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Children with specific language impairment in primary health care – tests, assessment,
prevalence and home activities

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Academic Dissertation

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List of original publications

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Hannus S, Kauppila T & Launonen K (2009) Increasing prevalence of specific language impairment (SLI) in a Finnish town, 1989 – 1999. *International Journal of Language & Communication Disorders*; 44 (1): 79 -97.

Hannus S, Kauppila T & Launonen K (2016) Type and duration of home activities of children with specific language impairment: case control study based on parents' reports. *Child Development Research*; article ID 1709314.

List of abbreviations

APA	American Psychiatric Association
ADHD	Attention-deficit/hyperactivity disorder
ASD	Autism spectrum disorders
DLT	Delayed language development
DSM	Diagnostic and Statistical Manual of Mental Disorders
EBP	Evidence based practice
GDP	Gross domestic product
ICD	International classification of diseases
ICF	International classification of functioning, disability and health
KELA	Kansaneläkelaitos (Social Insurance Institution of Finland)
NIHW	National Institute for Health and Welfare
OSF	Official Statistics of Finland
SLI	Specific language impairment
SLT	Speech and language therapist
WHO	World Health Organisation

Abstract

Developmental language disorders in children are common and constitute a common reason for support in both social and health care and the school system. Of speech and language disorders, specific language impairment (SLI) is diagnosed in Finland in accordance with the ICD (International Classification of Diseases) with either F80.1 or F80.2 diagnoses. The terminology related to SLI is not internationally unambiguous. Studies indicate that SLI may entail more extensive difficulties than those related purely to language. Both international and national studies show that SLI in childhood persists into adulthood.

SLI has been studied very little within the Finnish service system. More information is needed of the prevalence, identification and intervention of SLI in primary health care when trying to develop clinical practices and scaffolding the language development of children in the most efficient way. The present study explored SLI in the primary health care of one Finnish town. The children participating in the study belonged to the multidisciplinary *SLI in Vantaa* study group. *SLI in Vantaa* consisted of all the Finnish speaking children born in 1998 and 1999 who had been diagnosed with the diagnosis F80.1 or F80.2 in the secondary health care, and their matched controls. The present study consists of four sets of data. In the first data set (Study 1), the speech and language therapists (SLTs) assessed the level of confidence in the tests they used for assessing the language skills of 5–8-year-old children, estimated how frequently they used these tests, and specified the language constructs for which they used these tests. In the second data set (Study 2), the test performance of the children diagnosed with SLI was compared to the performance of children without a language impairment diagnosis. The children of these groups were of the same age and same gender, and they were living in the same residential area. The third study (Study 3) analysed the prevalence of the

diagnosed SLI in the SLTs' statistics over a period of eleven years. The fourth study (Study 4) compared the home activities of the children diagnosed with SLI with those of their matched controls. The material used was a parent questionnaire on the children's home activities.

Study 1 comprised 29 SLTs working in the town. Study 2 comprised altogether 83 children, from which 31 peer pairs were formed. The material of Study 3 consisted of the SLTs' annual statistics on the children with diagnosed SLI in secondary health care, who visited the SLTs' clinics during a period of 11 years. Study 4 comprised altogether 78 children, from which 20 peer pairs were formed. Study 1 showed that the SLTs used several tests to assess each construct of a child's language skills. None of the tests had "plenty of confidence" in the opinions of all the SLTs, and no specific test was used "very often" by all of them. A comprehensive test battery which was identified on the basis of the SLTs' answers, consisted of those tests that had statistically significantly more confidence scores and were statistically significantly more frequently used to test a specific construct of language than the average for all the tests. Nevertheless, the quality of the tests included in the test battery varied a lot. Study 2 identified 26 tests for which the test scores differed statistically significantly when comparing the children with SLI and their matched controls. Six tests classified 84.1 per cent of the children correctly into the groups which were evaluated to represent diagnoses F80.1 and F80.2 by the secondary health care. The data of Study 3 indicated that SLI increased statistically significantly during the 11-year follow-up period. Prevalence amounted to 0.69 per cent in the final year of analysis, which is statistically significant. Study 4 found that children with SLI spent time playing outdoors statistically significantly less and used more time for changing activities than the children in the matched group.

The tests that were considered to be the best in separating the children with language impairments from their peers were the same ones that the SLTs had most confidence in and that they most frequently used. On the other hand, the SLTs used some tests to assess also other constructs of language than those for which these tests were originally devised. The prevalence of SLI remained lower than the internationally reported level, even though it did increase during the study period. The low prevalence raised the possibility of under-diagnosing of SLI. When comparing the peer groups in home activities, similarities outnumbered differences. The existing differences seemed to be related to something else than language difficulties. These small observed differences, as well as numerous similarities, require future studies. More precise information about home activities may be needed when interviewing parents and offering them support to enhance their children's language development at home.

The results of the present study suggested that the SLTs seem to have useful methods for the identification of language disorders. However, the results suggested the need for future studies of more consistent use of their tools and developing practices. Organising the future studies in collaboration between the researchers and the clinicians is needed to benefit the children with language disorders in the best possible way.

Tiivistelmä

Lasten kielenkehityksen häiriöt ovat yleinen sekä sosiaali- ja terveydenhuollon että koulujärjestelmän järjestämien tukitoimien syy. Kielenkehityksen häiriöistä kielellinen erityisvaikeus diagnosoidaan Suomessa ICD -luokituksen mukaisesti joko F80.1 tai F80.2 -diagnooseilla. Kielenkehityksen erityisvaikeuden yleisyydestä huolimatta alan terminologia ei ole kansainvälisesti yksiselitteistä. Tutkimusten mukaan kielelliseen erityisvaikeuteen voi liittyä myös laajempia kuin pelkästään kieleen liittyviä vaikeuksia. Kansainvälisissä ja kotimaisissa tutkimuksissa on havaittu, että lapsuuden kielellinen erityisvaikeus vaikuttaa aikuisikään saakka.

Kielellisen erityisvaikeuden tunnistamista ja kuntoutusta on Suomen palvelujärjestelmässä tutkittu toistaiseksi vain vähän. Tutkimustietoa tarvitaan lasten kielihäiriöisyyden esiintyvyydestä, arvioinnista ja kuntoutuksesta perusterveydenhuollossa, jotta voidaan kehittää klinisiä käytänteitä ja tukea kielihäiriöisten lasten kehitystä mahdollisimman vaikuttavalla tavalla. Tässä tutkimuksessa tarkasteltiin kielellistä erityisvaikeutta yhden kaupungin perusterveydenhuollon puheterapeuttien työssä. Tutkimukseen osallistuneet lapset kuuluivat monialaiseen *Kielellinen erityisvaikeus Vantaalla* tutkimusryhmään. *Kielellinen erityisvaikeus Vantaalla* tutkimukseen kuuluivat kaikki suomea äidinkielenään puhuvat vantaalaiset vuosina 1998 ja 1999 syntyneet lapset, jotka olivat erikoissairaanhoidossa saaneet diagnoosin F80.1 tai F80.2 ja heidän verrokkilapsensa. Tutkimus koostui neljästä eri aineistosta. Ensimmäisessä tutkimuksessa (Tutkimus 1) puheterapeutit arvioivat 5 — 8 -vuotiaiden lasten kielellisten taitojen arviointiin käyttämiensä testien luotettavuutta ja käytön useutta sekä sitä, minkä kielellisen osa-alueen arviointiin he testiä käyttivät. Toisessa

tutkimuksessa (Tutkimus 2) kielellinen erityisvaikeus -diagnoosin saaneiden lasten suoriutumista verrattiin saman ikäisten, samaa sukupuolta olevien ja samalla asuinalueella asuvien lasten testisuoriutumiseen. Kolmannessa tutkimuksessa (Tutkimus 3) tarkasteltiin kielellisen erityisvaikeuden esiintyvyyttä puheterapeuttien tilastoissa yhdentoista vuoden seurannan aikana. Neljännessä tutkimuksessa (Tutkimus 4) verrattiin kielellinen erityisvaikeus -diagnoosin saaneiden lasten ja heidän verrokkiansa kotiajankäyttöä viikon ajalta. Aineostona oli vanhempien täyttämä kotiajankäytön seurantalomake.

Tutkimukseen 1 osallistui 29 puheterapeuttia, jotka työskentelivät tarkastelun kohteena olleessa kaupungissa. Tutkimukseen 2 osallistui yhteensä 83 lasta, joista analyysiin saatiin 31 verrokkiparia tiedot. Tutkimuksen 3 aineiston muodostivat puheterapeuttien vuosittaiset tilastot heidän vastaanotollaan 11 vuoden aikana käyneistä lapsista, joilla oli erikoissairaanhoidossa diagnosoitu kielellinen erityisvaikeus. Tutkimukseen 4 osallistui yhteensä 78 lasta, joista analyysiin saatiin 20 verrokkiparia. Tutkimuksessa 1 havaittiin, että puheterapeutit käyttivät useita testejä arvioidessaan lasten kielellisten taitojen kutakin osa-alueita. Mikään testeistä ei ollut kaikkien puheterapeuttien mielestä luotettava, eikä mikään testi ollut kaikkien puheterapeuttien 'hyvin usein' käyttämä. Ne testit, jotka puheterapeutit arvioivat tilastollisesti merkittävästi muita testejä luotettavimmiksi ja joita he käyttivät useimmin tietyn osa-alueen testaamisessa muihin osa-alueisiin verrattuna, muodostivat kattavan testipatteriston. Testipatteriston testien laatu vaihteli kuitenkin paljon. Tutkimus 2 tunnisti 26 testiä, jotka erottelivat tilastollisesti merkitsevästi kielellinen erityisvaikeus -diagnoosin saaneet lapset verrokkilapsista. Kuusi testiä luokitteli 84.1 prosenttia lapsista oikein erikoissairaanhoidossa diagnosoituihin F80.1 ja F80.2 -ryhmiin. Tutkimuksen 3 aineisto osoitti kielellisen erityisvaikeuden lisääntyneen 11 vuoden tarkastelujaksolla tilastollisesti merkitsevästi ja esiintyvyys oli 0.69 prosenttia viimeisenä tarkasteluvuonna.

Tutkimuksen 4 aineistossa tutkimuslapset leikkivät ulkona tilastollisesti merkitsevästi vähemmän kuin verrokkilapset ja tutkimuslasten siirtymävaiheiden määrä oli suurempi.

Ne testit, jotka erottelivat kielihäiriöiset lapset verrokeista parhaiten, olivat pääosin samoja, joihin puheterapeutit luottivat eniten ja joita he käyttivät eniten. Puheterapeutit käyttivät testejä kuitenkin arvioimaan myös muita kielellisiä osa-alueita kuin mihin ne alun perin on tarkoitettu. Kielellisen erityisvaikeuden esiintyvyys jäi kauaksi kansainvälisesti raportoidusta esiintyvyydestä, vaikka se tarkastelujaksolla lisääntyikin. Alhainen esiintyvyys antaa pohdittavaksi kielellisen erityisvaikeuden alidiagnosoinnin mahdollisuuden. Kahden vertaillun lapsiryhmän kotiajankäyttö oli enemmän samanlaista kuin erilaista. Havaitut erot näyttävät liittyvät enemmän toiminnan ohjaamisen vaikeuteen kuin kielelliseen vaikeuteen. Havaittujen pienten erojen yhteyttä kielihäiriöihin on suositeltavaa jatkossa tutkia lisää. Tietoa voidaan käyttää vanhempien haastattelussa ja vanhempien ohjaamisessa siinä, miten he voivat tukea lapsensa kielellistä kehitystä kotona.

Tutkimuksen tulokset viittasivat siihen, että puheterapeuteilla oli hyviä ammatillisia käytänteitä kielihäiriöiden arviointiin. Käytänteiden yhdenmukaistaminen ja niiden kehittäminen on kuitenkin tarpeen. Tutkimukset, joissa yhdistetään sekä tutkijoiden että kliinistä työtä tekevien puheterapeuttien osaaminen saattavat hyödyttää kielihäiriöistä lasta parhaiten.

1 Introduction

In the 1990s, the Finnish speech and language therapists (SLTs) got an impression that the number of children with specific problems in their speech and language development who were directed to speech and language therapy, was increasing. The number of children who were diagnosed as having a specific language impairment (SLI) in the secondary health care seemed to be increasing, too. The observed numbers of the children with SLI seemed to grow from year to year in the primary health care and the organisations were burdened with arranging services for these children. Together with the observation of the possible increase of the prevalence of SLI, the assessment of the language skills of these children and the tests used for assessment gave rise to concern. The SLTs working with children observed that the tests used for the identification of SLI did not seem to be the same among all the SLTs. Furthermore, it seemed that the tests were not used in similar ways by all of them. The SLTs were also worried because the test manuals demonstrated a great variation in their quality and many of them did not include information about the test scores for children with SLI. At the same time, international and Finnish researchers and clinicians started to emphasize the important role of environmental factors in both identification of language disorders and intervening in them. Many factors spoke of the need to develop new and better practices for assessment, identification and intervention of SLI. The basis for the new development was not, however, solid enough because there was only anecdotal information available concerning the assessment and identification of SLI and the variations in them, as well as in estimates of the prevalence of SLI.

The observations mentioned above provided the starting point for the present study. In Finland, the importance of early identification of language disorders had been emphasized

and, for that reason, the service system had been, in principle, well organized. Early identification and accurate assessment had been seen to be the basis for effective intervention. The care path from the child welfare clinics to the SLTs' clinics in the primary health care and from there, in cases of a suspected SLI, to the secondary health care had been well organized. However, there was a need to get information about the present identification of SLI and to establish the level of prevalence. Getting national information about the prevalence of SLI would have made it possible for the clinicians and the researchers to compare the Finnish level of prevalence to the internationally reported prevalence numbers. Furthermore, studying the prevalence of SLI was justified also because of the need for the planning of services and resources. The present study aimed also to promote the practices of the SLTs in choosing tests as well as offering support for parents when they enhance the language development of their children at home.

The present study focused on three main questions concerning the identification of SLI by tests and the SLTs' test use. The first question was what tests the SLTs preferred to use when assessing predefined language constructs. The second question was how confident the SLTs felt about the tests they used. The third question was what tests could discriminate between the language skills of children with and without SLI. The SLTs' confidence in the tests they used had not been studied in Finland but individual SLTs had constantly reported a lack of confidence in the tests available. In primary health care the SLTs' confidence in tests and the decision as to which test is preferred can be a crucial criterion when choosing tests to identify children to be referred to secondary health care.

The present study also focused on environmental factors. In a clinical context interviewing parents is, in addition to test scores, an important part of the assessment of children's language skills. Parents are the specialists in how their children act at home. Parent interviews are done to promote both identification of, and intervention in, language disorder. The collaboration between parents and the SLTs requires information about Finnish children's activities at home and about the possible differences in these activities between children with and without SLI.

In children's development language disorders are common problems and frequent reasons for early intervention, individual speech and language therapy and also special services in schools (Justin 2006). SLI is a term that has been used since the 1980s to describe children who have language disorder without any identifiable reason and whose cognitive skills are within normal limits (Reilly et al. 2014a). Though the discussion of the term SLI has lately suggested changes in the terminology used (APA 2013, Bishop et al. 2016a, Bishop et al. 2016b, Bishop 2014, Conti-Ramsden 2014, Leonard 2014, Reilly et al. 2014a, 2014b, Snowling 2014), in this study the term SLI is used.

SLI has been defined as a condition where difficulties in language acquisition persist over time, and a child with SLI is likely to remain at lower levels of language performance than her or his peers (e.g. Law et al. 2008). Because of the long-lasting effects that SLI may have, early identification of language disorders has been considered crucial (Bryan et al. 2015, Arkkila et al. 2011, Finnish Current Care 2010, Arkkila et al. 2009, Valtonen et al. 2009, Rutter 2008, Law et al. 1998a). Besides the individual effects that SLI may have on a person's later life, it has been suggested that language disorders may mean a loss in economic

potential. It has been calculated that the loss due to unfulfilled language needs is 1.5 per cent of gross domestic product (GDP) in the UK and 1.6 per cent to 1.9 per cent of GDP in the US (Sauerland 2016, Law et al. 2012, Ruben 2000). Therefore, the need for national studies is obvious: early identification of language disorders, their effective measures and methods of intervention will increase the efficiency of the offered support to children and their families when pursuing healthy development.

Health has been defined in the World Health Organisation's (WHO) Constitution as '*a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity*' (Constitution of the World Health Organization, WHO 1948). The definition has not been amended since 1948. The WHO emphasizes that healthy development is of basic importance to the child and the ability to live harmoniously in a changing environment is essential to such development. The extension of the benefits of medical, psychological and related knowledge to all people is essential to the fullest attainment of health. This framework of health directs authorities in different countries as the governments have a responsibility for the health of their peoples which can be fulfilled only by the provision of adequate health and social measures. In Finland, the state's responsibility to promote welfare, health and security is rooted in the Constitution (<http://www.finlex.fi/fi/laki/ajantasa/1999/19990731>). The public authorities that work with children and families should support parents and custodians in the child's upbringing and endeavour to provide families with the necessary assistance at a sufficiently early stage.

Planning healthy development in children includes screening their developmental milestones. Special services, examinations and therapies for children in the municipality aim at improving

their ability to function and the responsibility for organising them belongs to the primary health care (e.g. Finlex §15/2010, §29/2010). Finland has a community based public health care policy and practice, which guarantees that all children have an annual follow-up on their development (Ministry of Social Affairs and Health 2004). This is done by child welfare clinics. There the possible developmental delays and support for enhancing the development are identified by screening. Child welfare nurses can use screening tools which the National Institute for Health and Welfare (NIHW) have instructed to be used for screening the children's skills in different areas of development. If the screening gives cause to concern, children are referred for further assessments or intervention. In Finland, the NIHW estimates that more than 99 per cent of all children come to their annual child welfare clinics follow-up visits

(https://www.thl.fi/fi/web/lapset-nuoret-ja-perheet/peruspalvelut/aitiys_ja_lastenneuvola/lastenneuvola). In cases where a delay in language development has been observed or suspected, the SLTs carry out more precise assessments. This means that the early evaluation, assessment, intervention planning, and, in most cases, the intervention itself of children with language disorders are carried out in the primary health care. In cases of a suspected SLI the Finnish public services are organised according to the severity of a language disorder. Joint municipal authorities for hospital districts are responsible for coordinating the specialised medical care services with the needs of the population and, also, the requirements of the primary health care. Assessment of language skills in the primary health care forms the basis of these services and establishing the possible diagnosis of SLI takes place in the secondary health care. According to the Finnish legislation, the care paths, including the care path of suspected SLI, should be identical in the primary health care of all municipalities. So the findings of studies about services in one municipality should be reasonably generalizable in Finland and, therefore, feasible in developing new practices nationwide.

2 Review of the literature

2.1 Nature and nurture

People behave as they do according to their genetic predispositions and because they are taught to do so. This nature and nurture correlation has interested scientist for a long time and they have tried to figure out how much of a person's character and behaviour is shaped by the genes and how much by the environment. Fast-growing understanding of the human genome has made it clear that both nature and nurture are important in developmental language disorders (e.g. Rice 2012, Bishop 2009, Grigorenko 2009). Nature endows a new-born baby with abilities and features; nurture takes these genetic tendencies and moulds them as we learn and mature. Our confidence in intervention is based on the possible merits that the support in the environment for the language learning may accomplish (e.g. Allen & Marshall 2010, Buschmann et al. 2009).

Studies have suggested that developmental language disorders have a strong genetic basis and many attempts have been made to verify this genetic basis, the nature, of language disorders (Rice 2012, Grigorenko 2009, Bishop 2009). However, language disorders are complex and the genetic mechanisms involved are also complex (Rice 2012). Instead of specific genes acting on their own, it is more likely that many genes form networks that are recruited in the process of language acquisition (Grigorenko 2009). A possible benefit of knowing the genetic influence would be the early identification of a risk for language disorder (Bishop 2009). Myers (2013) commented that '*genes don't respect our diagnostic classification boundaries*',

suggesting that current classification systems are being called into question as we learn more about the genetic and neurological bases of neurodevelopmental disorders.

Language develops in the environment where the language is used. Since its publication in 1979, the Ecological systems theory by Bronfenbrenner has had a widespread influence on studies of human beings and their environments (e.g. Hildén et al. 2001, Määttä 2001). The theory identifies four environmental systems with which an individual interacts: micro-, meso-, exo- and macrosystems (Bronfenbrenner 1979). The microsystems include the everyday environments the child lives in, that usually consist of family or other caregivers and school or day-care. How these groups or organisations interact with the child will have an effect on how the child grows and develops; the more encouraging and nurturing these relationships and places are, the better the child will be able to grow (Launonen 2008). Specific genetic and biologically influenced personality traits of each child, which are known as temperament, end up affecting how others treat her or him (Launonen 2008, Bishop 2009). The mesosystem is formed of the everyday environments, the microsystems of the child. The exosystem includes people and places that have a strong effect on the child without direct interaction, such as the parents' workplaces. The macrosystem includes cultural values, the economy, service systems such as health care and education and the relative freedoms permitted by the national government and these, too, have a great influence over the child. The Ecological systems theory and other ecological approaches have turned the child language intervention towards collaboration with parents and have also increased the development of interventions where parents make changes in their communicative behaviour to enhance their child's language development in a beneficial manner (Allen & Marshall 2010, Baxendale & Hesketh 2003, Määttä 2001). Thus, effective intervention strategies call for more information of families' behaviour and children's activities at home.

2.2 Terminology and criteria for child language disorders

2.2.1 Classification of diseases

When clinicians make definitions of disorders they intend to classify an individual's symptoms to a particular category, distinct from others and informative with respect to aetiology, treatment and prognosis (e.g. Finnish Current Care 2010, Pickles & Angold 2003). In the cases of developmental disorders, where the underlying aetiological mechanisms, nature of variability and developmental course of symptoms are diverse, the process of diagnosis can become one of 'carving nature at the joints' (Pickles & Angold 2003). This variability and diversity applies also to language development, including also the situation where language is assessed, and may have influenced on the long-lasting discussions of researchers of the terminology of SLI. It has been estimated that language development is delayed in 20 per cent of children (Qvarnström ja Leppäsaari 2002, Rantala ym. 2004). The challenge for the clinicians, SLTs and physicians, is to distinguish the symptoms of delayed language disorders (DLD) from those of specific language impairment (SLI), and, also, from the variations in the typical language development.

