For Office Use

36. Language Expression

	O	E	R			
Says 15 meaningful words	1	2	3	V186		373
Uses consonant sounds, such as *lt, d, nl* and *lhl*	1	2	3	V187		375
Talks rather than uses gestures	1	2	3	V188		377
Imitates words overheard in conversation	1	2	3	V189		379
Asks “What’s that?’	1	2	3	V190		381
Asks for “more”	1	2	3	V191		383
Names five to seven familiar objects upon request	1	2	3	V192		385

Thank you for your time and co-operation

APPENDIX E: Permission letter from the Tshwane Research Committee

health and social development
Department: Health and Social Development
GAUTENG PROVINCE

Kuyasheshwa! Gauteng Working Better

427 Hilda Street, The Fields Building, Pretoria 0001 South Africa. Tel: +27 12 451 9000 Fax: +27 12 451 9125
Enquiries: Dr. K. E. Letebele-Hartell.
e-mail: Manei.Letebele@gauteng.gov.za

TSHWANE RESEARCH COMMITTEE

CLEARANCE CERTIFICATE

Meeting: 30th January 2013

PROJECT NUMBER: 2013/06

Title: Screening for Developmental delays in at-risk Infants in Primary Healthcare in South Africa for Therapeutic Referral.

Researcher: **Mrs. Jeannie Van Der Linde**
Co-Researcher:
Supervisor:
Department: **University of Pretoria**

DECISION OF THE COMMITTEE

Approved

NB: THIS OFFICE REQUESTED A FULL REPORT ON THE OUTCOME OF THE RESEARCH DONE

Date: 13th February 2013

.....
Dr. K.E Letebele-Hartell
Chairperson Tshwane Research Committee
Tshwane District

.....
Mrs. M Morewane
Director: District Health Services Support
Tshwane District

NOTE: Resubmission of the protocol by researcher(s) is required if there is departure from the protocol procedures as approved by the committee.

APPENDIX F: Permission letter from the Research Ethics Committee, Faculty of Humanities

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Research Ethics Committee

27 November 2012

Dear Prof Kritzinger

Project:	**Developmental surveillance and screening tools for infants in primary health care in South Africa**
Researcher:	**J van der Linde**
Supervisor:	**Prof A Kritzinger**
Department:	**Communication Pathology**
Reference number:	**21060038**

Thank you for your response to the Committee's letter of 30 October 2012.

I have pleasure in informing you that the Research Ethics Committee formally **approved** the above study at an *ad hoc* meeting held on 26 November 2012. Please note that this approval is based on the assumption that the research will be carried out along the lines laid out in the proposal. Should your actual research depart significantly from the proposed research, it will be necessary to apply for a new research approval and ethical clearance.

The Committee requests you to convey this approval to the researcher.

We wish you success with the project.

Sincerely

Prof. Elsabé Taljard
Acting Chair: Research Ethics Committee
Faculty of Humanities
UNIVERSITY OF PRETORIA
e-mail: elsabe.taljard@up.ac.za

APPENDIX G: Permission letter from the Research Ethics Committee, Faculty of Health Sciences

The Research Ethics Committee, Faculty Health Sciences, University of Pretoria complies with ICH-GCP guidelines and has US Federal wide Assurance.

* **FWA** 00002567, Approved dd 22 May 2002 and Expires 20 Oct 2016.
* **IRB** 0000 2235 IORG0001762 Approved dd 13/04/2011 and Expires 13/04/2014.

Universiteit van Pretoria
University of Pretoria

Faculty of Health Sciences Research Ethics Committee
Fakulteit Gesondheidswetenskappe Navorsingsetiekkomitee
DATE: 22/11/2012

NUMBER	**188/2012**
OLD TITLE OF THE PROTOCOL	~~Developmental surveillance and screening tools for infants in primary health care in South Africa~~
NEW TITLE	Screening for developmental delays in at-risk infants in primary health care in South Africa for therapeutic referral
PRINCIPAL INVESTIGATOR	**Student Name & Surname:** Jeannie van der Linde **Dept:** (e.g. Communication Pathology;University of Pretoria. **Cell:** 076 422 6142 **E-Mail:** jeannie.vanderlinde@up.ac.za
SUB INVESTIGATOR	Not Applicable
STUDY COORDINATOR	Jeannie van der Linde
SUPERVISOR	Prof Alta Kritzinger **E-Mail:** alta.kritzinger@up.ac.za jeannie.vanderlinde@up.ac.za
STUDY DEGREE	D. Phil Communication Pathology
SPONSOR COMPANY	Not Applicable
MEETING DATE	31/10/2012

The Protocol and Informed Consent Document were approved on 21/11/2012 by a properly constituted meeting of the Ethics Committee subject to the following conditions:

1. The approval is valid for 3 years period [till the end of December 2015], and
2. The approval is conditional on the receipt of 6 monthly written Progress Reports, and
3. The approval is conditional on the research being conducted as stipulated by the details of the documents submitted to and approved by the Committee. In the event that a need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.

Members of the Research Ethics Committee:

Prof M J Bester	(female)BSc (Chemistry and Biochemistry); BSc (Hons)(Biochemistry); MSc(Biochemistry); PhD (Medical Biochemistry)
Prof R Delport	(female)BA et Scien, B Curationis (Hons) (Intensive care Nursing), M Sc (Physiology), PhD (Medicine), M Ed Computer Assisted Education
Dr NK Likibi	MBBS HM – Representing Gauteng Department of Health) MPH
Dr MP Mathebula	(female)Deputy CEO: Steve Biko Academic Hospital; MBCHB, PDM, HM
Prof A Nienaber	(female) BA(Hons)(Wits); LLB; LLM; LLD(UP); PhD; Dipl.Datametrics(UNISA) – Legal advisor
Mrs MC Nzeku	(female) BSc(NUL); MSc(Biochem)(UCL, UK) – Community representative
Prof L M Ntlhe	MbChB (Natal) FCS (SA)
Snr Sr J Phatoli	(female) BCur(Bet.A); BTec(Oncology Nursing Science) – Nursing representative
Dr R Reynders	MBChB (Pret), FCPaed (CMSA) MRCPCH (Lon) Cert Med. Onc (CMSA)
Dr T Rossouw	(female) MBChB (cum laude); M.Phil (Applied Ethics) (cum laude), MPH (Biostatistics and Epidemiology (cum laude), D.Phil

DR R SOMMERS; MBChB; MMed(Int); MPharmMed.
Deputy Chairperson of the Faculty of Health Sciences Research Ethics Committee, University of Pretoria

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APPENDIX H: Permission letter from Prof JFM Hugo, Head of Family Medicine and COPC initiative

University of Pretoria

DEPT OF FAMILY MEDICINE, UNIVERSITY OF PRETORIA

Tel No: 012 354 2145 Fax No: 012 345 1317 Email: Jannie.hugo@up.ac.za

Prof A Kritzinger
Head
Department of Communication Pathology

Research: Screening for Early Childhood Intervention

I hereby confirm that we discussed the planned project for PhD by Jeannie van der Linde in your department as descibed in your letter dated 25 July 2012. We agreed that we will collaborate and that we will support the study being done in the community sites and clinics in Daspoort and Mamelodi.

JFM Hugo
MB BCh M Fam Med
Professor and Head of Department