Recently, Reilly and associates (2014a) have made a historical overview of the terminology of child language disorders. They conclude that the descriptions of language disorders have been influenced by different professional groups and their theoretical perspectives (Reilly et al. 2014a). The evolving health and education systems and the methodological approaches were applied to understand child language disorders. In child language disorders, the relevant professional groups can be loosely separated into the disciplines of medicine, linguistics,

speech pathology and developmental psychology. One of the earliest references to child language disorders that Reilly and associates (2014a) found was in 1822 when Gall, a physician, described children who had specific problems with language in the absence of other conditions. Many case reports and descriptions followed, drawing attention to a group of children with language disorders in the presence of apparently normal non-verbal intelligence. These observations predate the use of formal tests for verbal or non-verbal abilities. The early descriptions of child language disorders were made by physicians with an interest in language development as a symptom. The early terminology focused primarily on children whose expressive language output was severely restricted and included ‘congenital aphasia’. Language subgroups were gradually recognized, as was the differentiation between expressive and receptive skills. In the early 1900s the use of different terms reflected a growing awareness that language difficulties were not confined to production. A prevailing view emerged that language difficulties were neurological in origin, and terms such as ‘developmental aphasia’ and ‘developmental dysphasia’ were adopted from adult pathologies. In the latter half of the 20th century psycholinguistic and nativist theories of language acquisition posited modular cognitive architectures wherein the language acquisition process was considered to be entirely separable from other aspects of development (Reilly et al. 2014a).

The identification of language disorders relies on understanding the deviation from normal as indicated by signs, symptoms and results from tests. Whilst a diagnosis does not always imply that one has absolute certainty about correctness, it should carry the explicit probability. The challenge of diagnosis rests then on the recognition and identification of specific signs and symptoms. Because SLI affects a child’s functional, social and communication capacity, interviewing the parents about the child’s communication abilities and assessment of the

language skills with tests are both needed (Finnish Current Care 2010). Regarding SLI, there is no recognized ‘*golden standard*’ in diagnostics that could be applied though there are some suggestions (e.g. Bortolini et al. 2006, Stokes et al. 2006, Conti-Ramsden et al. 2003, Savinainen-Makkonen 2000).

In Finland, the professionals who diagnose SLI are physicians, and the international classification of diseases (ICD) is used as a base in the diagnostics (WHO. <http://www.who.int/classifications/icd/en/>). An important part of establishing the diagnosis is excluding symptoms of other diseases and including symptoms of the diagnosis (Finnish Current Care 2010). To enable discussions between all professionals who assess a child, the framework of the ICD guides the specialists other than physicians, too. In the ICD-10 manual the section ‘*Disorders of psychological development*’ includes specific developmental disorders of speech and language. The section specifies:

F 80.0 Specific speech articulation disorder is a specific developmental disorder in which the child's use of speech sounds is below the appropriate level for its mental age, but in which there is a normal level of language skills.

F80.1 Expressive language disorder is a specific developmental disorder in which the child's ability to use expressive spoken language is markedly below the appropriate level for its mental age, but in which language comprehension is within normal limits. There may or may not be abnormalities in articulation.

F80.2 Receptive language disorder is a specific developmental disorder in which the child's understanding of language is below the appropriate level for its mental age. In virtually all cases expressive language will also be markedly affected and abnormalities in word-sound production are common.

The Finnish national guideline has specified the use of ICD-10 classification. According to the Finnish Current Care (Käypä hoito, 2010) guidelines “specific language impairment (SLI) affects a child's functional, social and communication capacity. The associated language comprehension problems may be difficult to recognise in everyday life. Although the diagnosis of SLI is most reliable after four years of age, early support must be provided as soon as there is any suspicion of SLI. Diagnosis, rehabilitation and other therapeutic manoeuvres are based on multiprofessional co-operation. Key factors in achieving a favourable prognosis are (1) adequate and early support for language learning and daily participation, (2) adequate and timely rehabilitation and (3) paying attention to problems associated with SLI in school.“

In international discussions and studies of SLI the definition of the language disorder or the diagnosis is rarely made by using the terms of ICD. This compromises the comparison of different studies and, also, the definition of the SLI disorder (Bishop et al. 2016a, Finnish Current Care 2010, Law et al. 1998a, Law et al. 1998b).

International classification of functioning, disability and health (ICF) provides a basis for describing, understanding and studying health and health-related states, outcomes and determinants (WHO 2001). The health and health related states associated with any health

condition can be described using ICF. Primarily, health conditions are classified in the ICD which provides an aetiological framework. The ICF and ICD are two complementary WHO reference classifications and both are members of the WHO Family of International Classifications. The ICF describes the associated functioning dimensions in multiple perspectives at body, person and social levels. A health condition – whether diagnosed or not – is always understood to be present when ICF is applied. In classifying functioning and disability, there is no explicit or implicit distinction between different health conditions. By shifting the focus from health condition to functioning, the ICF places all health conditions on an equal footing, allowing them to be compared, in terms of their related functioning, via a common framework (WHO 2001).

In Finland, the National Institute of Health and Welfare (NIHW) maintains and publishes the core sets of disorders in Finnish. Disorders in language development have not been taken into the core sets in the Finnish version of ICF (<https://www.thl.fi/en/web/toimintakyky/icf-luokitus/icf-kuuluu-who-n-luokitusperheeseen>, loaded 30.9.15). However, in international discussions, it is suggested that the framework of ICF should be used also in the field of language disorders. ICF offers a vision of language disorders that is a complex network including the body, individual and societal factors (Dempsey & Skarakis-Doyle 2010). Using the ICF framework requires a broader overview than that provided in the ICD –system on language impairment and connects linguistic processes and the use of language in daily environment and the effect that their interaction has on the child’s functioning, thus offering us a more holistic view (Dempsey & Skarakis-Doyle 2010). The framework of ICF is also included in the Finnish Current Care of SLI (Finnish Current Care 2010).

In addition to the above-mentioned classifications, the Diagnostic and Statistical Manual of Mental Disorders (DSM, Diagnostic Classification, <http://dx.doi.org/10.1176/appi.books.9780890425596.x00DiagnosticClassification>) is also used in the international studies of language disorders. The new version, DSM-5, was published in 2013 (American Psychiatric Association, APA 2013) and it specifies communication disorders in the chapter '*Neurodevelopmental disorders*'. The DSM-5 specifies that disorders are typically manifested early in the development, often before the child enters school, and are characterized by developmental deficits that produce impairments of personal, social, academic, or occupational functioning. The range of developmental deficits varies from very specific limitations of learning or control of executive functions to global impairments of social skills or intelligence. According to the DSM-5 the neurodevelopmental disorders frequently co-occur. For example, individuals with autism spectrum disorder often have an intellectual disability, and many children with attention-deficit/hyperactivity disorder (ADHD) also have a specific learning disorder. The communication disorders include language disorder, speech-sound disorder, social communication disorder, and childhood-onset fluency disorder. The first three disorders are characterized by deficits in the development and use of language, speech, and social communication, respectively. Like other neurodevelopmental disorders, communication disorders begin early in life and may produce lifelong functional impairments. The DSM does not specify language disorders in the same way as the ICD. The disorders included in DSM-5 have been reordered into a revised organizational structure meant to stimulate new clinical perspectives. This new structure corresponds to the organizational arrangement of disorders planned for ICD-11. Nevertheless, in Finland physicians use the International Classification of Diseases (ICD) when diagnosing language problems of children and the services of the children with SLI depend on the diagnosis.

2.2.2 Challenges of diagnosing

Getting a correct diagnosis and identifying comorbidities in developmental language disorders of children are commonly considered to be important. Developmental disorders are age related and rely on understanding deviation from normal assessed by symptoms or test results (e.g. Reilly et al. 2014a, Law et al. 1998a). These symptoms and test results need to be classified appropriately including one diagnosis and excluding others. In neurodevelopmental disorders, the tools available for determining a diagnosis are not equivalent and may be broadly divided into three categories based upon the diagnostic processes applied (Reilly et al. 2014). The first and most easily classified category includes syndromic conditions with a known aetiology and, hence, a biological diagnostic test (e.g. Williams and Fragile X syndrome) (Reilly et al. 2014a). The two other categories require assessment of behaviour and skills. The category of non-syndromic conditions with no known aetiology, but which are diagnosed through objective testing (e.g. SLI, reading disorder) and the category of non-syndromic conditions diagnosed by using subjective rating scales or clinical judgments (e.g. ADHD, autistic spectrum conditions) (Reilly et al. 2014a) may include also symptoms of each other.

During the first years of life children acquire basic communicative and motor skills at an impressive speed. This early development is characterised by a wide variability. It has been argued that some motor skills are a prerequisite for language development (Iverson 2010). Difficulties in language and motor development may not be symptoms of separate disorders, rather they may be different manifestations of a common underlying neurodevelopmental

weakness (Wang et al. 2012). However, there also seem to be specific developmental pathways for each domain. Besides theoretical interest, more knowledge about the relationship between these early skills could shed light upon early intervention strategies and preventive efforts commonly used with children with problems in these areas (Iverson 2010, Wang et al. 2012). The findings suggest that the relationship between language and motor skills is not likely to be simple and directional but rather to be complex and multifaceted (Wang et al. 2012, Iverson & Braddock 2011, Cheng et al. 2009). Identification of all the developmental difficulties, including language and motor skills, is also important when planning the intervention. For identification of these skills we need more information about children's activities at home, too.

The co-occurrence and severity of developmental problems increases the probability that they will persevere (e.g. Valtonen et al. 2007). According to a Finnish study by Valtonen and associates (2007) at the age of four no single developmental factor could reliably predict a child's developmental status at age six. However, the development of all assessed skills at age four reliably predicted 78 per cent of the variance of developmental outcome at age six. For the most part, the results indicated that it is possible to recognise developmental problems at age four (Valtonen et al. 2007). In cases where family history indicates a higher level of risk, information on early motor development could be valuable for screening those children at risk of slower language development even before the production of speech (Viholainen et al. 2006). The follow up of the motor development of infants is recommended because it is a cost-effective strategy for public health services (Viholainen et al. 2006). Early delay in motor development may also be associated with a delay in language development (Viholainen et al. 2006). Finlay and McPhillips (2013) found in their study a comorbidity of language and motor disorders and their results suggest that children with clinically diagnosed SLI are likely

to exhibit other developmental deficits too. It has also been suggested that clinicians should be aware that about one third of children with SLI can also be diagnosed with developmental coordination disorder (Flapper & Schoemaker 2013). In Finland, the multidisciplinary assessment is done in the primary health care before the diagnosis of SLI in the secondary health care. This is supposed to guarantee a comprehensive assessment of all the child's skills. Anecdotal information from the SLTs requires additional information about the children with SLI in Finland including the behaviour and the activities at home.

At later ages, language problems may have a co-occurrence with other neurodevelopmental disorders, for example attention deficit hyperactivity disorder (ADHD) and autism spectrum disorders (ASD) (e.g. Bishop 2014, Reilly et al. 2014a). ADHD is a common neurodevelopmental disorder, its worldwide prevalence estimation being the same as with SLI (Green et al. 2014). ADHD is characterized by persistent inattention, impulsiveness and/or hyperactivity that is inappropriate for age and occurs in a range of settings. Children with features of ADHD commonly have pragmatic language difficulties (Green et al. 2014). These difficulties are consistent with deficits in executive functioning that are thought to characterize ADHD, providing some support for the theory that executive functioning contributes to pragmatic language competency (Green et al. 2014). Thus, pragmatic language difficulties of children may be a sign of problems in executive functioning. The relationship between SLI and ASD and emotional/behavioural disorders has intrigued researchers and the overlap between these disorders has been recognised (Bishop 2014, Reilly et al. 2014a, Pinborough-Zimmerman et al. 2007). So far, it seems that these phenomena emerge from complex neurodevelopmental systems and use the same etiological pathways which affect each other (Reilly et al. 2014a, Pinborough-Zimmerman et al. 2007). Careful assessment and accurate diagnosis form the basis of diagnosis, intervention and, also, the basis of the

economic support for families (e.g. Law et al. 2012, Finnish Current Care 2010). The magnitude of the economic support from Social Insurance Institution of Finland (Kansaneläkelaitos Kela) for families who have children with SLI has been based also on the assessment of everyday extra troubles, difficulties in all daily living and overall burden caused by the delay in the child's development.

2.2.3 Terminology

Terminology in the field of child language disorder studies can be considered confusing in many ways. Bishop (2014) made a review of the literature using Google Scholar and found 130 possible combinations that used a certain prefix, descriptor and noun when specifying language problems. The confusion of the terminology is fundamental as the terms *speech*, *language* and *communication* are used separately or combined or even overlap (Bishop 2014). The use of acronyms, very common in the literature in the field, confuses the terminology even more. Bishop (2014) argued that from the view point other than that of an English-speaking clinician, the acronyms should not be used if they have different meanings in different countries. In addition, following the international demands, the terminology has been changing in different countries. In Finland the terms dysphasia (*dysphasia*), or developmental dysphasia (*kehityksellinen dysphasia*) were replaced with the term “*Kielellinen erityisvaikeus*” (SLI) in 2010 (Finnish Current Care 2010). In French speaking countries the term dysphasia is still used (Beauregard 2011). Furthermore, terminology may vary between different professional settings, e.g. the UK academic settings favour the term SLI which is not used in clinical and educational settings (Bishop 2014).

Obviously, developmental language disorders are troublesome to define. Therefore, the international debate about the terminology was started in 2014 (Baird 2014, Bellair et al. 2014, Bishop 2014, Clark & Carter 2014, Conti-Ramsden 2014, Dockrell and Lindsay 2014, Gallagher 2014, Grist and Hartshorne 2014, Hansson et al. 2014, Hüneke & Lascelles 2014, Lauchlan & Boyle 2014, Leonard 2014, Norbury 2014, Parsons et al. 2014, Reilly et al. 2014a, Reilly et al 2014b, Rice 2014, Rutter 2014, Snowling 2014, Strudwick & Bauer 2014, Whitehouse 2014, Taylor 2014, Wright 2014). Lately, international discussions have supported the decision to exclude the term SLI from DSM-5 (APA 2013) and have concluded that the term has been a convenient label for researchers, but that the current classification is unacceptably arbitrary (Reilly et al. 2014). Furthermore, it has been argued that there is no empirical evidence to support the continued use of the term SLI and there is also limited evidence that it has provided any real benefits for children and their families (Clark & Carter 2014, Hüneke & Lascelles 2014). In fact, the term may be disadvantageous to some due to the use of exclusionary criteria to determine eligibility for and access to speech and language therapy services. Suggestions have been made to remove the word '*specific*' and to use the label '*language impairment*' (e.g. Bishop et al. 2016b, Bishop 2014, Conti-Ramsden 2014, Leonard 2014, Reilly et al 2014b, Snowling 2014). In addition, in discussions about the terminology the researchers have suggested that the exclusionary criteria should be relaxed and be replaced with inclusionary criteria. Inclusionary criteria are supposed to take into account the fluid nature of language development, particularly in the pre-school period when developmental milestones in language acquisition are reached one after another. The fluctuation of the terminology is still going on.

To build on the goodwill and collaborations between the clinical and research communities, the establishment of an international consensus panel has been proposed (Bishop 2014, Conti-

Ramsden 2014, Leonard 2014). The challenge for this international panel is to develop an agreed definition and set of criteria for language disorders and, also, to specify the language constructs to be assessed and the tests to be used. Given the data now available in population studies, at least in languages with large populations, it is possible to test the validity of these definitions and criteria. An additional requirement is the consultation with service users and policy-makers that should be incorporated into the decision-making process (Reilly et al. 2014b). Until now the term '*language disorder*' has been preferred to be used with a language profile that causes daily functional difficulties and is associated with a poor prognosis (Bishop et al. 2016b). The present study of the primary health care in Finland uses the term specific language impairment, SLI, because in Finland the term is still in clinical use in health care.

2.3 Child language assessment

2.3.1 Early screening

Early identification and a possibility of early intervention for children with a suspected or diagnosed SLI follows the spirit of the WHO's definition of health. These are the current practices in Finnish child health care, too (Finnish Current Care 2010). Children's ages and developmental stages should be considered when assessing their language skills. Early screening has been found to be crucial, but it is confusing that a symptom like delayed speech occurs in cases with a later severe language disorder and, also, in cases with a later normal language development (e.g. Bishop et al. 2016b, Reilly et al. 2010). The phenomenon of language acquisition is complicated and there are many reasons why early screening has intrigued both clinicians and researchers. Children's language development delays or disorders are common. Early identification and intervention have been seen as useful and the necessity to distinguish persistent language disorder from that of a transient one has also been

seen to be crucial (Kasper et al. 2011, Sachse & Von Suchodoletz 2008, van Agt et al. 2007, Law et al. 2003, Law et al. 2000). So far, the benefit of population based screening of SLI with a single test has not proven to be possible (Kasper et al. 2011, Klee 2007). The focus in the screening of language skills is on finding a deviation or delay from a normal developmental curve, but not identifying SLI. It has been noted that parental support and education, as well as education of professionals who regularly have contact with young children, is necessary and promotes appropriate early identification of communication problems (Skeat et al. 2010).

In Finland, a current practice is that developmental difficulties are screened in child welfare clinics by health nurses (NHWS, https://www.thl.fi/fi/web/lapset-nuoret-ja-perheet/peruspalvelut/aitiys_ja_lastenneuvola/lastenneuvola). The age-related developmental screening is made at least once a year, and almost all children and their families use these services (https://www.thl.fi/fi/web/lapset-nuoret-ja-perheet/peruspalvelut/aitiys_ja_lastenneuvola/lastenneuvola). In 2013 there were more than one million visits to child welfare units in Finland (https://www2.thl.fi/avohilmo_report). The Ministry of Social Affairs and Health is responsible for guiding the consistent operations of child welfare clinics in Finland. Nurses in child welfare clinics try to identify problems affecting families with small children at an early stage and to arrange for appropriate help. Multidisciplinary collaboration between professionals working with families is seen to be essential. The health care nurses in child welfare clinics use a standard screening tool, The Lene screening method (Valtonen et al. 2007) which has been examined in relation to Finnish culture and has been accepted for national use for children aged 2.5 years to 6 years (Valtonen et al. 2007, Terveyden ja hyvinvoinnin laitos. <https://www.thl.fi/fi/web/lastennevolakasikirja/ohjeet-ja->

[tukimateriaali/menetelmat/neurologis-kognitiivinen-kehitys/lene](#)). If a delay or a risk of language disorder is found, more precise guidelines define whether a further assessment, for example in a SLT's clinic, is needed.

2.3.2 Assessment in the SLTs' clinics

If the screening indicates a risk to the child's language development a referral to a SLT is made. When assessing children's language skills and their development the SLTs use observation, parent interview and language test assessment. With these tools the SLTs aim at recognising the strengths and weaknesses in a child's language skills. Due to differences between languages and also, between cultures, the SLTs in a country can use only those assessment tools that have norms or standards in a language used in the country (McLeod & Verdon 2014, Betz et al. 2013, Slott et al. 2008, Huttunen et al. 2008). The assessment of language abilities includes a variety of language constructs. In all cases active and passive language skills require assessment. In clinical use tests evaluate at least the size and quality of vocabulary, phonological skills, comprehension of words and sentences, the most important morphological structures, auditory memory and, also, speech motor abilities (Huttunen et al. 2008). Because several language constructs should be assessed there is a need either for many tests or an omnibus test (Betz et al. 2013). In Finland, a test covering all the most important language constructs is not available and the SLTs also use tests from an unofficial selection (Huttunen et al. 2008). Language specific tests and the varying number of them in different countries (Pring et al. 2012, Joffe & Pring 2008, Slott et al. 2008, Skahan et al. 2007) may imply that the criteria for the diagnosis of SLI differs between studies and obviously the quality of clinical diagnostics varies (e.g. Kasper et al. 2011, McLeod et al. 2010, Boyle et a.

2007, Clegg et al. 2005). The lack of a ‘*golden standard*’ for SLI may explain the large number of tests in clinical use and vice versa.

It is commonly assumed that children with language disorders can be identified because they will obtain lower scores in language tests. However, clinicians and researchers appear to use somewhat more relaxed criteria for cut-off scores in one or more language tests (e.g. Spaulding et al. 2006). These relaxed criteria for cut-off scores and low score assumption indicate that SLI can be understood as the low end of the normal continuum (e.g. Leonard 1991). The use of tests is challenging in many ways. To consider the extent to which the child in question is similar to or different from the sample from which the data of the test were derived, a clinician may need to adjust the confidence level of the test appropriately. This consideration of both the interpretation of the test data and the confidence in the interpretation reflects the probabilistic nature of diagnostics. Test results can only indicate the likelihood, rather than the certainty, that a disorder is present. Also, a simplified review of the critical information in test manuals (e.g., sensitivity and specificity data, mean group differences) may justify the interpretations that a clinician makes. A simple review of the currently available evidence can greatly improve the clinician’s certainty in this clinical determination (Spaulding et al. 2006, Eadie 2004). In the beginning of the 21st century in Finland information about the sensitivity or the specificity of each test was not easily, or not at all, available in the test manuals.

Psychometric tests play an important role in the identification of children with language disorders. They allow the clinicians to observe aspects of language functioning in a standardized setting, and to relate performance to normative data. The criteria for SLI

(DAPA, World Health Organization) emphasize the need for diagnosis to be based on standardised individually administered measures of both receptive and expressive language. However, the cut-off in many tests has been found to be arbitrary and un-validated (e.g. Spaulding et al. 2006, Eadie 2004). There is no specification as to which language test or tests should be used to assess different language constructs, despite the fact that there can be variation in the sensitivity of tests to language disorder (e.g. Spaulding et al. 2006, Eadie 2004). Non-word repetition, verb morphology and auditory processing have been among the suggested '*clinical markers*' of SLI (Kunnari et al. 2011, Stokes et al. 2006, Conti-Ramsden 2003). Because of possible cultural and language specific features the tests assessing these suggested clinical markers should be validated in each language, thus reducing the problems of translation from one language to another.

In addition to assessment with tests, parents' interview is seen to be an essential part of the evaluation of children's language disorders and especially their severity (Bishop & McDonald 2009). There seems to be a strong agreement between language test scores and parental reports (Bishop & McDonald 2009). When a consistent checklist has been used in interviewing the parents, their ratings have been as effective as the teachers' observations or standardised tests in identifying children at risk of language disorder (Bishop & McDonald 2009). Parents' observations are also valued because the parents can describe the functioning of their child in environments where testing cannot be carried out. Interviewing parents and using their reports is in accordance with the framework of ICF. It has been suggested that the assessment with tests and the information from parental reports should be incorporated in diagnostic criteria (Bishop & McDonald 2009). As discussed above international studies indicate that the assessment of the child's language skills is complicated. Much more

information is needed regarding test use among SLT's clinics, from different aspects and in different countries using different languages, for example Finnish in Finland.

According to the Finnish current care of SLI (Finnish Current Care 2010) no single test has enough reliability to be used as the only test to distinguish children with SLI from children without SLI. In Finland, a physician has the responsibility to determine the diagnosis of SLI and to coordinate the intervention based on a multidisciplinary assessment. The Finnish Current Care lists ten tests that the SLTs mostly use when assessing SLI (Table 1). However, the Finnish Current Care does not specify the standard deviations used for the diagnosing.

Table 1. Tests and their original and Finnish developers/translators listed in the Finnish Current Care.

Test	Finnish version: developer/translater and year	International version: developer and year
Reynell Developmental Language Scales III	Kortesmaa et al. 2001	Edwards et al. 1997
ITPA (Illinois Test of Psychometric Abilities)	Kuusinen & Blåfield. 1974	Kirk et al. 1968
Sananlöytämistesti (Test of Word Finding)	Tuovinen et al. 2007	German 1989
Lausetesti	Korpilahti 1996	
Bostonin nimentätesti (Boston Naming Test)	Laine et al. 1997	Kaplan et al. 1976
Nopean sarjallisen nimeämisen testi	Ahonen et al. 1999	

(Test for Rapid Serial Naming)		
Lene - Leikki-ikäisen lapsen neurologinen arvio	Valtonen et al. 2003	
Boehmin peruskäsitteetesti (Boehm Test of Basic Concepts)	Heimo 1993	Boehm 1986
Token	Two master's thesis in Finnish: Kyheröinen 1985 and Posti 1999	DiSimoni 1978
Morfologiatesti	Lyytinen 1988	

Eight of these tests are the same as presented in the study of the language tests used by Finnish SLTs (Huttunen et al. 2008). However, Huttunen and associates (2008) found that 95 per cent of their respondents also used established, widely-used assessment methods that had not been revalidated in Finnish. This result may indicate that the repertoire of standardised tests in Finnish is not extensive enough to fulfil the demands of a comprehensive assessment of a child's language. However, there is no information about how much confidence the SLTs have in these tests and other assessment tools that have not been standardised in Finnish.

Best practices in testing and consistent test use have intrigued clinicians, and some international guidelines have been created (e.g. International Test Commission). Also, the use of valid and reliable clinical tools when assessing language skills has been highlighted as a goal of the evidence based practice (EBP) (Spek et al. 2013, McCurtin and Roddam 2012, Klee 2008). However, only a few surveys have compared the SLTs' assessment tools' use between different countries. According to the findings of the studies from the US (Skahan et al. 2007) and from the UK (Pring et al. 2012, Joffe and Pring 2008) the SLTs used similar profiles of assessment, but the tests used most in each country differed so much that there was

no overlap in assessment even between these two English speaking countries. In studies from Denmark (Slott et al. 2008) and Finland (Huttunen et al. 2008), countries with different languages, the same number of tests was available to assess children's language skills. In practice, a large number of tests may be useful but not necessary to achieve best practices in the field of child language assessment. Though the SLTs have expressed discontent with the tests, their confidence in the tests has not been studied comprehensively. More information is needed about the possible connections between the number of tests, qualities of these tests and the SLTs' confidence in these tests. This knowledge may have beneficial consequences to clinical practises in form of, for example, more fluent practices and reduced number of visits to the clinics of the SLTs.

2.3.3 Evaluation of the severity of SLI

It is commonly accepted that a delay in language development is very common (e.g. Law et al. 1998a). The distinction between a delayed development (late talker) and a developmental disorder is not, however, always definite and identifying the risk factors and comorbidity calls for multidisciplinary expertise in child language (Kasper et al. 2011, Finnish Current Care 2010, Rutter 2008, Sachse & Von Suchodoletz 2008, van Agt et al. 2007, Law et al. 2003, Law et al. 2000). Four key milestones have been suggested as being relevant in the differentiation of normal variation and SLI and these can be used also in the follow-up visits in child welfare clinics: late onset of first words, late talker at the age of three years, does not catch up the language delay by the age of five years and receptive difficulties (Rutter 2008). Rutter (2008) also draws three conclusions. The first conclusion is that SLI persists for a long time beyond the normal age of language acquisition and it varies a lot. The second conclusion is that most late talkers do catch up by about the age of five years, thereafter showing normal

development. Thirdly, there is probably no entirely sharp categorical distinction between SLI and normal variation and those who catch up may have a mild SLI. Finnish current care recommends intervention as early as possible in the form of environmental support in cases of suspected SLI (Finnish Current Care 2010). It has been suggested that disorder in receptive skills leads to more severe consequences than that of expressive language (e.g. Finnish Current Care 2010).

The diagnosis of SLI is based on test results. In the Finnish version of ICD (WHO ICD-10) the test performance of -2 standard deviation (SD) is the diagnostic criterion both in expressive and receptive skills (Finnish Current Care 2010). However, all tests in clinical use in Finland do not offer the standard deviation data and, therefore, there is a recommendation to use diagnoses F80.1 and F80.2 when a multidisciplinary assessment finds a clinically significant language disorder, even without the criterion of test performance of -2 SD. SLI has been divided in three levels according to its severity: mild, moderate and severe (Finnish Current Care 2010, <http://www.kaypahoito.fi/KH2014-suositukset-portlet>). Assessing and categorising the difficulties of SLI outline seven language behaviour classes: receptive abilities and retention, discussion and narration, playing, relations with age mates, emotional abilities, acquiring new knowledge and showing his or her own knowledge (Finnish Current Care 2010). Thus, the classification of the severity of SLI takes into account a child's ability to participate in life, according to the principles of ICF (WHO 2001). There is a large variation in the performance in language tests between the children with the diagnosis of F80.2 and those with the diagnosis of F80.1 and, accordingly, in the SLTs' clinics the children with SLI may present quite a large variation of difficulties. The evaluation of the severity of language disorder forms the base of the diagnosis. It seems that the diagnosis alone does not define the services needed. The child's everyday life, for example his or her

activities at home should be considered and their connections and consequences to language development and use should be discussed, too.

2.4 Intervention forms based on assessment and diagnosis

Comprehensive and consistent assessment of language disorders is important for the organising of the individually appropriate measures of support as the services are based on the diagnosis. The ecological model of intervention has diversified the intervention services adding the collaboration between parents and professionals to the more traditional professional centred measures (e.g. Woods et al. 2011, Allen & Marshall 2010, Buschmann et al. 2009, Baxendale & Hesketh 2003, Bronfenbrenner 1994). Therapy services for children with language disorders can be delivered via multiple interventions: individual therapy or group therapy, direct or indirect modes of intervention and delivered by an SLT or trained assistant (in the US) (e.g. Boyle et al. 2009, Dickson et al. 2009, Boyle et al. 2007). In addition, the complexity of the intervention strategies grows because the content and the frequency of the intervention may be different in each child's speech and language therapy (Law et al 2012, Boyle et al. 2009, Dickson et al. 2009, Dockrell & Law 2007). Due to the large prevalence of developmental language disorders the costs and cost-effectiveness of different interventions have interested the researchers (Law et al. 2012, Wake et al. 2012, Boyle et al. 2009, Dickson et al. 2009, Boyle et al. 2007, Gibbard et al. 2004).

Early intervention is seen to be important because children who still have a delayed language development when they move into school have been found to be at risk of more persistent difficulties (Clegg et al. 2005, Law et al. 2009, Arkkila et al. 2008, Arkkila et al. 2009). There

are growing grounds for optimism that interventions can improve the language abilities or reduce the disadvantages involved in SLI (e.g. Dockrell et al. 2014a, Boyle et al. 2009, Dickson et al. 2009, Boyle et al. 2007). In Finland, assessment is initiated when the delay in language is found and a commonly shared principle is that intervention, at least in the form of guidance to the parents, should start without delay (e.g. Finnish Current Care 2010). Reducing harmful consequences is also seen to be important because today's society demands good literacy skills. Information and services are more and more based on using language and many of these services are available through internet the use of which demands language-based abilities. In addition, today's employment opportunities in physical jobs are minor compared to those of a few decades ago. Therefore, adolescents and adults with a language disorder do have to try to get employed in language based jobs even though they might be more suited to a manual job.

Traditionally, therapy interventions aim at improving children's skills at the level of disorder (Cunningham & Rosenbaum 2015). However, the framework of ICF (WHO 2001) shifts beyond the traditional focus on remediation of disorders towards addressing a child's ability to participate in life. Increased communicative participation is an important outcome of interventions as young children with communication disorders are often socially isolated from and excluded by their peers (Brinton & Fujiki 2005, Brinton et al 2000), a difficulty which may extend into later childhood and adolescence (Arkkila et al. 2009). Communication skills are also central to how people interact in the world and construct their identities.

2.5 Prevalence of SLI

The percentage of cases in a predetermined population at a specified time in a normal rather

than clinical population is the definition of prevalence in one of the most referred reviews in the field of language disorder (Law et al. 2000, Law et al. 1998a). Internationally prevalence data are of high interest to health professionals and educators for many reasons. Prevalence data are the source of service planning and allow for the calculation of the level of impact of intervention, and, also, for the consideration of the boundaries between typical development and disorder (Law et al. 1998a, b, Tomblin et al. 1997). The prevalence of SLI varies very much in different studies and the level depends partly on the criteria used (Law et al. 1998a, b). In a systematic review of studies of speech and language delay, Law and associates (2000, 1998a) suggested that the median prevalence of speech and language delay is 5.95 per cent with a range from 1.35 to 8 per cent. Figures were higher when speech and language were considered separately. The prevalence of language delay ranged from 2.02 to 19 per cent and speech delay ranged from 2.3 to 24.6 per cent. Thus, Law and associates (2000) concluded that speech and language disorder is a condition with high prevalence. They also reported that prevalence figures appeared to be stable across the thirty-year period surveyed (from 1967 to 1997). The internationally accepted prevalence of SLI is seven per cent but the variation in prevalence numbers of SLI in different international studies is large. Law and associates attributed the range of prevalence to methodological differences across the studies and suggested such confounding factors as gender, socio-economic status and bilingualism.

After the review of Law and associates (1998a, 2000) some epidemiological studies have been done. Most of them have been based on samples of school-aged children (e.g. McLeod & Harrison 2009). Though the criteria in the prevalence studies presented varied, the speech and language disorder continues to be regarded as a high prevalence condition (McLeod & Harrison 2009). The studies presented were based on multiple sources using parent and teacher reports, and direct assessment by clinicians or trained research assistants. Parent and

teacher reports have been used because of their efficiency (Hall & Segarra 2007, Klee 2007) as well as the high costs associated with the direct assessment (Pinborough-Zimmerman et al. 2007). Perhaps due to the complexity of direct language assessment and problems with the tests' sensitivity and specificity, procedures other than direct assessment have been studied. Studies comparing these different assessment methods have also been done (Sachse & von Suchodoletz 2008, McKinnon et al. 2007) and highlight the need for additional prevalence information.

Prevalence of communication disorders in the students with special needs have also been studied (Eadie et al. 2015, Reilly et al 2010, McLeod & Harrison 2009, McLeod & McKinnon 2007). The prevalence numbers seem to differ according to the age of the children and whether the disorders in language or in speech were examined (Eadie et al. 2015, Reilly et al. 2010, McLeod & Harrison 2009, McLeod & McKinnon 2007). There are speculations concerning whether the prevalence numbers in clinical samples are more or less representative than large community based cohorts. In addition, prevalence differs depending on whether clinicians, teachers or parents are the ones assessing the existence of the disorder (e.g. Eadie et al. 2015, Reilly et al. 2010, McLeod & McKinnon 2007). When compared with the systematic review data provided by Law and associates (1998), the figures in later studies fluctuate from equivalent to higher numbers. In a follow-up study (McLeod & McKinnon 2007) of special needs of students aged 5 years to 18 years the prevalence of needs concerning specific learning difficulty (17.93% to 19.10%) and communication disorder (13.04% to 12.40%) were the most common. The prevalence of speech sound disorder at age four was 3,4 per cent (Eadie et al. 2015) whereas the result in the same cohort at the same age suggested 20.6 per cent prevalence of language disorder (Reilly et al. 2010). Internationally

reported prevalence studies in languages other than English are few and show equal prevalence numbers (Thordardottir et al. 2010)

SLI has long-lasting effects and its impact on learning is especially important. There are many studies highlighting the special needs and high levels of support required by students within the classroom (e.g. Isoaho et al. 2016, Isoaho 2012, McLeod & McKinnon 2007). Children with additional learning needs require support from both the health and the education sectors in order to achieve their potential. Determining the prevalence of children with additional learning needs is important for planning health and education services, to enable calculation of the success of future interventions and to reflect current theories of the margins between typical development and disorder (McLeod & McKinnon 2007, Law et al. 2000). In Finland in each community the SLTs in the primary health care plan the services for children with language disorders based merely on the available statistics of their own. These community based statistics are not available or reported in public. Unfortunately, NIHW does not collect any national statistics of diagnoses F80.1 and F80.2. More studies of SLI in the Finnish health care services are needed and the prevalence of SLI is one of the most important study targets.

In Finland, support of learning for comprehensive school students has been divided into general, intensified and special support since the year 2011. The percentages of intensified and special support are in line with the internationally accepted prevalence of SLI. In autumn 2013, 6.5 per cent of all comprehensive school students received intensified support and 7.3 per cent of all comprehensive school students received special support. These statistics from 2013 show that 65 per cent of the recipients of intensified support were boys and 35 per cent girls. Among the recipients of special support, 70 per cent were

boys and 30 per cent girls. After the legislation amendment, the proportion of students having received intensified support has grown yearly (Official Statistics of Finland, OSF)

Language disorders are common though they are complicated to assess. They are long-lasting and their consequences are expensive for the society. Terminology seems to vary and researchers and clinicians in different countries may not mean the same when speaking of SLI. Assessments and tests used in them seem to vary internationally, and there is a lack of studies of the Finnish SLTs test use. Furthermore, because there is a lack of national prevalence data of SLI we may conclude that estimating its prevalence has been a difficult task to perform in Finland. According to the Ecological systems theory the intervention should include also the activities at home. Neither are there any studies about the home activities of children with SLI in Finland. Despite missing studies and missing data, the SLTs in the primary health care in Finland have to assess children's language disorders and plan intervention for the children with SLI and advise their families. There is a lack of information in current practices concerning the tests used for the assessment of SLI, its prevalence and matters concerning, for example, the participation and activities at home.

3 Aims of the study

The aim of this study was to explore SLI in the primary health care of one town and especially in its clinics of the SLTs. The interest was especially targeted to the assessment and assessment tools of language skills, home activities and prevalence of SLI. The specific aims were:

The aim of Study 1 was to collect information of the SLTs' test use when assessing different language constructs of children aged 5 to 8 years. The results consider the uniformity of the use of the tests with the aim of achieving more fluent assessment practices. The study questions were:

- What tests do the SLTs' use for assessing children's language abilities?
- How confident do the SLTs feel about the tests they use?
- What is the frequency of the use of each test used by the SLTs?

The aim of Study 2 was to identify the possible differences in language test scores of the children with SLI and their matched controls. The aim was also to identify the possible differences in language test scores of the children with diagnoses F80.1 and F80.2. The results consider the tests with highest sensitivity and specificity. The study questions were:

- Are there differences in language test scores between the children with SLI and their matched controls?
- Are there differences in language test scores between the two SLI diagnoses, F80.1 and F80.2?

The aim of Study 3 was to define the prevalence of SLI in the statistics of the SLTs in the primary health care over a period of 11 years. The statistics of children with SLI were collected at different ages. In addition, the aim was to study the prevalence of delayed language disorder (DLD), being the nearest class of speech and language disorders to SLI. The study also aimed at taking part in the international discussion on the prevalence and suspected increase in children's language disorders. The study questions were:

- What is the prevalence of SLI and is there an increasing or decreasing tendency in the prevalence?
- What are the ages of the children with SLI found in the annual statistics of the SLTs?
- Are there gender differences in the prevalence of SLI and between F80.1 and F80.2?
- What is the prevalence of delayed language disorder (DLD)?
- Does the number of the SLTs correlate with the prevalence of SLI?

The aim of Study 4 was to recognise the possible differences in the home activities of the children with SLI and their matched controls by using the parents' daily reports. The study focused especially on information about the time when children were at home with their parents. The results consider the influence of SLI on the home activities. The study questions were:

- Is there a difference in the type of the daily home activities between the children with SLI and their matched controls?
- Is there a difference in the duration of the daily home activities between the children with SLI and their matched controls?

The data of home activities and their possible differences between the children with SLI and their matched controls may enhance diagnostics and diversify the intervention strategies and advice given to parents

4 Subjects and methods

4.1 The data collection

In the town where the data of this study were collected, identification and intervention of a suspected delay in the language development of a child was the responsibility SLTs in the primary health care. The first step in the path of intervention of a child with a suspected delay in speech and language development was usually taken at the child welfare clinic. At these clinics child welfare nurses used screening instruments that the SLTs had developed for their use, separately for each age group. When a child welfare nurse found in an age-specific screening a child who was suspected to have problems in language development, the parents were advised to contact a SLT. The speech and language therapy services were free of charge for the families and, thus, available to all without any referral and the comprehensiveness of services was good. The second step was that the parents of the child contacted the SLT and an assessment was carried out to determine which services were needed. At the third step the child was tested, as an essential part of the assessment of the language abilities, together with observation and interviewing the parents. Finally, the fourth step was a referral to the secondary health care to set the diagnoses. Usually this was done only in the cases of a suspected SLI or other developmental neurological disorders.

In the town, speech and language therapy services to residents of all ages were organised in the health care unit. Also, the documentation of the clients' diagnoses, as well as speech and language therapy services for them, was performed more efficiently than the collecting of statistics for NIHW normally requires. A multiprofessional research project *SLI in Vantaa* was started in 2004, and the present study was part of that project. Data for the *SLI in Vantaa* were collected from all children born in 1998 and 1999 who were diagnosed in secondary

health care as having SLI (ICD-10 diagnoses F80.1 or F80.2) living in the city of Vantaa, Finland. The size of this birth cohort was 4,553 children in January, 2006 (www.vantaa.fi/tilastot). The inclusion criteria for the study were 1) Finnish as mother language, 2) normal intellectual ability, 3) normal hearing, 4) agreement to participate in this study and 5) either diagnosis F80.1 or F80.2 assessed in the secondary health care. A control child without the diagnosis of SLI was selected from the Vantaa population register for each child with a diagnosis. The criteria for the control children were that their gender, month of birth (± 1 month) and the area of the town in which they lived were matched with the child with a diagnosis. Approximately one hundred children were evaluated and, the parents of 54 children with SLI gave their consent.

The present study included four sets of data. The data from children with SLI and their matched controls in studies 2 and 4 composed the research *SLI in Vantaa* of children speaking Finnish as their native language. Studies 2 and 4 included their own introduction and consent letters. The SLTs of children with SLI received paper forms to be filled out of tests assessing children's language abilities (Study 2). Studies 1 and 2 consisted of forms and questionnaires filled out by many SLTs in primary health care and in private clinics. In addition to the questionnaires of the Studies 1, 2 and 4, the parents of children with SLI as well as the parents of control children were asked to fill out the questionnaires of the research *SLI in Vantaa*, at different time points.

The statistical data about prevalence of a classified delayed language disorder (DLD) in the primary health care set by the SLTs or diagnoses of SLI (set by the physicians in the secondary health care) covered 11 years and are reported in the Study 3. As the official patient

records of the town (from Finstar and Graphic Finstar) did not offer the information the data were collected from the statistical reports of the SLTs who gave annual numbers of different diagnoses of children treated in the speech and language therapy of the town. During the study period the organisations where the SLTs were employed had changed but the collection of statistic information of the SLTs had remained the same during the entire period which made the retrospective data collection possible. The SLTs participated in two studies (Study 1 and 2). Study 1 included all the SLTs employed in the town. In Study 2 the SLTs who assessed children with SLI were employed in the town, in the secondary health care or in the private clinics. In Study 2 the SLTs performed the assessment of the children with and without SLI.

4.2 Subjects

4.2.1 Children with SLI and matched controls

The introduction letter of the research *SLI in Vantaa* was delivered to all the SLTs who offered SLT services in the town, the kindergarten teachers and the secondary health care clinics. They were asked to give the parents of children with SLI the introductory letter of the research and to inform the parents about this research project. Information concerning the research was also given to the families in the meetings of the local society for SLI (Vantaan dysfasiayhdistys) where information letters of the study were delivered. The letter was accompanied by the preliminary letter of consent to be returned to the responsible researcher in a prepaid envelope. After the preliminary consent was received, a more specified information letter of Studies 2 and 4 was delivered.

All the children born in 1998 and 1999 who were diagnosed in the secondary health care as having SLI (ICD-10 diagnoses F80.1 or F80.2) living in this town were included in Study 2 and Study 4. After the consent to the study, for each child with the diagnosis and the consent, three control children without a diagnosis, selected from the Vantaa population register, were matched on gender, date of birth (± 1 month) and area of residence. An information letter was sent to the first of the three children. After two weeks, if no reply was received, the second control child was approached, and then the third. Study 2 included 46 children with SLI and 37 matched control children. Out of these 31 matched pairs were found (Table 2).

Table 2. Participants of Study 2

	Boys	Girls	Total
F80.1	22	6	28
F80.2	16	2	18
Total	38	8	46
Control children	30	7	37
Total number of children	68	15	83
Matched pairs			
F80.1	17	4	21
F80.2	9	1	10
Total	26	5	31

In Study 4 parents of 56 children with SLI and 36 suggested control children agreed to the study. Questionnaires of 48 children with SLI and 30 control children were returned. Out of these 20 matched pairs were identified (Table 3).

Table 3. Participants of Study 4

	Boys	Girls	Total
F80.1	17	4	21
F80.2	15	2	17
Total	42	6	48
Control children			30
Matched pairs	17	3	20

4.2.2 Speech and language therapists

In Study 1, the SLTs' test use, confidence in the tests and frequency of the test use, the data consisted of the answers of the 29 SLTs. They were all employed in the health care of the town, representing all the SLTs of the town at the time of the data collection. All the SLTs received information about the study and were asked to fill in a paper questionnaire. All the SLTs received the questionnaire at the same time, and they returned the questionnaire in three weeks. Most of the SLTs were born in the 1960's. Dispersion in years of birth was from 1945 to 1980. Two of the SLTs had graduated in 1978, nine in the 1980's, eight in the 1990's and ten in the first decade of 2000. The SLTs were asked to fill in the questionnaire individually.

In Study 2, the test performance of children with SLI and their matched controls were studied and altogether 32 SLTs assessed the children. The SLTs were working in the health care of the town, in secondary health care or in private clinics. The test results, if not older than one year, were collected from the patient documents in the specialist healthcare. Otherwise, testing was carried out in the clinics of the SLTs in primary health care, in the day care, in the private clinic or at the child's school. As the testing procedure took a long time and more than one appointment, each SLT could determine the time and appointments needed.

4.3 Methods

4.3.1 Tests

Study 1 included all the tests and assessment tools that were in the clinical use of the SLTs in the town. In the study the term, ‘test’, includes both standardised tests and other assessment tools. The number of the tests was 14, the total number of assessment tools, including all subtests, was 38. Study 2 included also 14 tests that together with their subtests formed a battery of 39 different tasks. The number of subtests in Studies 1 and 2 were different because scored subtests that were included in each study were different (Table 4).

All the tests included cover a wide range of different aspects of language skills and language constructs including also oral-motor functions (Table 4).

Table 4. Tests, developer, year and targets as mentioned in the test manual or informal guidance.

Test or assessment tool, reference of English and Finnish version	Target as mentioned in the Finnish test manual	Validated or standardised	Study 1 (38 subtests)	Study 2 (39 subtests)

Bo Ege Sproglig Test 1 (Ege 1984, Finnish version Test group of SLTs in Pirkanmaa)	Use of the vocabulary, production	Age-related norms			
Boehm test of basic concepts (Boehm 1986, Finnish version Heimo 1993)	Mastering basic concepts	Standardised			
Boston Naming Test (Kaplan et al. 1976, Finnish version Laine et al. 1997)	Size of vocabulary, naming	Age-related norms			
ITPA Illinois Test of Psycholinguistic Abilities (Kirk et al. 1968, Finnish version Kuusinen & Blåfield, 1974)	Auditory reception	Standardised			
	Visual reception	Standardised			
	Auditory association	Standardised			
	Visual association	Standardised			
	Auditory sequential memory	Standardised			
	Grammatical completion	Standardised			
	Auditory closure	Standardised			
	Sound blending	Standardised			
	Visual sequential memory	Standardised		Not included	
	Visual closure	Standardised		Not included	
	Manual expression	Standardised		Not included	
	Verbal expression	Standardised		Not included	
	Lausetesti [Sentence Level Test of speech comprehension] (Korpilahti 1996)	Comprehension of sentences	Age-related norms		
	Morphology Test for Finnish Children (Lyytinen 1988)	Mastering adverbial forms	Age-related norms	6 subtests were included	6 subtests and sum of all subtests were included
Mastering comparative forms		Age-related norms			
Mastering superlative forms		Age-related norms			

	Mastering present tense	Age-related norms		
	Mastering past tense	Age-related norms		
	Mastering relative forms	Age-related norms		
Reynell Developmental Language Scales III, comprehension and production (Edwards et al. 1997, Finnish version Korttesmaa et al. 2001)	Language comprehension and production.	Standardised	Subtests comprehension and production were included	Subtest comprehension was included
Token Test for Children (DiSimoni 1978, Finnish version Korkman 1988)	Language comprehension and short-term memory	Standardised	Test was scored once	5 subtests and sum of all subtests were included
Test for Rapid Serial Naming (Ahonen et al. 1999)	Velocity/speed and mistakes of naming colours, pictures, numbers, letters and colours, numbers and letters	Standardised	Five subtests were included	Velocity and mistakes of subtests naming colours and pictures were included
Makeko, Matematiikan keskeisten käsitteiden diagnoosi [The Diagnoses of mathematical basic concepts] (Ikäheimo 2002)	Mastering mathematical basic concepts	Age-related norms		
Self-made versions	No written manual			
Oral motor and face function	Motor function of face		Four subtests were included	Four subtests and sum of all subtests were included
	Motor function of jaw			
	Motor function of palatal			
	Motor function of tongue			
Non-word repetition	Repetition of non-words, articulation, auditory memory			
Word repetition	Repetition of words, articulation, auditory memory			
Syllable repetition	Repetition of syllables, articulation, auditory memory			

4.3.2 Prevalence statistics

The data of the retrospective Study 3 were collected from the annual statistics of the SLTs in an eleven-year period, 1989-1999. Each year the diagnoses, gender, age and year of birth of each child who used the speech therapy services were recorded. These were register-based data and identifying the children was made impossible. Furthermore, two samples of the children with delayed language development (DLD), classified by the SLTs, were collected. The data of the children with SLI included ages up to 15 years. Also, the annual number of the SLTs in the primary health care of the town was registered. The data of the diagnosis SLI were collected from 1989 - 1999 and the samples of children with DLD were from 1989-1991 and 1996-1998. The statistic and research centre of the town provided the official number of children and total population for every year. The data were collected from the statistics in 2000.

4.3.3 Questionnaires

4.3.3.1 Questionnaire of the SLT's test use

The data of SLTs' test use (Study1) were collected using a paper questionnaire. The SLTs in the town (n=29) worked in the same organisation and they had collected a coherent collection of the tests they used (Table 4). These tests included standardised tests, tests that had age related norms, and, also, widely used but unspecified assessment tools. All the tests that were found to be used in assessing the language skills in children between ages 5 to 8 years were listed. The questionnaire was first formulated according to discussions with clinicians in the field. The discussions elaborated the language constructs, alternatives when assessing the

confidence and the frequency of use and the assessment scale used in them. After that, SLTs outside this study (n=5) performed a pilot study using a draft version of the questionnaire. The comments in the pilot study suggested adding or removing some tests (Table 4). Also, the SLTs comments concerned the names and numbers of suggested language constructs. The final questionnaire was formulated where the comments and the feedback from the preliminary questionnaire were taken into account. The final questionnaire included fourteen tests, the total number of assessment tools, including all subtests, being 38 and five language constructs. The SLTs were asked to answer in the case of each test if they used it (1) or if they did not use it (0), to gauge the confidence they had in each test and score it (1=plenty of confidence, 2=confidence, 3=demands interpretation, 4=untrustworthy, 5=not suitable for this purpose). In addition, the SLTs were asked to gauge the frequency of each test use and score it (1=very often, 2=often, 3=only in special situations, 4=seldom, 5=never). All of these questions were grouped according to five different classes of language constructs addressed in the pilot study: Vocabulary, Comprehension, Grammar, Auditory memory, Speech motor skills. There was also a possibility to add some other language construct if needed. Furthermore, the questionnaire included an open question about the assessment tool of pragmatic skills (Appendix 1).

4.3.3.2 Questionnaire of the home activities

The data of children's home activities were collected by using a paper questionnaire for a one-week period. Because of the absence of earlier studies of the daily basis questionnaires of home activities, the parent questionnaires in this study were first formulated according to the common knowledge and the parent interviews (n= 10) of home activities of children in Finland. Essential further information about the daily activities and the formulation of the

questionnaire was received using a pilot questionnaire for the parents outside of the aimed study groups (n=7). The comments of the pilot survey also contributed to the time scoring method used and the time score was extended from the original. The final questionnaire, separately for each day during one week, was formulated so that the observed time was between 5 pm to 9.30 pm and it was divided into 30 minutes scoring periods. As the children do not act in 30-minute sessions, parents were advised to choose the main activity of their child in each session (Appendix 2).

4.4 Statistical analysis

In all studies the data were analysed using SPSS for Windows, using the updated versions 12, 15, PASW, 18, 20 (SPSS inc. Chicago, IL, USA). The statistical difference level was set to $p < 0.05$.

Study 1. Assessing language disorders of children – Use of language tests in clinical work of speech and language therapists in Finland

Study 1 was based on data of the SLTs' test use when they assessed different predefined language constructs and the confidence they have in the tests. Descriptive statistics were conducted in order to determine the use of each test. In five predefined language construct the users (n, %, SD), scores of the confidence (mean, SD) and scores of the frequency of use (mean, SD) of each test were recorded. Analyses were carried out with the data including all the answers, empty spaces being filled with 0. Non-parametric one-way analysis of variance

(Kruskall-Wallis) was used to compare the medians of each test's scores of the confidence and scores of the frequency of use. The test was used because the values did not follow the normal distribution. When statistically significant differences were obtained pairwise multiple comparison procedures (post-hoc Tukey Test) tested the difference between the tests' values of the scored confidence and frequency of use between language constructs. Correlations between the use of all tests and the experiences of the confidence, as well as all tests' scores of the confidence and the scores of the frequency of use were analysed (Spearman correlation).

Study 2. Use of language tests when identifying SLI in primary health care

Study 2 was based on data of the test scores of children with SLI. These test scores were compared with those of matched control children. The aim was to find the tests that were most sensitive and had best specificity when assessing SLI. The matched pairs' data were analysed by calculating the difference in the raw test scores for each pair of children. Also, mean scores, corresponding SDs and the standardized effect size and 95% CI were calculated and analysed. In the calculation of the p-values, the age difference between the testing ages between SLI cases and controls were adjusted, and controlled for multiple comparisons (39 tested items). The false discovery rate (FDR) procedure was applied to avoid reporting false positive findings in calculating the p-values. Linear discriminant analysis was used to analyse the difference between the test scores of SLI children with diagnoses F80.1 or F80.2.

Study 3. Increasing prevalence of SLI in primary healthcare of a Finnish town, 1989-1999.

Study 3 was based on data about the prevalence of diagnosed SLI during the eleven years follow-up period. The ages and genders were studied as well as the prevalence of DLD in two samples. Furthermore, the number of the SLTs was collected in each year and compared to those of the children with SLI. When analysing the data of the prevalence of SLI the Pearson chi-square and Poisson regression model were applied to detect changes in the absolute number of all children and the number of children with the diagnosis of SLI during the follow up period. The development of the prevalence of SLI was analysed by using the Pearson chi-square's Linear-by-Linear Association. The numbers of all children and children with SLI diagnoses in different years were first compared separately with the respective numbers for 1989 that, being the starting point of our study, was considered the control year. To study the prevalence of SLI and its increase over the follow-up period, we analogously compared separately the prevalence of the control year, 1989, with the respective prevalence of each of the following years. These contingency tables were tested using the Pearson Chi-square (χ^2 -test). In two-group comparisons the T-test or Paired T-test was applied when necessary. The number of children with DLD in two samples were analysed. The prevalence of language disorders, presenting DLD and SLI together, were analysed. The ages and genders of children with SLI were analysed yearly as well as the numbers of the SLTs.

Study 4. Type and duration of home activities of children with SLI: case control study based on parents' reports

Study 4 was based on data about children's home activities. They were compared with the data of their matched controls. First, each child's activities were calculated together for each

day from Monday to Friday. Cross tabulation was used to count the activities between each pair of children, with and without SLI. To detect the possible differences in the daily home activities the Chi-square test was used. A nonparametric test for related samples was used to compare the time spent on each daily activity of children with and without SLI. This test was used because the values did not follow the normal distribution. Furthermore, in order to test the strength of the putatively observed statistically significant differences of home activities the data was reanalysed by using the most unfavourable scores for each observed activity difference and thereby checking the specificity of the present findings (Joffe et al. 2005).

4.5 Ethics

The Coordinating Ethics Committee of the Hospital District of Helsinki and Uusimaa Dnro 218/E7/04 and City of Vantaa Dnro SOSTER 4442/2004/092 (municipal and local ethical committee) approved the study. Parents of children gave their written informed consents separately for the study of assessment of language skills and the study of home activities and returned them in prepaid envelopes (studies 2 and 4). Study 1, the SLTs' test use, was performed as part of their official work permission given by the head of the unit in Vantaa.

5 Results

5.1 Study 1. Assessing language disorders of children – Use of language tests in clinical work of the speech and language therapists in Finland

The SLTs reported that they used in total twenty tests when assessing *vocabulary* (Table 5). *Sproklig test 1* and *Boston naming test* scored to be statistically significantly the ones that

inspired most confidence and frequency of use in assessing vocabulary compared to all other constructs (Table 6).

Table 6. Vocabulary. The medians (scores 1-5), 25% QRs and 75% QRs of those tests which scored to be statistically significantly ($P < 0.05$, Tukey test) the ones inspiring most confidence and the most frequently used in Vocabulary are shown. Language constructs compared to which the statistical significance was found.

Vocabulary with the highest scores of confidence and frequency of use	median score	25% QR	75% QR	Language constructs compared to which statistical significance was found
Sproklig test 1				
confidence	3.0	2.8	3.0	comprehension, auditory memory, grammar, speech motor skills
frequency of use	1.0	1.0	2.0	auditory memory, comprehension, grammar, speech motor skills
Boston				
confidence	2.0	2.0	3.0	comprehension, auditory memory, grammar, speech motor skills
frequency of use	2.0	1.8	3.0	comprehension, auditory memory, grammar, speech motor skills

In addition to these two tests, more than ten SLTs scored their use of five further tests. These five tests were BOEHM test of basic concepts, three subtests of ITPA test (auditory association, speech production, auditory reception) and Reynell test's subtest speech production (Figures 1 and 2). None of these seven tests were scored as *plenty of confidence* and used *very often* by all the SLTs (Figures 1 and 2). Due to the scattered scores of use as well as of confidence and frequency of use, the scores of tests that more than ten, one third of all SLTs scored are presented.

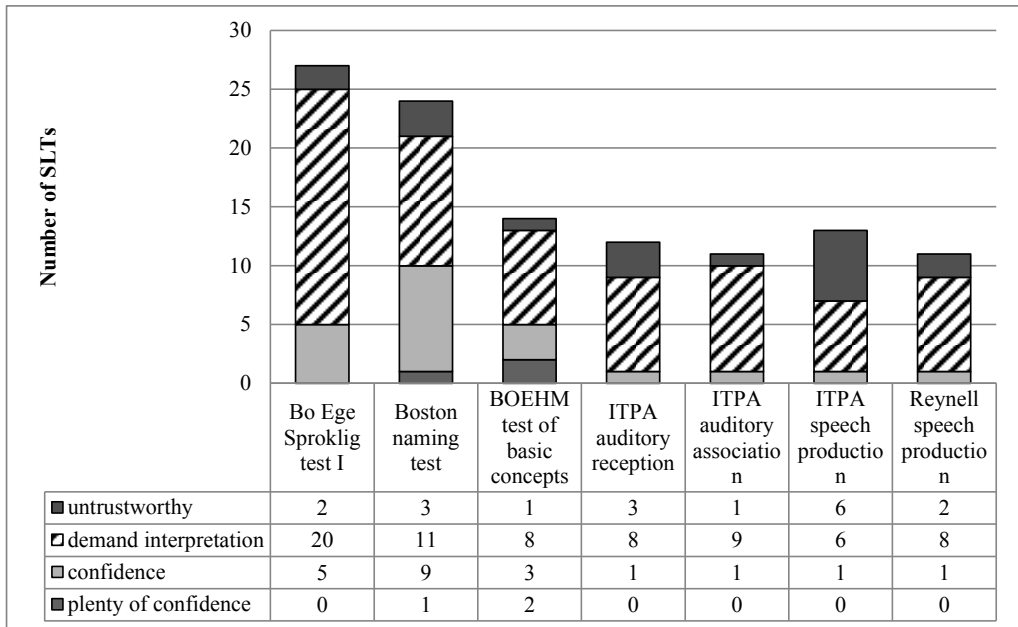


Figure 1. Numbers of confidence scores of test that more than ten SLTs used when assessing vocabulary.

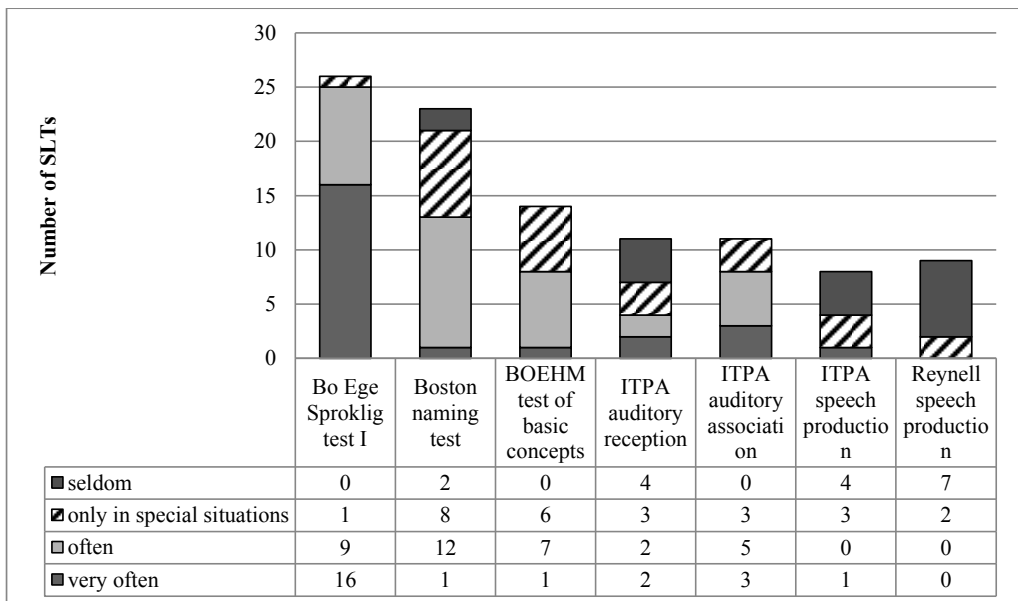


Figure 2. Numbers of frequency of use scores of tests that more than ten SLTs used when assessing vocabulary.

The SLTs reported using in total twenty-seven tests when assessing *comprehension* (Table 5). ITPA auditory reception showed statistically significantly more confidence and was statistically significantly more often used compared to all other constructs (Table 7).

Table 7. Comprehension. The medians (scores 1-5), 25% QRs and 75% QRs of those tests which scored to be statistically significantly ($P < 0.05$, Tukey test) the ones inspiring most confidence and the most frequently used in Comprehension are shown. Language constructs compared to which the statistical significance was found.

Comprehension with the highest scores of confidence and frequency of use	median score	25% QR	75% QR	Language constructs compared to which the statistical significance was found
Sentence level test				
confidence	2.0	2.0	3.0	vocabulary, speech motor skills
frequency of use	1.0	1.0	2.0	speech motor skills, vocabulary
ITPA auditory reception				
confidence	3.0	2.0	3.3	speech motor skills, grammar, auditory memory, vocabulary
frequency of use	3.0	2.0	3.3	speech motor skills, auditory memory, grammar, vocabulary
ITPA auditory association				
confidence	3.0	2.0	3.0	speech motor skills, grammar
frequency of use	2.0	0.0	2.3	speech motor skills, grammar
Boehm test of basic concepts				
confidence	2.0	0.0	3.0	speech motor skills
frequency of use	2.0	0.0	3.0	
Reynell comprehension				
confidence	2.0	2.0	3.0	speech motor skills
frequency of use	2.0	1.0	2.0	speech motor skills
Token test				
confidence	2.0	0.8	3.0	speech motor skills, vocabulary
frequency of use	2.0	1.0	2.0	speech motor skills

In addition to the ITPA auditory reception, more than ten SLTs scored their use of five further tests. These five tests were Sentence level test, ITPA auditory association, BOEHM test of

basic concepts, Reynell subtest comprehension and Token test. None of these six tests were scored as *plenty of confidence* and used *very often* by all the SLTs (Figures 3 and 4). Due to the scattered scores of use as well as of confidence and frequency of use, the scores of tests that more than ten, one third of all SLTs scored are presented.

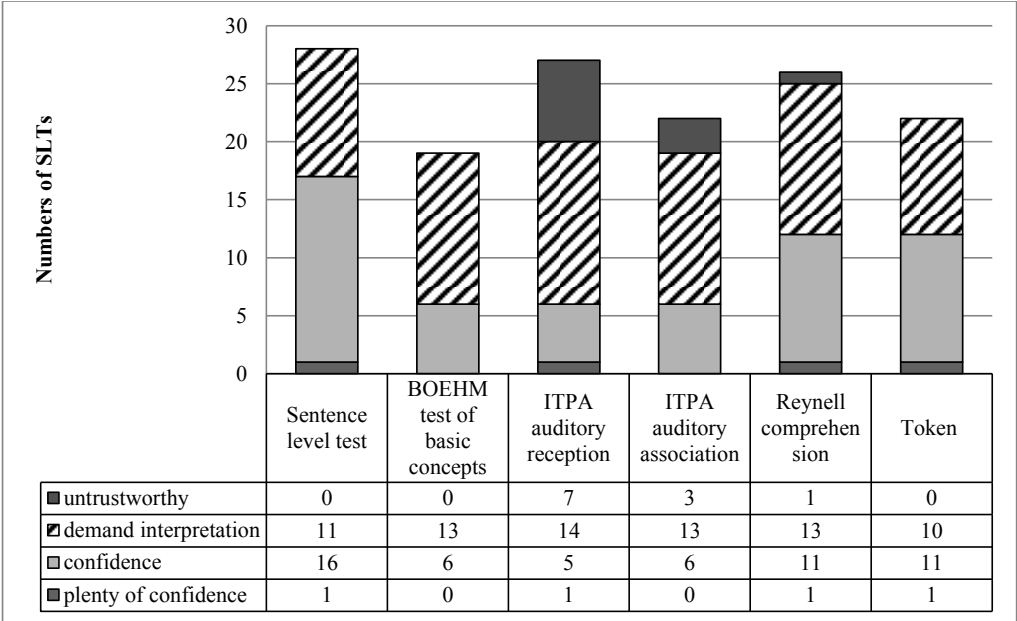


Figure 3. Numbers of confidence scores of test that more than ten SLTs used when assessing comprehension.

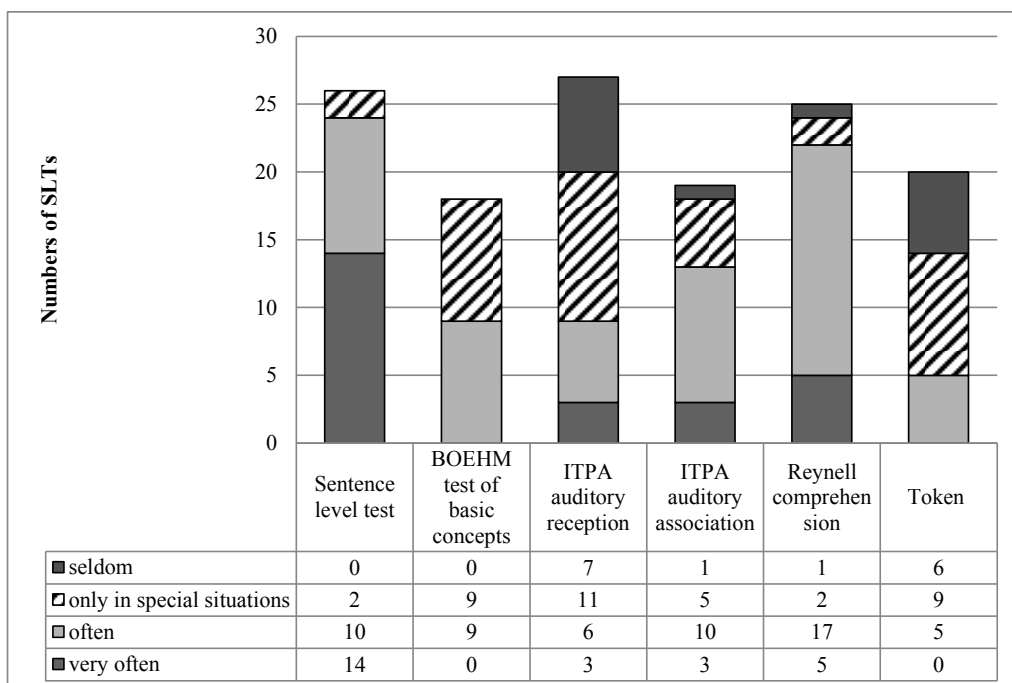


Figure 4. Numbers of frequency of use scores of test that more than ten SLTs used when assessing comprehension.

The SLTs reported using in total twenty-three tests when assessing *grammar* (Table 5). Seven tests (ITPA's subtests grammatical completion and all Morphology test's subtests) were scored to be statistically significantly those that inspired most confidence and frequency of use in assessing grammar compared to other constructs (Table 8).

Table 8. Grammar. The medians (scores 1-5), 25% QRs and 75% QRs of those tests which scored to be statistically significantly ($P < 0.05$, Tukey test) the ones inspiring most confidence and the most frequently used in Grammar are shown. Language constructs compared to which the statistical significance was found.

Grammar with the highest scores of confidence and frequency of use	median score	25% QR	75% QR	Language constructs compared to which the statistical significance was found
ITPA grammatical completion				
confidence	2.0	2.0	3.0	speech motor skills, vocabulary, auditory memory, comprehension
frequency of use	3.0	2.0	3.0	speech motor skills, vocabulary, auditory memory, comprehension

Morphology mastering adverbial forms				
confidence	2.0	0.0	3.0	speech motor skills, auditory memory, vocabulary, comprehension
frequency of use	3.0	0.0	4.0	speech motor skills, auditory memory, vocabulary, comprehension
Morphology mastering comparative forms				
confidence	2.0	0.0	3.0	speech motor skills, vocabulary, auditory memory, comprehension
frequency of use	3.0	0.0	4.0	speech motor skills, auditory memory, comprehension, vocabulary
Morphology mastering superlative forms				
confidence	2.0	0.0	3.0	speech motor skills, vocabulary, auditory memory, comprehension
frequency of use	3.0	0.0	4.0	speech motor skills, auditory memory, vocabulary, comprehension
Morphology mastering present tense				
confidence	2.0	0.0	3.0	speech motor skills, auditory memory, vocabulary, comprehension
frequency of use	3.0	0.0	4.0	speech motor skills, auditory memory, vocabulary, comprehension
Morphology mastering past tense				
confidence	2.0	0.0	3.0	speech motor skills, auditory memory, vocabulary, comprehension
frequency of use	3.0	0.0	4.0	speech motor skills, auditory memory, vocabulary, comprehension
Morphology mastering relative forms				
confidence	2.0	0.0	3.0	speech motor skills, auditory memory, vocabulary, comprehension
frequency of use	3.0	0.0	4.0	speech motor skills, auditory memory, vocabulary, comprehension

In addition to these seven tests, more than ten SLTs scored four other tests. These four tests were Sentence level test, ITPA’s subtest speech production, Reynell comprehension and speech production (Figures 5 and 6). None of these eleven tests were scored as *plenty of confidence* and used *very often* by all the SLTs (Figures 5 and 6). Due to the scattered scores of use as well as of confidence and frequency of use, the scores of tests that more than ten, one third of all SLTs scored are presented.

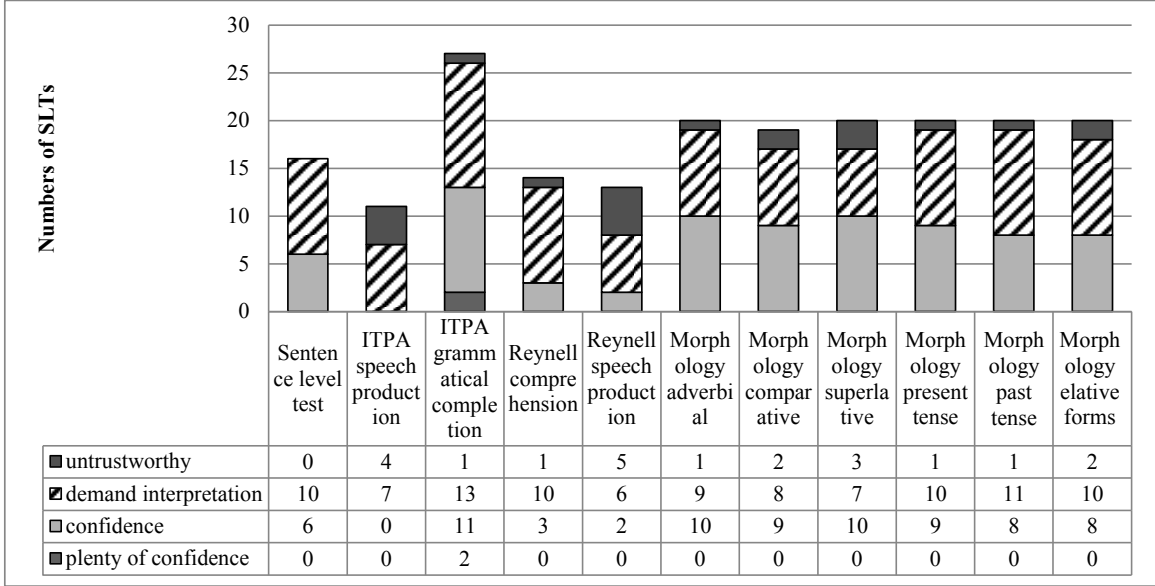


Figure 5. Numbers of confidence scores of tests that more than ten SLTs used when assessing grammar.

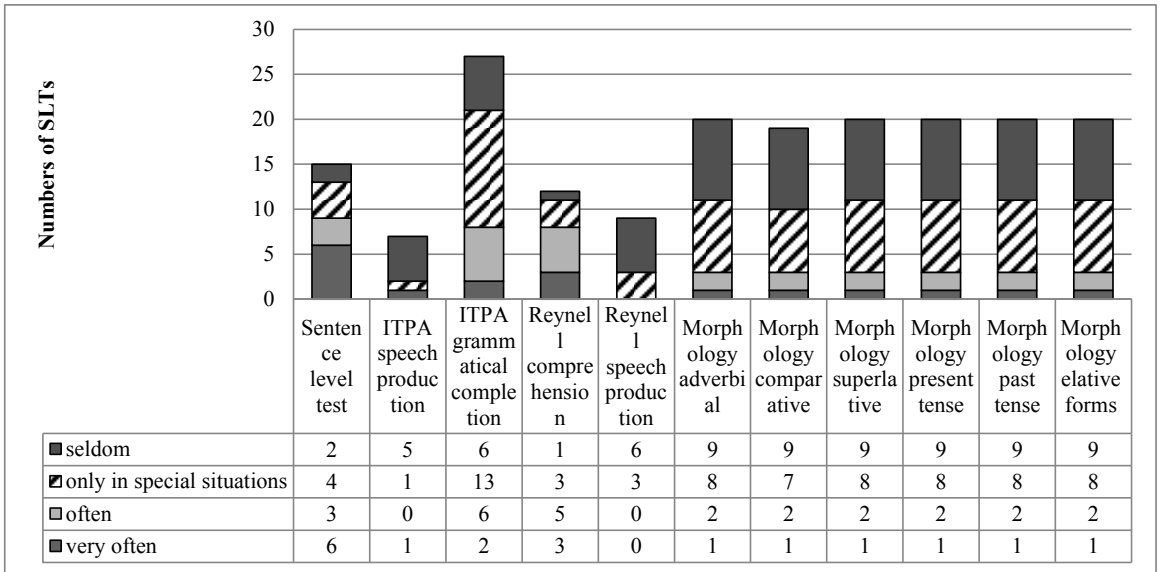


Figure 6. Numbers of frequency of use scores of tests that more than ten SLTs used when assessing grammar.

The SLTs reported using in total twenty-six tests when assessing *auditory memory* (Table 5).

ITPA’s subtest auditory sequential memory scored to be statistically significantly the one that inspired most confidence and frequency of use in assessing auditory memory compared to other constructs (Table 9).

Table 9. Auditory memory. The medians (scores 1-5), 25% QRs and 75% QRs of those tests which scored to be statistically significantly ($P<0.05$, Tukey test) the ones inspiring most confidence and the most frequently used in Auditory memory are shown. Language constructs compared to which the statistical significance was found.

Auditory memory with the highest scores of confidence and frequency of use	median score	25% QR	75% QR	Language constructs compared to which the statistical significance was found
ITPA auditory sequential memory				
comprehension	2.0	2.0	2.0	vocabulary, grammar, comprehension, speech motor skills
frequency of use	2.0	1.0	2.0	grammar, vocabulary, speech motor skills, comprehension

In addition to the auditory sequential memory test, more than ten SLTs scored their use of three other tests. These three tests were Sentence level test, Reynell comprehension and Token test (Figures 7 and 8). None of these four tests were scored as *plenty of confidence* and used *very often* by all the SLTs (Figures 7 and 8). Due to the scattered scores of use as well as of confidence and frequency of use, the scores of tests that more than ten, one third of all SLTs scored are presented.

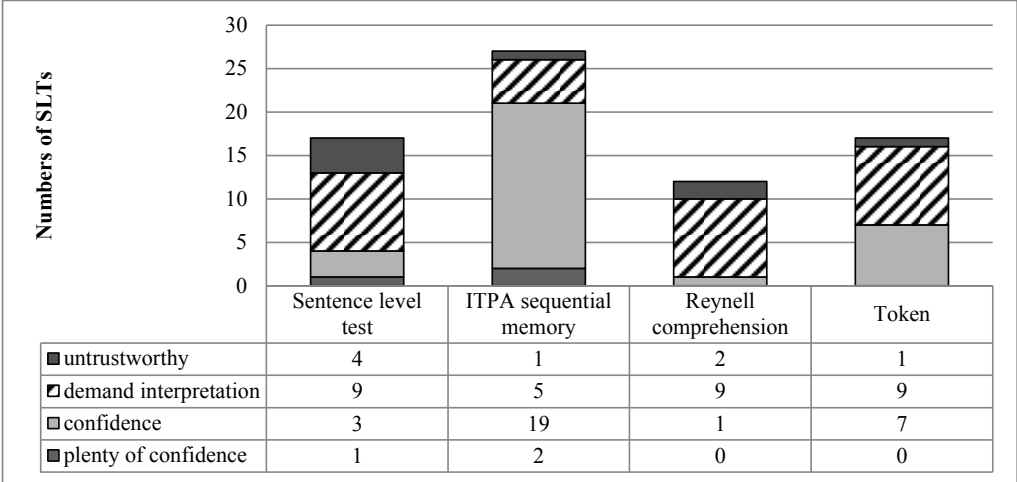


Figure 7. Numbers of confidence scores of tests that more than ten SLTs used when assessing auditory memory.

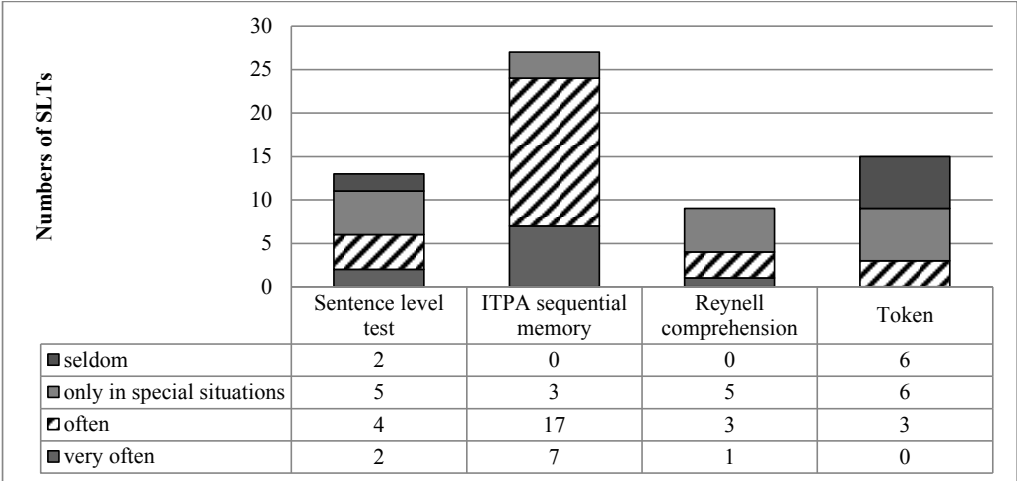


Figure 8. Numbers of frequency of use scores of tests that more than ten SLTs used when assessing auditory memory.

The SLTs reported using in total eighteen tests when assessing *speech motor skills* (Table 5). Six tests (Word repetition, Syllable repetition, Non-word repetition and Tongue, Jaw and Palatal motor functions) were scored to be statistically significantly the ones that inspired most confidence and frequency of use in assessing speech motor skills compared to other constructs (Table 10).

Table 10. Speech motor skills. The medians (scores 1-5), 25% QRs and 75% QRs of those tests which scored to be statistically significantly ($P < 0.05$, Tukey test) the ones inspiring most confidence and the most frequently used in Speech motor skills are shown. Language constructs compared to which the statistical significance was found.

Speech motor skills with the highest scores of confidence and frequency of use	median score	25% QR	75% QR	Language constructs compared to which the statistical significance was found
Jaw motor functions				
confidence	2.0	0.0	3.0	auditory memory, grammar, comprehension, vocabulary
frequency of use	2.0	0.0	3.0	auditory memory, grammar, comprehension, vocabulary
Palatal motor functions				
confidence	2.0	0.0	3.0	auditory memory, grammar, comprehension, vocabulary
frequency of use	3.0	0.0	4.0	auditory memory, grammar, comprehension, vocabulary
Tongue motor functions				
confidence	2.0	0.0	3.0	auditory memory, grammar, comprehension, vocabulary
frequency of use	1.0	0.0	2.0	auditory memory, grammar, comprehension, vocabulary
Repetition of syllables				
confidence	2.0	0.75	3.0	grammar, comprehension, vocabulary, auditory memory
frequency of use	2.0	1.0	3.0	grammar, comprehension, vocabulary, auditory memory
Repetition of words				
confidence	2.0	1.0	3.0	grammar, comprehension, vocabulary, auditory memory
frequency of use	2.0	0.0	2.3	grammar, comprehension, vocabulary, auditory memory
Repetition of non-words				
confidence	2.0	0.0	3.0	grammar, comprehension, vocabulary
frequency of use	2.0	0.0	3.0	grammar, comprehension, vocabulary, auditory memory

In addition to these six tests, more than ten SLTs scored assessment of face motor functions. None of these seven tests were scored as *plenty of confidence* and used *very often* by all the SLTs (Figures 9 and 10). Due to the scattered scores of use as well as of confidence and frequency of use, the scores of tests that more than ten, one third of all SLTs scored are presented.

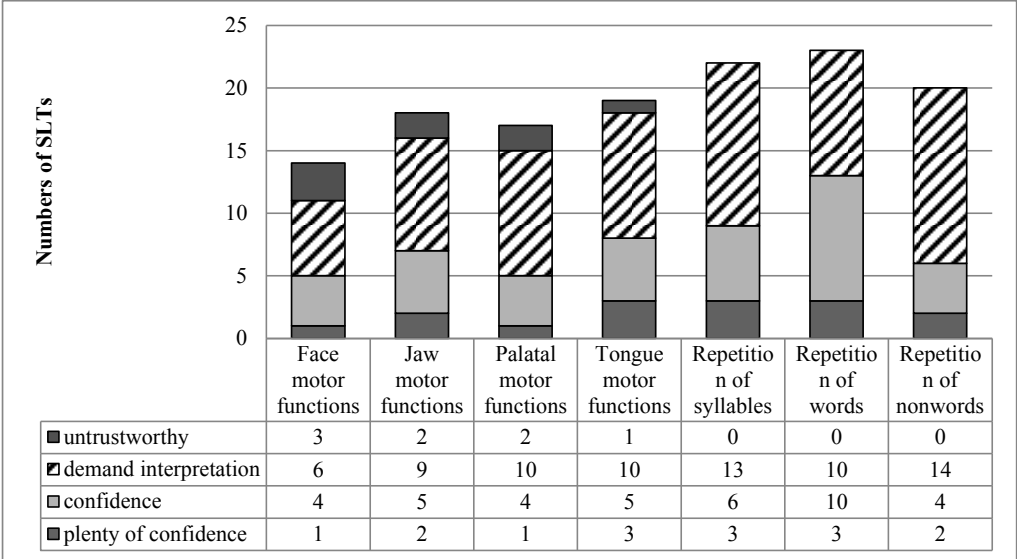


Figure 9. Numbers of confidence scores of tests that more than ten SLTs used when assessing speech motor skills.

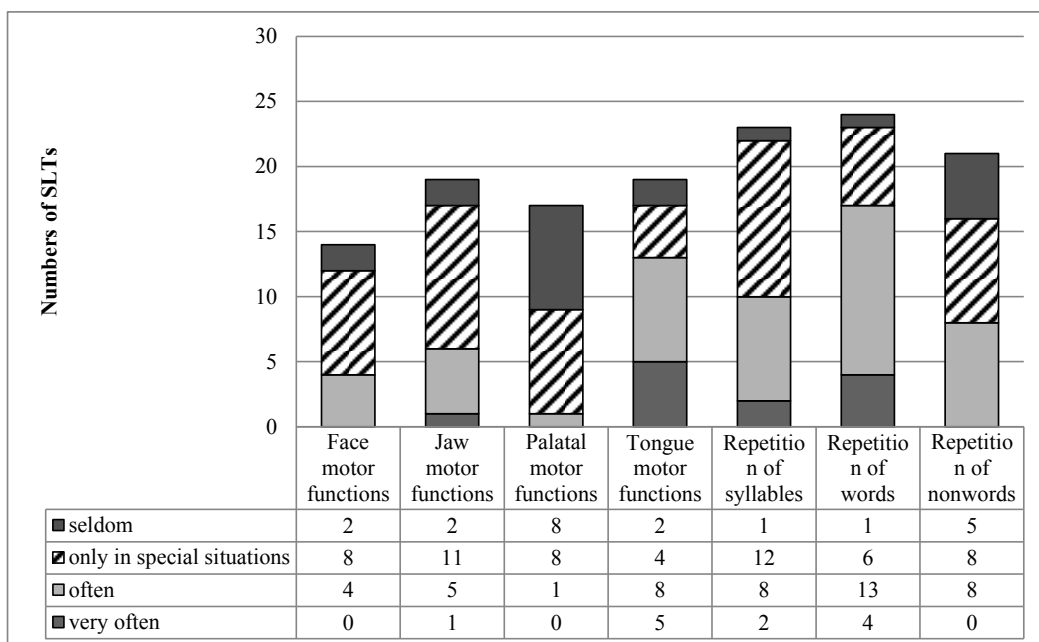


Figure 10. Numbers of frequency of use scores of tests that more than ten SLTs used when assessing speech motor skills.

The SLTs named the Rapid serial naming test as a test assessing naming, the speed of naming, serial naming and serial memory. This test was used actively, as 83 per cent (n=24) of the SLTs reported that they used its different subtests. The confidence in different subtests was scored between plenty of confidence (=1) and confidence (=2) (Table 11). Naming colours and naming pictures had the highest frequency of use (Table 11).

Table 11. Rapid serial naming subtests, number of answers, mean and SD of confidence (scores 1-4) and frequency of use (scores 1-4).

Subtest	n	Confidence, mean (SD)	Frequency of use, mean (SD)
Naming colours	24	1.87 (0.612)	2.37 (0.576)
Naming pictures	24	1.96 (0.751)	2.37 (0.576)
Naming numbers	24	1.87 (0.612)	2.71 (0.624)
Naming letters	24	1.92 (0.654)	2.62 (0.576)

Naming colours, numbers, letters	24	1.87 (0.680)	2.96 (0.690)
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Only three SLTs (10%) reported using any tool to assess children’s pragmatic skills. However, when all the comments the SLTs had given in the questionnaire were analysed, 24 per cent (n=7) of the SLTs described some method they used to assess pragmatic skills. The methods mentioned were observational or based on discussions and interviewing parents (Table 12).

Table 12. Methods that seven SLTs mentioned when assessing pragmatic abilities

discussion and observation of the interaction	MCDI, Portaat,	cards of situations and mood	Schopler-Mesibov (unofficial translation), interview of the parents of their child’s communication abilities
spontaneous discussion + naming, telling, description	observations of the play, discussion and from the other tests and tasks	assessing in the play situation	

In summary, the scores of confidence and scores of frequency of use of each test were not consistent, but rather scattered. However, the more the SLTs had confidence in a test the more frequently they used it ($r= 0.919, p< 0.001$).

Eleven tests (Sproklig Test1, Boston, ITPA auditory reception, grammatical completion and auditory sequential memory, Morphology, jaw, palatal and tongue motor functions and repetition of syllables and words) showed statistically significant differences in scores of confidence and frequency of use in one language construct compared to all other constructs. The results also suggest that more than ten SLTs used eight assessment tools assessing more than one language construct. These tests were Sentence level test, BOEHM test of basic

concepts, ITPA subtests auditory reception, auditory association and speech production, Reynell comprehension and speech production and Token test.

5.2 Study 2. Language tests identifying SLI in primary health care

The test scores of children with SLI and their matched controls were statistically significantly different ($p < .01$) in 26 tests of 39 tests (Table 13). Language constructs of vocabulary, comprehension, auditory skills, grammar and motor functions were assessed with these tests. In 13 tests the difference between the matched pairs' scores was not statistically significant. These 13 tests assessed visual skills, motor functions of the jaw, palate and face, sentence comprehension and rapid serial naming (Table 13).

Table 13. Language tests, number of pairs, mean in the difference and SD of test scores, p-values for the difference in test scores.

Tests	Number of pairs	Mean in the difference of test points (SD)	Univariate p
Boston Naming Test	31	-9.03 (8.77)	.000
Sentence Level Test	30	-2.07 (3.94)	.015
Sproklig Test 1	30	-5.76 (7.71)	.000
Reynell comprehension	29	-1.93 (3.46)	.001
ITPA visual reception	30	-1.63 (6.67)	.359
ITPA auditory reception	31	-11.58 (10.92)	.000
ITPA visual association	30	-4.87 (8.58)	.006
ITPA auditory sequential memory	31	-8.00 (9.34)	.000
ITPA grammatical completion	31	-9.03 (9.48)	.000
ITPA auditory association	31	-8.68 (8.99)	.000
ITPA auditory closure	31	-3.29 (5.09)	.002
ITPA sound blending	31	-7.42 (7.97)	.000
BOEHM	31	-4.68 (-4.77)	.000

Morphology (sum of all subtests)	30	-24.37 (25.30)	.000
Morphology, mastering adverbial forms	30	-3.50 (5.43)	.001
Morphology, mastering comparative forms	30	-4.33 (7.03)	.003
Morphology, mastering superlative forms	30	-5.37 (6.22)	.000
Morphology, mastering present tense	30	-4.53 (5.49)	.000
Morphology, mastering past tense	30	-2.57 (5.55)	.003
Morphology, mastering relative forms	30	-3.53 (5.38)	.002
Rapid serial naming Sum of mistakes in naming colours	30	1.28 (3.61)	.057
Rapid serial naming Time of naming colours	30	11.53 (25.34)	.030
Rapid serial naming Sum of mistakes in naming pictures	30	-0.24 (2.94)	.752
Rapid serial naming Time of naming pictures	30	2.77 (23.42)	.519
Face and oral motor functions	31	-3.68 (5.43)	.001
Tongue motor functions	30	-1.70 (2.35)	.001
Jaw motor functions	30	-0.53 (1.22)	.030
Palatal motor functions	31	-0.19 (0.54)	.139
Face motor functions	30	-1.63 (3.02)	.011
Syllable repetition	31	-2.39 (4.21)	.003
Word repetition	31	-3.45 (2.42)	.000
Non-word repetition	31	-2.58 (3.26)	.000
Makekeo	28	-2.86 (4.87)	.004
Token (sum of all subtests)	27	-4.26 (5.70)	.000
Token1	27	-0.56 (1.55)	.073
Token2	27	-0.11 (1.01)	.549
Token3	27	-0.41 (1.52)	.137
Token4	27	-0.67 (1.49)	.036
Token5	27	-2.15 (3.59)	.004

In the discriminant analysis, six tests showed good sensitivity (89.3%, CI 95%: 71.8% to 97.7%) and moderate specificity (75%, CI 95%: 47.6% to 92.7%) when diagnosing SLI. This

group of six tests consisted of the Sentence level test of speech comprehension, three subtests of Morphology test addressing the mastering of present tense, superlative and comparative forms respectively, a self-made test of word repetition and, finally, an assessment of the motor function of the palate. With these six tests 84.1 per cent of the children with diagnosis F80.1 or F80.2 were correctly classified.

5.3 Study 3. Increasing prevalence of SLI in primary healthcare

The prevalence of SLI in age group 0-15 years was 0.04 per cent in 1989 and 0.69 percent in 1999. In age group 0-6 years the prevalence in 1989 was 0.09 percent and in 1999 0.85 per cent. The increase was statistically significant ($p < .001$). The number of all SLI diagnoses was higher in boys than in girls ($p < .001$). Boys had a bigger number of SLI diagnoses with receptive difficulties (Table 14) than girls ($P = .037$) and the increase of the receptive difficulties in boys was statistically significant ($p < .001$). The population of children aged 0-15 years was 35 228 in 1992 and 38 344 in 1999.

Table 14. Numbers of boys and girls with diagnoses F80.2 and F80.1

Diagnosis	1992 boys	1992 girls	1999 boys	1999 girls	Total boys	Total girls
F80.2+3153A	14	7	130	35	144	42
F80.1+3153X	21	4	75	24	96	28
Total	35	11	205	59	240	70

Two samples of DLD, covering three years, were collected. The prevalence of delayed DLD was higher than the prevalence of SLI in both three-year samples (Table 15). Counting

together the prevalence of SLI and DLD in each of these samples suggests a prevalence of 2.5 per cent. The number of SLTs increased from 9 to 24 SLTs during the study period, but the increase in the children with SLI was higher than that of SLTs (Table 16). Thus, caseloads in SLT clinics of children with SLI increased annually during the observed period (Table 16)

Table 15. Samples of DLD

Sample years	DLD	SLI in age groups 0-15 years
1989-91	116	60
1996-98	909	664
total	1025	1264

Table 16. Number of SLTs compared to number of children with SLI

Year	1989	1999
SLI	15	266
SLTs	9	24
Comparing SLI with SLT	1.6	11.1

5.4 Study 4. Type and duration of home activities of children with and without SLI

The children with SLI *played less outdoors* ($p = .03$) and *changed more activities* ($p = .03$) and *played less table games* ($p = .03$) than their typically developing controls (Table 17). In order to test the strength of the putatively observed statistically significant differences, the data was reanalysed by using the most unfavourable scores for each activity and checking the specificity of the present findings. In the specificity testing the statistically significant difference in *Playing table games* disappeared ($p = .08$).

In one activity (*Watching TV/video*) the hours spent on it were similar in both groups. In all other studied activities (*Playing table games, Playing indoors, Building, Drawing, Looking at books, Playing electric games, Listening to reading, Exercise at home indoors, Activities with music, Guided hobbies, Meal times, Washing, sauna, Doing homework*) there were differences between the groups but the differences were not statistically significant (Table 17).

Table 17. Home activities. Statistical significance <.05, sum of hours, day mean (SD)

Activity	p	Children with SLI, sum of hours	Control children, sum of hours	Day Children with SLI Mean, (SD)	Day Control children Mean, (SD)
Playing outdoors	0.02	18.5	49.5	0.925 (0.832)	2.48 (2.60)
Playing indoors	0.42	41.0	39.5	2.05 (1.74)	1.93 (1.88)
Building	0.92	11.0	13.0	0.55 (0.94)	0.65 (1.33)
Drawing	0.33	13.5	6.5	0.70 (1.39)	0.40 (0.79)
Watching books	0.78	22.0	23.0	1.10 (1.25)	1.15 (1.66)
Playing table games	0.05	6.5	16.0	0.40 (0.79)	0.80 (1.07)
Playing electric games	0.50	34.0	23.5	1.70 (1.45)	1.17 (1.34)
Listening to book reading	0.05	19.5	14.5	0.98 (1.19)	0.73 (0.97)

Exercise at home indoors	0.57	26.0	17.0	0.65 (1.75)	0.43 (0.86)
Watching TV or video	0.94	69.5	69.5	3.48 (1.53)	3.48 (1.39)
Activities with music	0.94	9.0	5.0	0.05 (0.22)	0.08 (0.24)
Guided hobbies	0.79	11.0	17.0	0.55 (0.81)	0.85 (1.00)
Meal times	0.74	85.0	80.5	4.25 (1.34)	4.05 (1.39)
Washing, sauna	0.06	56.0	43.5	2.8 (1.17)	2.18 (0.80)
Changing activity	0.02	83.0	46.0	4.15 (3.07)	2.30 (2.24)
Doing homework	0.31	11.0	8.0	0.68 (1.00)	0.40 (0.58)

Parents in both groups, children with SLI and their matched controls, had made more than one choice for some 30-minute sessions. However, parents of children with SLI had made these overlapping choices more often than parents of control children, the difference being statistically significant ($p = .04$).

Table 18. Total duration of activities of matched pairs groups. Median of hours, 25% and 75% quartile and statistical significance.

Activity	Matched pairs group	Median (h)	25% quartile	75% quartile	P
Reported total duration of activities	SLI	24.8	21.6	28.0	.04
	control	23.5	20.5	25.3	

The parents were also asked separately for each day, whether the day was usual or unusual. In eight cases the parents of the children with SLI reported that all the days of the studied period followed accustomed habits, the same estimation was given in thirteen cases by the parents of the matched pairs.

6 Discussion

The present study focused on SLI from the viewpoint of the SLTs working in the primary health care. The study questions had arisen from the observations and worries in the clinical practices of the SLTs where more information was considered to be needed of identification and intervention of SLI. Identification of a disease is closely connected to the diseases prevalence. Prevalence, and its possible changes, should be known when planning and developing the services in the primary health care for children with language disorders.

The present study indicated that the SLTs use many tests for assessing each language construct and none of the tests reached the highest values for confidence or frequency of use. Nevertheless, SLTs seemed to use a set of tests which assessed all the language constructs needed. The present study also indicated that the prevalence of SLI was increasing. However, the presently observed prevalence remained lower than the internationally accepted prevalence. In addition, there seemed to be a few differences in home activities between the children with and without SLI. These differences seemed to be related to the ability of the child to organise his or her behaviour.

6.1 The SLTs' test use

The SLTs of the present study used many tests when assessing each of the predefined language constructs and they seemed to prefer a certain battery of tests in clinical use. None of the tests reached the highest values for confidence or frequency of use. Among the tests the SLTs used were tests that were standardised or validated in Finnish, tests with age-related norms, but also, self-made assessment tools. The SLTs assessed language with complementary tools and gathered information through a variety of sources as has also been found in international studies (Camilleri & Botting 2013, Friberg 2010). In addition, the SLTs completed their assessment with tests that had norms for some other language construct than the one it had been designed for, thus representing the use of informal or complementary assessment procedures (Camilleri & Botting 2013, Friberg 2010, Huttunen et al. 2008, Slott et al. 2008). This finding is in line with earlier studies and also clinical observations, suggesting that the SLTs use assessment tools and even screening tools for purposes other than that originally intended (Huttunen et al. 2008, Slott et al. 2008).

Diagnostic thresholds of the tests in the present study were not explicit and the validity of most tests was insufficient (e.g. Laine et al. 1997, Korpilahti 1996, Heimo 1993, Ege 1984). This may explain the result that none of the tests reached the highest values for confidence. The result of the present study supports results found in earlier studies of many tests used in Denmark (Slott et al. 2008) and in Finland (Huttunen et al. 2008). A large number of test seems to be common in the clinics of SLTs in many countries. In addition, two studies in the US (Skahan et al. 2007) and in the UK (Pring et al. 2012, Joffe & Pring 2008) showed that the most-used tests of those countries differed from each other so much that there was no overlap

in assessment even between these two English speaking countries. Obviously, it is not easy to find consensus in the assessment of language disorders in children.

According to the two earlier studies, the SLTs in Denmark (Slott et al. 2008) and in Finland (Huttunen et al. 2008) used 31 different assessment tools and only part of these were standardised which is in line with the findings of the present study. Two standardised tests (ITPA and Boehm) were the same in the present study and in the US according to the study of Betz and associates (2013). When comparing all the tests, standardised and non-standardised, listed in the present study and in the Danish study (Slott et al. 2008), two tests (Sproglig test 1 and Reynell) were the same. Also, a test of morphology, which had been separately constructed for each language, was used in both languages. The results of the present study supported the observation that the tests used to assess children's language skills are internationally highly variable. Language specific or cultural factors may explain this high level of variability.

The present study found a battery of eleven tests whose scores of confidence and frequency of use showed a statistically significant difference in one language construct when compared to all other constructs. However, these tests had different frames of reference and they had been developed in different kinds of child populations. With these eleven tests vocabulary, comprehension, grammar, auditory memory and speech motor skills could be assessed. Furthermore, for the purposes of assessing naming and its velocity, the SLTs actively used the Rapid serial naming test, especially subtests naming colours and naming pictures.

The more the SLTs had confidence in a test the more frequently they used it. However, the variation in their scores of confidence in the tests was high. The high variation in the test scores may lead us to hypothesise that the SLTs rely in their clinical decision making on clinical expertise. This clinical expertise may be present in the form of the work experience, consulting, or opinions of colleagues, outweighing test scores. Relying on clinical expertise and dismissing the psychometric properties of tests may result in using a test based on other factors than the scientific criteria (Klee 2008). However, according to the anecdotal information from the Finnish SLTs, following the scientific criteria when choosing a test has been considered problematic because there is a shortage of Finnish scientific studies about the tests and their properties. Most of the commercially available international standardised tests have also been found to have imperfect psychometric properties (Friberg 2010).

Test use in clinical settings has other challenges, too. The SLTs have reported difficulties in balancing time constraints and in finding the best methods for gathering and analysing the relevant data to guide therapy and monitor its progress, and to perform this with EBP (Betz et al. 2013, Mc Curtin & Roddam 2012, Pring et al. 2012, O'Connor & Pettigrew 2009, Skeat & Perry 2008, Nail-Chiwetalu et al. 2007, Skahan et al. 2007). A test that requires time or equipment that is unavailable to the average clinician shall not be recommended unless it can be shown to result in significantly more accurate decisions than those resulting from the use of simpler or more readily accessible tools (Dollaghan 2004). Ambiguous instructions that leave possibilities for several interpretations may cause avoidance of a test (Huttunen et al. 2008). Alternatively, a simple tool originally intended for qualitative or even screening use may be used as a test because of its handiness. In addition, some standardised language tests have been defined only as psychological instruments (Huttunen et al. 2008, Slott et al. 2008)

and SLTs have developed their own versions of those tests. An example of this in the present study was the self-made non-word repetition test.

The SLTs reported only observational tools for assessing pragmatic skills, as has been found in earlier studies, too (e.g. Huttunen et al. 2008, Slott et al. 2008, Adams 2002). The result was expected as no test was suggested to be prelisted for this purpose. It seemed that there was a lack of any kind of an assessment tool for pragmatics in Finnish. Thus, the conclusion of a missing test is more likely than that of missing assessments of pragmatic skills. For example, parent interview is an essential part of the assessment of children's language skills and parents can give substantial information about their child's behaviour in different situations where pragmatic skills are needed. Questions made for the parents about these situations compose an important part of their interview. However, the way the SLTs in the present study used interview tools seemed not to be coherent and, therefore, consistent tools for the assessment of pragmatic skills are still needed. Assessment of pragmatic skills may also increase the understanding of the link between insufficient language skills and problems with attention or social skills (Guralnick et al. 2006a, Guralnick et al. 2006b, Marton et al. 2005, Jerome et al. 2002, Bishop et al. 2000). The results of the present study also gave support to the assumption that there is a link between insufficient language skills and problems with attention (study 4).

If a disorder in language development is found in an assessment, public health care usually starts an intervention. In Finland assessment and intervention are offered from the public services and they are mostly free of charge. Besides the effects that SLI has on the child and his or her family, SLI has also economic effects on the society, in the form of intervention

expenses, for example. To guarantee an equal and fair treatment of children, the assessment of SLI, based on scientific evidence and criteria, is important. EBP assesses the quality of a study through the research reports but research reports of tests as well as test manuals demonstrate great variation in their quality (Robey 2004). In addition of the variable qualities of research reports, the lack of professional time or knowledge or skills of making good use of EBP have been considered as barriers for clinicians to apply EBP (Brackenberry et al. 2008, Zipoli & Kennedy 2005). The use of EBP in the field of language assessment may be discouraged by recommendations that are too difficult, frustrating, time consuming, or do not yield productive outcomes (Brackenberry et al. 2008). The challenge for the SLTs in their test use is to consider clinical expertise and patient perspectives together with the highest quality of scientific evidence (Dollaghan 2004). Consistent test use is needed and it increases the chance of a reliable assessment. Inconsistent tests together with a shortage of time and limited amount of therapy meetings may cause a degree of variability in judgements made by therapists (John & Enderby 2000). The result of the present study, the SLTs actively using assessment tools without validation or standardisation, supported the view that the SLTs often decide to use other than evidence based criteria when choosing a test.

Many standardised tests are published only in English. Differences in cultural characteristics and language structures may hamper the translation of a test (Huttunen et al. 2008, Slott et al. 2008, Saaristo-Helin 2006, Kunnari 2000, Savinainen-Makkonen 2000). Because of the differences between languages, international tests cannot be used as can be done in many other fields, e.g. in medicine, occupational therapy and physiotherapy. However, resources for the development of new tests and the possibility of their commercial availability in different countries and languages are not similar (Bishop et al. 2016). Internationally studied and reported tests may not be available in smaller populations with their own languages, such as

Finnish. In the countries with smaller populations the SLTs do not have opportunities to use international and standardised tests. However, child language studies in different languages that aim at international publication classify children's language disorders based on tests that have been used in earlier internationally published studies. The inclusion criteria of an international study may include language tests that are not in clinical use because the scores are developed only for study purpose, not for tests that are commercially available (Kunnari et al. 2011). In the present study the list of tests that the SLTs used included international tests that had been translated from English and did not include all tests that are used in international studies. Due to the use of different tests in different settings, criteria for diagnoses, e.g. SLI, may differ in clinical work and in studies. That should worry both clinicians and researchers.

A high number of tests with varied qualities set challenges for the SLTs in clinical settings. A lack of adequate instruments is not, however, the responsibility of the SLTs only. In municipalities the SLTs are employed to give services to inhabitants, not for research. The researchers of child language development are also responsible for providing an adequate set of assessment methods for the clinical work of the SLTs (McLeod & Verdon 2014, Dollaghan 2004). In addition, researchers and clinicians should have enough dialogue to guarantee the feasibility of the test in a clinical context (McLeod & Verdon 2014, Dollaghan 2004). The result of the present study, fluctuating confidence and frequency of use with many assessment tools available for the assessment of children with suspected language disorder, may confirm this need for closer dialogue between researchers and clinicians. Close collaboration between researchers and SLTs in clinical settings is needed to provide good, applied research in developing updated, well documented tests which will serve the needs of the SLTs' clients in the best possible way (Slott et al. 2008). Though the quality of the Finnish tests in the present

study was insufficient and the confidence that the SLTs had in the tests was low, they seemed to have collected effective components and could assess all the language constructs needed. The fluctuating use of tests and fluctuating confidence in them may suggest that the SLTs in countries with smaller populations, for example in Finland, need extra professional expertise. Extra professional expertise may be needed when assessing children with suspected language disorder with these non-standardised tools, compared to the colleagues in, for example, English speaking countries with their standardised tools.

6.2 Language tests identifying SLI

According to the present study, in 26 Finnish tests the scores between the matched pairs were statistically significantly lower in children with SLI. Several language constructs need to be assessed and thus, a comprehensive assessment demands either many tests or one test including subtests for different language constructs (Betz et al. 2013). Studies in the field have aimed at defining '*clinical markers*' of SLI and these studies have been carried out on children of different ages and, furthermore, in different languages (Kunnari et al. 2011, Slott et al. 2008, Stokes et al. 2006, Huber et al. 2005, Conti-Ramsden 2003). To date, these studies have suggested non-word repetition and past tense marking as well as verb morphology and auditory processing to be worth assessing when identifying children with SLI. The result of the present study with its 26 tests classifying children with and without SLI supported the use of these clinical markers and also, their inclusion as universal characteristics of language difficulties. The present data did not offer scores in different ages or thresholds for the diagnosis in each test. However, language deficits that were found to identify children with SLI in the present study seemed to be consistent with those found in international studies (Stokes et al. 2006, Slott et al. 2008, Bortolini et al. 2006, van Weerdenburg et al. 2006).

Among the 26 language tests that separated and the 13 tests that did not separate children with SLI from their controls, were tests that had been translated into Finnish and had standard scores. There were also self-made assessment tools. This result, especially regarding standardised tests not able to separate the children with SLI, asks for further studies with bigger data. Assessing language skills aims at the best performance of the child with a suspected language disorder. In addition to language skills, many factors may contribute to the actual performance of the child, for example the lack of concentration as well as the effects of fatigue when performing many tests. Thus, 26 tests found in the present data to classify children with and without SLI is regarded as a high number of tests and the SLTs need professional expertise to decide which tests to administer in each case. Furthermore, professional expertise is needed because the quality of these tests varies a lot. It would be reasonable to reduce the amount of language tests in clinical use of the SLTs and thus, to unify the clinical practices of the SLTs in Finland.

SLI includes both expressive and receptive problems and a group of six tests in the present study most often gave the right categorisation of the children in the original grouped cases of F80.1 and F80.2. However, there were inconsistencies in test performances. Therefore, the result of the present study requires further studies with a larger number of children. Therefore, the result of the present study supports international discussion of the need of these two diagnoses and the difficulties in defining their borders (Law et al. 1998b).

Examining the results of Studies 1 and 2 together showed that in the group of tests that were able to separate children with SLI from their matched controls and, in the group of tests that the SLTs had most confidence in and used most frequently there were eight tests that were the

same. These tests were Sproklig test 1, Boston naming test, ITPA subtests auditory reception, grammatical completion and auditory sequential memory, Morphology test with all subtests, Repetition of words and repetition of syllables. The test of Rapid serial naming, the Sentence level test and the jaw and palatal motor functions seemed not, however, to discriminate the children with SLI from the controls, but both the frequency of use of these tests and the confidence the SLTs had in these tests were high. On the other hand, there were tests that the SLTs scored as having a low frequency of use and inspiring low confidence but that did separate the children with SLI from their controls. These tests were ITPA subtests of visual association, auditory closure and sound blending and Makeko (Diagnoses of Mathematical Basic Concepts). These tests' qualities and validations vary a lot from each other, from standardised tests to assessment tools with age related norms. The result that these five tests separated children with and without SLI may also be due to the easiness or the difficulty of the test. The tasks that a test includes may be so easy that most children, even those with a language disorder, can manage them. Other tests can also be so difficult or take such a long time to perform that many children, even without language disorders, cannot manage them.

The present study suggested that many of the tests can classify children's language skills. However, in Finland the assessment of language skills is performed with tests having large variability in their validation and quality. Thus, professional expertise is needed to estimate a test's ability to identify a language disorder and to interpret its results. The SLTs in Finland do need clinical expertise when choosing an assessment tool for each child, because all the 26 tests cannot be performed. The interest and research activity directed to test use may in the future increase scientific Finnish publications. In addition, increased research activity may increase the development of standardised tests and their commercial versions in Finland. This, at best, may have the consequence of diminishing the number of tests in clinical use and the

suggestions in national guidelines. Finnish is a language with a small number of users which may explain why, at the time of the present study, there were only a few standardised tests available in Finnish. Researchers, SLTs and, in addition, commercial publishers should have more interest in developing or translating and standardising tests in Finnish.

6.3 Prevalence of SLI

The present study examined the prevalence of SLI in the SLTs' clinics in the primary health care. The ICD-criterion for the diagnosis of SLI was in use and the diagnoses were made in the secondary health care. Unfortunately, criteria for SLI in clinical settings and in research seem to be different in Finland (e.g. Kunnari et al. 2011) which hampers, for example, the estimation of the prevalence of SLI. The prevalence of SLI in the present study increased statistically significantly during the observed period of 11 years. At the end of the period this prevalence was less than one per cent. Though the prevalence of SLI was increasing during the eleven years study period, still, at the end of the study period it remained lower than the reported prevalence in international studies (Law et al. 1998, Tomblin et al. 1997). It is thus possible that SLI was under diagnosed in Finland. There are a few Finnish prevalence studies. Therefore, the national SLI publications (e.g. Finnish Current Care of SLI) refer to the internationally accepted higher prevalence rather than that found in the present study.

In international studies the prevalence of SLI seemed to be connected to the criteria use (Law et al. 1998). Therefore, the present study also analysed the prevalence of SLI and DLD together. The prevalence of SLI and DLD together showed a prevalence of 2.5 per cent in the age group up to six years. This prevalence remained low though it came closer to the

international median figures for SLI (Law et al. 1998). Also, in an earlier Finnish study from the secondary health care of the prevalence of SLI (Helminen & Vilkman 1990) the observed numbers were found to be smaller than the internationally accepted prevalence numbers (Law et al. 1998, Tomblin et al. 1997). SLI seemed to be more frequent in boys though it was increasing in girls, too. Most of the children with SLI in the present study were five or six years old, but the age for making the SLI diagnosis was not studied. Comparing prevalence numbers and drawing conclusions from them is challenging because the variation in reported prevalence is large and the SLI-criteria used seem to vary from study to study (e.g. Law et al. 1998)

According to anecdotal information language disorders have different kinds of care paths in municipalities. These differences may lead to under diagnosing of SLI. The question of the prevalence of SLI is also connected with the debate on terminology (e.g. Botting et al. 2014, Reilly et al. 2014). As discussed earlier, the debate on the terminology of SLI has been varied as have been the diagnostic criteria of SLI, too (Botting et al. 2014, Reilly et al. 2014). Due to the lack of agreement about terminology and criteria of language disorders, including SLI, multidisciplinary and multinational attempts have been made in order to get an agreement on them (Bishop et al. 2016a, Bishop et al. 2016b). So far, the reported statement includes the use of consistent terminology and proposes the term '*language disorder*' for children who are likely to have language problems with a significant impact on everyday life and social interactions, even with education (Bishop et al. 2016a, Bishop et al. 2016b). The term '*language disorder*' includes that there are long-lasting effects into middle childhood and even beyond (Bishop et al. 2016a, Bishop et al. 2016b).

The problematic nature of the language disorders appears when diagnosing between the expressive and the receptive disorders (Law et al. 1998). A child with an obvious expressive disorder may also have disorder in comprehension and vice versa. The prevalence of SLI with receptive problems seemed to increase in boys during the study period of 11 years. The trend towards an increase in receptive difficulties can be considered to be a worrying state of language disorders. Difficulties in understanding what one is told create many kinds of risks for an individual, for example, risks of problems in social relations and behaviour (e.g. Finnish Current Care 2010). Due to the importance of receptive skills in children's development there is a prime need for a valid test for assessing these skills and recognising problems in them. Thus, the receptive language difficulties of children need further studies with bigger data, and, hopefully, both internationally and nationally.

It has been discussed that the possibility for services increases the use of services. Therefore, the present study included the number of SLS each year, too. The number of SLTs increased during the 11-year follow-up period in the town. This increase could have explained, at least in part, the observed increase in the prevalence of SLI. In the beginning of the period, one SLT had had only one or two children with SLI in her therapy in a year. The number of children with SLI per therapist increased and was ten times bigger at the end of the study period. Because the criterion for the referrals remained stable, the result did not suggest that the increase in SLI was caused by the increase of SLTs. The increase in the number of children with SLI in SLTs' clinics had other consequences, too. The more children there were, the more services were needed. However, resources for the intervention were not increased. The most important result was that individual speech and language therapy could not be offered at the same amount and in the same way as in the beginning of the period. The SLTs had a challenge to develop more ecological ways to support their child clients' speech

and language development. This ecological principle of intervention should, at best, have an effect on the activities at home too, studied in the present study 4.

SLI influences the child and her or his parents and the emphasis on the role of the environment in identification and intervention was constantly strengthening during the time of the data collection of the present study. The Ecological systems theory (Bronfenbrenner & Ceci 1994) has described that organisations at different levels of the ecological systems surrounding the child have an effect on the child's development though not necessarily all of the elements of the interacting systems interact directly with him or her. Together with the individual effects SLI and its prevalence, there is also an economic effect on the society. The prevalence of SLI and also, its increase should be taken into consideration at different levels of the Ecological system theory (Bronfenbrenner 1979). Especially, the macrosystem that includes cultural values, the economy, service systems such as health care and education should be aware of the prevalence of SLI and its possible changes. According to the Ecological system theory, the macrosystem makes the needed changes in services possible in a society (Bronfenbrenner 1979, Bronfenbrenner & Ceci 1994).

The present data suggested an increase in the prevalence of diagnosed SLI. However, the increase was not confirmed in other national statistics. The confirmation is lacking mostly because of the lack of national statistical data. In Finland, the right of a child to economic support as well as to special services, for example, the use of small groups in day-care or at school, are based on the clinically confirmed diagnosis of SLI. The Social Insurance Institution of Finland (Kansaneläkelaitos Kela) provides some statistical information about speech and language therapy services paid by Kela. According to its statistics from 2014, at

least a seven years speech and language therapy period, has been paid to eight per cent of all individuals with serious disabilities based on one diagnosis in the diagnostic group F80 (Autti-Rämö et al. 2015). However, information about the proportion of SLI in this group F80 is not available. Expenditure on rehabilitation service of speech and language therapy provided by Kela in 2014 for children aged 0 to 15 years has been more than 21 million euros (Kelasto http://raportit.kela.fi/ibi_apps/WFServlet). In Vantaa, the expenditure on speech and language therapy for the same age group and the F80 diagnosis group was more than two million euros in 2014. The publicly available statistics of Kela did not provide statistics of more specified diagnoses, for example SLI. Neither was the number of the SLTs offering private clinic services for Finnish children with SLI available.

6.4 Type and duration of the home activities

The findings of the present study suggested that children with SLI played less outdoors, and changed activities more frequently than their matched controls. Furthermore, the parents of the children with SLI had made more overlapping choices than the parents of the typically developing children. The result may suggest that interviewing the parents of children with language disorders should include questions about their observations of their child's home activities. This knowledge of the home activities may confirm the diagnosis, specify the intervention strategies and allow more precise advising of the parents. According to the findings of this prospective study, children with SLI had in some respects different daily activities compared to their matched controls (see also Tandon et al. 2011, Hammer et al. 2010, Schoon et al. 2010, Zimmerman & Christakis 2005). The children with SLI, compared to their controls, seemed to have more situations when they did not concentrate on one activity at a time. The difficulty of the children with SLI to maintain one activity may also

explain the fact that their parents scored more overlapping choices than the parents of the control children. Also, the parents of the children with SLI reported fewer activities of *Playing outdoors* than the parents of the control children. In most of the home activities, however, no statistical difference was found between the pairs.

Language disorders do not occur in test situations only but make an appearance on all living where language is needed. Language disorders and their complexity form a challenge not only to the assessment but also to the intervention. Along with the development of ecological approaches in the research and intervention of children with disabilities (e.g. Bronfenbrenner & Ceci 1997, see also Hildén et al. 2001, Määttä 2001) more and more emphasis has been placed on the professional's collaboration with children's parents (e.g. Woods et al. 2011, Wilcox et al. 2011, Malani et al. 2010, Buschmann et al. 2009, Baxendale & Hesketh 2003, Hammer et al 2001). As stated earlier, parents' interview is an essential part of the assessment of language disorders (Bishop & McDonald 2009). In addition, parents' ratings have been found to be as effective an assessment as the teachers' observations or standardised test scores (Bishop & McDonald 2009). The result of the present study may suggest that questions of home activities and time spent on them are highly recommendable when interviewing the parents and, also, when advising them. Collaboration between the parents and the SLTs is supposed to cause beneficial changes in the daily activities of children with disabilities at home and those changes, in turn, should support children's development and diminish the problems caused by their individual disabilities. In clinical situations, the SLTs settings provide instructions on activities that support children's language development. In addition, SLTs offer families individual material to be used in homes. This material consists, for example, of individually modified table games. The SLTs also guide parents on book reading in an age-appropriate way. The collaboration between the parents and their SLT includes also

discussions about the behaviour of their child with a language disorder and about the possible problems the disorder may cause in his or her behaviour. The SLTs often provide guidance and instructions for the parents to manage these problems. The findings of the data on the home activities of the children with and without SLI suggested only approximate differences between the study groups in *Playing table games* and *Watching books* or *Listening to book reading*. These activities had been commonly recommended to the parents in printed guidelines and orally by the SLTs' in the clinics. However, only activities related to children's behaviour, not to these commonly guided activities, showed statistically significant differences between the two groups. The result of more often changing activity, less playing outdoors and parents having more overlapping choices supported the experiences that parents have reported anecdotally: challenges with daily living activities are common in the behaviour of children with SLI. Though the differences in home activities were few, the result may suggest that a language disorder is not only a disorder in language use but may have an effect also on a child's behaviour and his or her social relations.

Though the difference in the *Playing table games* parameter did not remain statistically significant its trend to difference was analogous ($p < .08$) to the *Playing outdoors* parameter. In both of these activities, children need language abilities to enter the peer group, to maintain involvement with peers and to solve conflicts in appropriate ways. The results of a longitudinal study with a two-year follow-up of peer relationships of children with mild developmental delays have revealed only modest increases in children's peer interactions and the existence of poorly organized and conflict-prone pattern of peer interaction (Guralnick et al. 2006). Difficulties in the social pragmatic skills of children with SLI may also provide an explanation for the clinical experience of the SLTs that the parents of children with SLI have reported difficulties in their daily life and a need to keep an eye on the behaviour of their

child. Parents have also discussed these difficulties in a Finnish parental journal of children with SLI (Kielipolku 2013). Because of the children's problems in language use, parents of children with SLI might have felt unsafe to leave their child outdoors playing together with peers without adult supervision. Many mechanisms have been suggested through which family risk might have influenced the peer relationships of children with mild developmental delays (Guralnick et al. 2006). Among the factors of family risk have been also the levels of parents' stress and their ability to support their children's development and behaviour (Guralnick et al. 2006). It has been suggested that parents' increased activity in arranging peer play opportunities for their child with a mild developmental delay is unrelated to the peer interactions of the child (Guralnick et al. 2006). Thus, parents' activity in this area may be a necessary but not sufficient condition to promote their child's peer relationships as the skills of a child needed in these relationships may be required as well (Guralnick et al. 2006).

As stated earlier, the findings of the present study suggested that the children with SLI seemed to have fewer home activities with peers than their controls. This may be a sign of more than only a language problem. Children with SLI often viewed themselves as at a social disadvantage compared to their peers, not having enough friends, often being lonely, and never being chosen as a leader in a group situation (Durkin & Conti-Ramsden 2007, Jerome et al. 2005, Marton et al. 2005). The social status of children among their peers seemed to be of greater value for them than the academic achievements, thus having a larger impact on their level of self-esteem. However, the diminished self-esteem, together with the lack of social competence and pragmatic problems in language use, may also have had an effect on decreasing the possibilities to improve the pragmatic language and social skills. In addition, the conversational language behaviour of children with language development delays has been found to show a high incidence of unintelligible, grammatically inappropriate and

tangential utterances (e.g. Bishop et al. 2000). In a study of the social pragmatic skills of children with SLI, including negotiation, conflict resolution skills and ability to access an on-going interaction, Marton and associates (2005) have demonstrated difficulties in social pragmatics. Moreover, in their study the children with SLI have exhibited significantly poorer social pragmatic than linguistic skills. The reactions of the children with SLI have reflected the tendency of departing the scene without resolving the conflict or expecting a third person to solve the conflict. The disorders of children's conversational behaviour as well as of social pragmatic skills (Marton et al. 2005, Bishop et al. 2000) may be in line with the suggested findings of this study.

SLI has been found to have a strong genetic basis (Rice 2012, Bishop 2009, Grigorenko 2009) that may manifest itself in the daily activities of the family, too. Thus, parents' own unwillingness, for example, to play with their child may have resulted in low commitment to play table games. Table games are commonly used tools for language intervention, too, and the SLTs recommend, even modify individually, table games for children with SLI and their parents to be played together at home to advance the language skills of the child. These recommendations often include playing activities for every day. Therefore, the finding of the present study, the lack of a statistically significant difference in playing table games, was an interesting finding. Further discussions require new studies where the instructions given to the families and the parents' language skills and parents' interests on language are studied, too.

The findings of this study of more changing activities and more parents' overlapping choices also supported the clinical experiences of SLTs, according to which parents have reported their children with SLI having problems in organising their own behaviour in a coherent and

consistent manner. Because of the children's problems in organising their behaviour, their parents have commonly been advised to modify their own language behaviour, too. Parents of children with a DLD have been found to produce significantly more clarification requests, self-repetitions, corrections, topic reintroductions, interruptions and incoherent responses than the parents of children with normal language development (van Balkom et al. 2010). Children with DLD also have been found to lack insight into the social aspects of discourse, that is, social cognition (van Balkom et al. 2010). Parents' use of the above mentioned strategies, based on language use, together with their child's problems in language and discourse may have resulted in a loss of conversational coherence and shared interest, partly increasing the length of the moments of *Changing activity* in this study. Children with SLI had also been found to have difficulties in recognizing the perspective and needs of other individuals (Marton et al. 2005). They seemed to fail frequently to provide adequate explanations to others regarding their behaviour and exhibited problems in executive functions (Henry et al. 2012, Marton et al. 2005). Because of the difficulties in higher order thinking and reasoning skills, children with SLI may have difficulties in analysing social situations, setting goals to resolve a conflict or to initiate an interaction, with planning and organizing the social situation to negotiate, and with shifting the setting (Henry et al. 2012, Marton et al. 2005). In these data, all the formerly mentioned difficulties might have appeared in daily living as moments when parents could not specify the activity of their child but chose the alternative of *Changing activity*.

As discussed earlier, the behaviour of the children with SLI has been found to be affected by functions that appear in complicated clusters and have not been focused on the verbal behaviour only (Henry et al. 2011, van Balkom et al. 2010, Marton et al. 2005). The difficulties have extended to non-verbal behaviour, too (e.g. Henry et al. 2011). The executive

functioning difficulties of children with SLI have been found to show similar prevalence as of those of children with ADHD (Henry et al. 2011). Also, the comorbidity of language disorders and other developmental disorders have been discussed through the decades (e.g. Hill 2001). The findings of the present data may suggest that children with SLI exhibited more varying activity and lack of concentration and this caused the bigger number of overlapping choices of the parents of the children with SLI than the parents of their controls. Altogether, the information about the possible connections between a language disorder and behaviour can be useful for the SLTs when interviewing parents and supporting the parents to enhance their children's development.

7 Strengths and limitations

One of the most important strengths of the present study was that the data of the children with SLI were from the research project *SLI in Vantaa* which represents the largest data ever collected in the Finnish primary health care of children with SLI. In addition, each set of data of the children with and without SLI and the SLTs of the present study considered SLI and its assessment strategies in one town.

The strength of Study 1 was that the data of the SLTs' test use included all the SLTs in one town which made it possible to guarantee the similarity of the equipment and the homogeneity in training the use of the tests. Also, the number of SLTs in the study can be considered to have been representative even if not very large. All the SLTs of the town returned the questionnaire. However, their feedback on the questionnaire was that it was laborious to complete during the busy hours of clinical work. Due to the empty spaces on the

questionnaires the numbers of answers in the scores of confidence and frequency of use were not consistent. The limitation of the Study 1 was that small data and empty spaces on the questionnaire influenced the methods used in the analysis and, thus, the conclusions to be drawn from the results. However, the present study provides detailed data about test use in clinical work of the SLTs in the primary health care in Finland. Also one limitation of the present study was that it was not possible to include the evaluation of the quality of the tests and assessment tools that were used in primary health care and in this study.

The strength of Study 2 was that the data were a representative sample of SLI because all the children born in 1998 and 1999 who were diagnosed as having SLI living in this town were included in this study. However, the case-control setting diminished the number of children. The study protocol was carefully considered to cause minimal disturbance to the children. The children's rehabilitation at the same time as testing, the large number of tests and the long time used on testing caused differences between the age groups when tests were performed and made the blinded testing impossible. That can be seen as a limitation of the Study 2. Furthermore, the number of SLTs assessing the children, with and without SLI, was large and their test training for the present data was not verified. Also, the SLTs were not instructed in the way they administered the tests. The only instruction given was that they could use their clinical knowledge when deciding in what order or in how many parts they carried out testing. However, the SLTs in Finland have a coherent university education that is supposed to guarantee consistent principles of test use. Also, because the present study aimed at examining the clinical practices of child language disorders, extra practice or advices were not needed.

One further limitation may be that the children without SLI, seen as typically developing children, relied on the screening that was administered in child welfare clinics. Incorporation bias relied on this screening as it is in the clinical work of SLTs. The children in matched controls' group represented the children that in real life do stay in the group of typically developing children.

There are also other limitations concerning the statistical analyses of the data. If the studies 1, 2 and 4 had reached all the children known to be diagnosed in the town the possibilities for more qualified statistical analyses would have been possible. In the case of all these data the statistical analyses had to be carefully considered because of the relatively low number of children and their different ages when tested. Furthermore, there were differences between participants in each study. The missing data in each study compromised the result of the statistical analyses used, too. In each case the statistical analyses were thoroughly considered and a statistician looked through the data that were collected.

The strength of Study 3 was that the data were from a long period of time and from one town. Prevalence of SLI was evaluated in a retrospective study and it was not possible to change the collected statistics or their accuracy. The limitation of the Study 3 was that the data of this retrospective study included some inaccurate facts, which may have increased or decreased the conditions identified. First, the temporarily employed SLTs may have affected the preciseness of the registering of SLI diagnoses because of a possible lack of knowledge of the accuracy of the statistics. Second, in some cases the diagnoses from the secondary health care had not reached the SLTs, so they could not have listed them. However, such unlisted

diagnoses could have appeared seldom and their statistical effect can be considered to have been minimal.

The strengths of Study 4 were the case-control setting and the prospective data collection daily during the same time period with all children. In addition, all children of this matched case-control study lived in the same town, in the same areas, thus having supposedly the same sort of social surroundings and similar facilities for their daily activities. The cultural background of the participants in the study was homogenous. Among the strengths of the present study were also the length of the study period, one week, and daily questionnaires that are supposed to diminish the mistakes of memorising. The cohort was large and the number of returned questionnaires was satisfactory, however, the number of case-control pairs remained small. Due to the small data, clear-cut conclusions about parameters which did not turn out to differ statistically significantly could not be drawn and only preliminary conclusions could be drawn from the data. The subjective nature of the parents' observations of their own child's behaviour may also be a weakness of the study. Many of the parents of the children, both with and without SLI, are aware of the commonly known recommendations of children's developmental activities. These recommendations may have affected parents' scoring on the questionnaires but there was no means to find out whether this had happened and if so, whether the parents of the two groups had differed from each other in this respect. The data of home activities remained smaller than expected because part of the sent questionnaires of home activities was lost during the mail delivery, independent of the researcher's actions. The study criterion of the home activities data included the questionnaire filled in at the same period and, therefore, it was not possible to repeat the questionnaire delivery.

The small number of matched pairs was the main weakness of this study. The cohort of children was large and the number of questionnaires was satisfactory but, however, the number of case-control pairs remained small. Clear cut conclusions about parameters of home activities and, in addition, test use cannot be drawn and only preliminary conclusions can be made from the data. In addition, though the legislation in Finland should guarantee similar care paths, there are limitations in generalising the results because of variations in the organisations in different municipalities in Finland.

8 Conclusions

The result of the test use of SLTs as well as the test achievement of children in tests suggested that the SLTs' clinical decisions are probably best achieved through a variety of means. However, the SLTs' use of a repertoire of tests in heterogeneous ways constitutes a risk of variability in specification of language disorders, diagnosis and intervention. The result of the present study of the current practice in test use show that SLI can be identified with a large battery of tests and, in the future, the defining of SLI requires discussions of the criteria. One step towards the consent criteria may be increasing the test knowledge of the SLTs and also, critical rating in their use. Increased training in tests use is needed for the SLT students in the universities and also, for the SLTs with a history in clinical work. Furthermore, the prevalence of SLI in this study was low compared to internationally reported prevalence. In Finland, the possibilities of under diagnosing should be taken into consideration and unifying the care path of language disorder is needed. More effective ways are needed to support parents' role in encouraging the language development of their children as part of daily home living. SLI seemed to be more than a disorder in language; it seemed to be connected, for example, with restlessness and difficulties in maintaining constant activity.

The present study can be considered to have been professionally important if it arouses interest to set up a national study, with clinicians and researchers collaborating together.

9 Clinical implications

The perspective of the present study with its four data was in the primary health care. The WHO's definition of health underlines the responsibility of authorities in the primary health care to screen the possible developmental language disorders and to start the early intervention (Constitution of the World Health Organization 1948). The Finnish Current Care of SLI also emphasizes the importance of early intervention and adapting the support to the environment of everyday living (Finnish Current Care 2010). The findings of the present study can be used when developing the care path of children with SLI, including the prevalence and the assessment.

It seems that language disorders in general are under-studied in Finland. Especially, the primary health care's role in the care path of SLI in Finland is under-studied. This can be considered to be as a worrying story. SLI has effects on an individual and also, on the economics of society. The possible loss of the economic potential due to language disorders in Finland has not been studied, unlike in the UK and the US (Law et al. 2012, Ruben 2000). The primary health care plays a critical role in the care path of children's language disorders though the final diagnosis is made in the secondary health care. The present study increases the knowledge and aims at encouraging discussion of the role of the primary health care in the field of language disorders. Though the present study did not evaluate the validity of the tests

and assessment tools the findings indicate that in the future the validity of the tests used should be carefully studied. An uniform care path, equal use of tests when assessing language disorders, consent of criteria of SLI as well as the role of the parents in promoting their child's language at home asks for multidisciplinary discussions. In the future, we need more knowledge of daily activities of children with SLI and their parents' role in it. In addition, more knowledge is needed of the benefits of the effective activities between parents and children when trying to diminish the possible harmful effects of SLI.

Due to the small number of children in the data more detailed conclusions about the possible differences in home activities between children with expressive or receptive disorder, or between genders, are not possible. However, if the international debate on the terminology of SLI accepts the definition stated in DSMV-5, in which communication disorders include language disorders, speech sound disorders and social (pragmatic) communication disorders studies with bigger data in Finland are also needed. Hopefully, studies of home activities will stimulate an interest, and more sophisticated technological methods can be used when studying the children's home activities in these groups are needed in Finland. The need for further, even national, studies is well validated. The disorders are characterized by deficits in the development and use of language, speech, and social communication, respectively and they may produce lifelong functional disorders (e.g. Arkkila et al. 2008, Durkin & Conti-Ramsden 2007).

Language disorders begin early in life and they produce lifelong functional impairments (DSM-5). The comorbidity of various difficulties as well as the sequence or the correlation between them is a risk for the later development (e.g. Clegg et al. 2005). Emotional and

behavioural problems connected with language disorders have been studied (e.g. Gregl et al. 2014, Horner 2011, Pinborough-Zimmerman et al. 2007). Thus, the studies of language difficulties and criminal behaviour have seemed to show both a sequence and comorbidity (Bryan et al. 2015). There seems to be a risk that language disorders may also cause an exclusion from the job market. More often than before, speaking, reading and writing skills are needed in getting employment, due to the digitisation and computerisation of society. Acquiring language is crucial for later success in education and livelihood but less research is published on SLI compared to other neurodevelopmental disorders (Bishop 2010).

Early identification of language disorders using reliable sources of information is crucial. The reliable sources of information on children's language skills can be defined to include trustworthy and consistent tests and, in addition, interview of the parents about their child's behaviour. Thereafter, an individually timed and well targeted intervention is needed for the children with SLI to diminish their possible lifelong functional impairments. More support for national studies of SLI are needed. Language disorders should be involved in each research concerning child welfare in Finland in order to increase knowledge about the Finnish language disorders, including SLI. Increased knowledge of Finnish language disorders and their care paths and may improve individual participation of the child with SLI and finally, their quality of life.

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Appendix 1 Questionnaire of SLT's test use

MITÄ TESTEILLÄ MITATAAN?

Kysely Vantaan puheterapeuttien käytössä olevien testien/arviointimenetelmien käyttökelpoisuudesta.

Kyselyllä on tarkoitus selvittää mitä menetelmiä puheterapeutit käyttävät 5-8 vuotiaan lapsen X sen luotettavuuden arvioivat niiden käyttökelpoisuuden. Kysely liittyy Dysfasia Vantaalla -tutkimukseen.

Lomakkeella on 14 testiä/arviointimenetelmää, joiden käyttöä arvioit 3 kysymyksellä. Pyydän sinua vastaamaan kysymyksiin itsenäisesti keskustelematta kollegan kanssa.

Puheterapeutin valmistumisvuosi

Puheterapeutin syntymävuosi

OHJE:

Rastita se kielellisen taidon osa-alue, jota menetelmä mielestäsi mittaa ja käytä numerovaihtoehtoa sen luotettavuuden ja käyttötiheyden arviointiin.

Kysymys A.

Mitä seuraavista kielellisen taidon tai puheen osa-alueita menetelmä mittaa? Rastita vaihtoehto/-ehdot. Jokun muu, mikä? -vaihtoehtoon voit vastata riveille 15-16. Merkitse riveille myös menetelmän nimi.

Kysymys B.

Kuinka luotettavasti menetelmä tätä taitoa mittaa? Arvioi numerovaihtoehtoilla.

1 = hyvin luotettavasti 2 = luotettavasti 3 = vaatii tulkintaa 4 = epävarma 5 = ei soveltu tämän taidon mittaamiseen

Kysymys C.

Kuinka usein käytät menetelmää lapsen taitoja arvioidessasi? Arvioi numerovaihtoehtoilla.

1 = hyvin usein 2 = usein 3 = vain valikoituissa tilanteissa 4 = harvoin 5 = en koskaan

Mikäli sinulla ei ole jotain testiä/arviointimenetelmää, jätä kyseinen rivi tyhjäksi.

Mikäli et käytä jotain testiä/arviointimenetelmää, arvioi se jos mahdollista ja kirjoita syy käyttämättömyyteen lomakkeen lopussa olevaan vapaaseen tilaan.

testi O	sanavarasto
	X
	B 2
	C 1

Vastausesimerkki:

Kysymys A. Rastita vaihtoehto

Kysymys B. 1=hyvin luotettavasti 2=luotettavasti 3=vaatii tulkintaa 4=epävarma 5=ei sovellu ko. taidon mittamiseen

Kysymys C. 1=hyvin usein 2=usein 3=vain valikoituissa tilanteissa 4=harvoin 5=en koskaan

Kysymys A. Mitä kielellistä osa-
aluetta menetelmä mittaa?

Sana- varasto	Ymmär- täminen	Kieli- opin hallinta	Kuulo- muisti	Puhe- moto- riikka	Jotain muuta, mitä?	En osaa sanoa
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TESTI / arviointimenetelmä

1. Lausetesti

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

B	B	B	B	B	B	
C	C	C	C	C	C	

2. Bo Ege Sproglig test 1

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

3. Bostonin nimentäesti

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

4. BOEHM

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

5. MAKEKO

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

6. ITPA

kuullun ymmärtäminen

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

nähdyn ymmärtäminen.

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

auditiivinen järkeily

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

visuaalinen järkeily

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

puheilmaisu

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

B	B	B	B	B	B	B
C	C	C	C	C	C	C
B	B	B	B	B	B	B
C	C	C	C	C	C	C
B	B	B	B	B	B	B
C	C	C	C	C	C	C
B	B	B	B	B	B	B
C	C	C	C	C	C	C

B	B	B	B	B	B	B
C	C	C	C	C	C	C
B	B	B	B	B	B	B
C	C	C	C	C	C	C
B	B	B	B	B	B	B
C	C	C	C	C	C	C
B	B	B	B	B	B	B
C	C	C	C	C	C	C

eleilmaisu										
B: kuinka luotettavasti mittaa? asteikko 1-5	B	B	B	B	B	B	B	B	B	
C: kuinka usein testiä käytät? asteikko 1-5	C	C	C	C	C	C	C	C	C	
kielipillinen täydentäminen										
B: kuinka luotettavasti mittaa? asteikko 1-5	B	B	B	B	B	B	B	B	B	
C: kuinka usein testiä käytät? asteikko 1-5	C	C	C	C	C	C	C	C	C	
kuvien täydentäminen										
B: kuinka luotettavasti mittaa? asteikko 1-5	B	B	B	B	B	B	B	B	B	
C: kuinka usein testiä käytät? asteikko 1-5	C	C	C	C	C	C	C	C	C	
auditiivinen sarjamauisti										
B: kuinka luotettavasti mittaa? asteikko 1-5	B	B	B	B	B	B	B	B	B	
C: kuinka usein testiä käytät? asteikko 1-5	C	C	C	C	C	C	C	C	C	
visuaalinen sarjamauisti										
B: kuinka luotettavasti mittaa? asteikko 1-5	B	B	B	B	B	B	B	B	B	
C: kuinka usein testiä käytät? asteikko 1-5	C	C	C	C	C	C	C	C	C	
sanojen täydentäminen										
B: kuinka luotettavasti mittaa? asteikko 1-5	B	B	B	B	B	B	B	B	B	
C: kuinka usein testiä käytät? asteikko 1-5	C	C	C	C	C	C	C	C	C	
ääniteiden yhdistäminen										
B: kuinka luotettavasti mittaa? asteikko 1-5	B	B	B	B	B	B	B	B	B	
C: kuinka usein testiä käytät? asteikko 1-5	C	C	C	C	C	C	C	C	C	
7. Reynel/RLDS III										
Puheen ymmärtäminen										
B: kuinka luotettavasti mittaa? asteikko 1-5	B	B	B	B	B	B	B	B	B	
C: kuinka usein testiä käytät? asteikko 1-5	C	C	C	C	C	C	C	C	C	
Puheilmaisu										
B: kuinka luotettavasti mittaa? asteikko 1-5	B	B	B	B	B	B	B	B	B	

C: kuinka usein testiä käytät? asteikko 1-5

8. Token (36 tehtävää)

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

C	C	C	C	C	C	C
B	B	B	B	B	B	B
C	C	C	C	C	C	C

9. Morfologia

adverbi

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

komparatiivi

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

superlatiivi

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

presens

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

imperfekti

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

elatiivi

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

B	B	B	B	B	B	B
C	C	C	C	C	C	C
B	B	B	B	B	B	B
C	C	C	C	C	C	C
B	B	B	B	B	B	B
C	C	C	C	C	C	C
B	B	B	B	B	B	B
C	C	C	C	C	C	C
B	B	B	B	B	B	B
C	C	C	C	C	C	C
B	B	B	B	B	B	B
C	C	C	C	C	C	C

10. Nopea sarjallinen nimeäminen

värit

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

B	B	B	B	B	B	B
C	C	C	C	C	C	C

esineiden kuvat

B:	kuinka luotettavasti mittaa?	asteikko 1-5	B	B	B	B	B	B	B
C:	kuinka usein testiä käytät?	asteikko 1-5	C	C	C	C	C	C	C
	numerot								
B:	kuinka luotettavasti mittaa?	asteikko 1-5	B	B	B	B	B	B	B
C:	kuinka usein testiä käytät?	asteikko 1-5	C	C	C	C	C	C	C
	kirjaimet								
B:	kuinka luotettavasti mittaa?	asteikko 1-5	B	B	B	B	B	B	B
C:	kuinka usein testiä käytät?	asteikko 1-5	C	C	C	C	C	C	C
	värit, numerot ja kirjaimet								
B:	kuinka luotettavasti mittaa?	asteikko 1-5	B	B	B	B	B	B	B
C:	kuinka usein testiä käytät?	asteikko 1-5	C	C	C	C	C	C	C

11. Kasvojen ja puhelihasten liikkeet

kasvojen liikkeet

B:	kuinka luotettavasti mittaa?	asteikko 1-5	B	B	B	B	B	B	B
C:	kuinka usein testiä käytät?	asteikko 1-5	C	C	C	C	C	C	C
	leuan liikkeet								
B:	kuinka luotettavasti mittaa?	asteikko 1-5	B	B	B	B	B	B	B
C:	kuinka usein testiä käytät?	asteikko 1-5	C	C	C	C	C	C	C
	kitapurjeen liikkeet								
B:	kuinka luotettavasti mittaa?	asteikko 1-5	B	B	B	B	B	B	B
C:	kuinka usein testiä käytät?	asteikko 1-5	C	C	C	C	C	C	C
	kielen liikkeet								
B:	kuinka luotettavasti mittaa?	asteikko 1-5	B	B	B	B	B	B	B
C:	kuinka usein testiä käytät?	asteikko 1-5	C	C	C	C	C	C	C
	12. Tavojen toistaminen								
B:	kuinka luotettavasti mittaa?	asteikko 1-5	B	B	B	B	B	B	B

C: kuinka usein testiä käytät? asteikko 1-5

13. Sanojen toistaminen

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

14. Epäsanojen toistaminen

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

Kysymys A, vaihtoehto Jokin muu, mikä?

15. menetelmän nimi:

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

16. menetelmän nimi:

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

C	C	C	C	C	C
B	B	B	B	B	B
C	C	C	C	C	C
B	B	B	B	B	B
C	C	C	C	C	C

B	B	B	B	B	B
C	C	C	C	C	C
B	B	B	B	B	B
C	C	C	C	C	C

Mitä testiä et käytä. Miksi?

Käytätkö pragmaattisten taitojen arviointiin jotain testiä/arviointimenetelmää?

En _____ Kyllä _____; kirjoita nimi ja arvioi menetelmä alla

17. Testin/arviointimenetelmän

nimi:

B: kuinka luotettavasti mittaa? asteikko 1-5

C: kuinka usein testiä käytät? asteikko 1-5

B	B	B	B	B	B
C	C	C	C	C	C

Voit jatkaa kääntöpuolelle. Toivoisin myös kommenttejasi lasten testaamisesta ja arvioinnista.

Ja tietenkin toivon palautetta myös tästä kyselylomakkeesta!

Kiitos vastauksistasi. Ne ovat arvokkaita puheterapeutin työn jatkokehittämisessä.
Sinikka

Appendix 2 Questionnaire of home activities

Kotiajankäytön seuranta	klo	klo	klo	klo	klo	klo	klo	klo	klo
	17- 17.30	17.30 18.00	18.00 18.30	18.30 19.00	19.00 19.30	19.30 20.00	20.00 20.30	20.30 21.00	21- 21.00
Ulkona leikkiminen esim. lumileikit, omatoiminen pelailu									
Sisällä leikkiminen leluilla, esim. auto-, rooli-, kotileikit									
Rakenteleminen esim. palikoilla, legoilla.									
Piirtäminen, maalaaminen, askartelu									
Kirjojen katseleminen, omatoiminen selailu									
Pöytäpelien pelaaminen esim. noppa-, korttipelit									
Pelaaminen tietokone- ja videopelit									
Lukemisen kuuntelu satukasetit/sadut/kirjat/lehdet									
Liikunta kotona sisätiloissa esim.pallon/renkaan heittäly									
TV:n tai videon katseleminen									
Musiikin kuuntelu, lauleikit, laulaminen									
Ohjattu harrastetoiminta esim. viulutunnit, satujumppa, uinti, jääkiekko									
Syöminen välipalat, iltaruoka, iltapala jne.									
Peseytymiset, saunominen									
Siirtymisvaihe, yleinen riehuminen, oleilu ilman tekemistä									
Läksyjen tekeminen									
Muu toiminta, mikä?									

tavanomainen päivä _____ lapsen mieliala oli _____ myönteinen
poikkeuksellinen päivä _____ nukkumaan meno klo _____ _____ kielteinen

Appendix 3. Table 5. Use of tests. N (%), use mean (sd), mean confidence (sd), mean frequency of test use mean (sd). Confidence on test and frequency of use: scores 1-4 included.

	Vocabulary	Comprehensio n	Grammar	Auditory memory	Speech motor skills
1. Sentence level test use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	2 (6.9) 0.07 (0.26)	26 (89.7) 0.9 (0.31) 2.36 (0.56) 1.54 (0.65)	14 (48.2) 0.48 (0.51) 2.63 (0.50) 2.13 (1.13)	15 (51.7) 0.52 (0.51) 2.94 (0.83) 2.54 (0.97)	
2. Bo Ege Sproklig test 1 use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	25 (86.2) 0.86 (0.35) 2.89 (0.51) 1.42 (0.58)	2 (6.9) 0.07 (0.26)	3 (10.3) 0.10 (0.31)		9 (31.0) 0.31 (0.47)
3 Boston naming test use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	22 (75.9) 0.76 (0.44) 2.67 (0.76) 2.48 (0.73)				7 (24.1) 0.24 (0.44)
4 BOEHM use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	12 (41.4) 0.41 (0.50) 2.57 (0.85) 2.36 (0.63)	18 (62.1) 0.62 (0.49) 2.68 (0.48) 2.5. (0.51)	9 (31.0) 0.31(0.47)	6 (20.7) 0.21 (0.41)	

5	Makeko use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	4 (13.8) 0.14 (0.35)				
6	ITPA auditory reception use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	11 (37.9) 0.38 (0.49) 3.17 (0.58) 2.82 (1.17)	26 (89.7) 0.90 (0.31) 3.00 (0.78) 2.81 (0.96)	4 (13.8) 0.14 (0.35)	4 (13.8) 0.14 (0.35)	
7	ITPA visual reception use n (%) scored confidence, mean (sd) scored frequency of use, mean (sd)scored use mean (sd)	2 (6.9) 0.07 (0.26)	8 (27.6) 0.28 (0.45)	2 (6.9) 0.07 (0.07)	3 (10.3) 0.10 (0.31)	1 (3.4) 0.03 (0.19)
8	ITPA auditory association use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	13 (44.8) 0.45 (0.51) 3.00 (0.45) 2.00 (0.77)	21 (72.4) 0.72 (0.45) 2.86 (0.64) 2.21 (0.79)	6 (20.7) 0.21(0.41)	8 (27.6) 0.28 (0.45)	
9	ITPA visual association use n (%)	1 (3.4)	6 (20.7)			

use mean (sd)	0.03 (0.19)	0.21 (0.41)			
scored confidence, mean (sd)					
scored frequency of use, mean (sd)					
10					
ITPA					6 (20.7)
speech production					0.21 (0.41)
use n (%)	13 (44.8)	1 (3.4)	11 (37.9)		
use mean (sd)	0.45 (0.51)	0.03 (0.19)	0.38 (0.49)		
scored confidence, mean (sd)	3.38 (0.65)		3.36 (0.50)		
scored frequency of use, mean (sd)	3.24 (1.04)		3.43 (1.13)		
11					
ITPA					
gesture production					
use n (%)		4 (13.8)			
use mean (sd)		0.14 (0.35)			
scored confidence, mean (sd)					
scored frequency of use, mean (sd)					
12					
ITPA					
grammatical completion					
use n (%)	5 (17.2)	8 (27.6)	26 (89.7)	6 (20.7)	2 (6.9)
use mean (sd)	0.17 (0.38)	0.28 (0.45)	0.90 (0.31)	0.21 (0.41)	0.07 (0.26)
scored confidence, mean (sd)			2.48 (0.70)		
scored frequency of use, mean (sd)			2.85 (0.86)		
13					
ITPA					
visual completion					
use n (%)		2 (6.9)			
use mean (sd)		0.07 (0.26)			
scored confidence, mean (sd)					
scored frequency of use, mean (sd)					
14					

ITPA auditory sequential memory use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	2 (6.9) 0.07 (0.26)			25 (86.2) 0.86 (0.35) 2.19 (0.62) 1.85 (0.60)	3 (10.3) 0.10 (0.31)
15 ITPA visual sequential memory use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	2 (6.9) 0.07 (0.26)				1 (3.4) 0.03 (0.19)
16 ITPA auditory closure use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	4 (13.8) 0.14 (0.35)	9 (31.0) 0.31 (0.47)	2 (6.9) 0.07 (0.26)	6 (20.7) 0.21 (0.41)	
17 ITPA sound blending use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	3 (10.3) 0.10 (0.31)	4 (13.8) 0.14 (0.35)	2 (6.9) 0.07 (0.26)	9 (31.9) 0.31(0.47)	
18 Reynell comprehension use n (%) use mean (sd)	24 (82.8) 0.83 (0.38)	9 (31.0) 0.31 (0.47)	13 (44.8) 0.45 (0.51)	12 (41.4) 0.41 (0.50)	

scored confidence, mean (sd)		2.54 (0.65)	2.86 (0.53)	3.08 (0.51)	
scored frequency of use, mean (sd)		1.96 (0.68)	2.17 (0.94)	2.44 (0.73)	
19 Reynell speech production					
use n (%)	12 (41.4)	6 (20.7)	15 (51.7)	5 (17.2)	
use mean (sd)	0.41 (0.5)	0.21 (0.41)	0.52 (0.51)	0.17 (0.38)	
scored confidence, mean (sd)	3.09 (0.54)		3.23 (0.73)		
scored frequency of use, mean (sd)	2.40 (1.07)		3.67 (0.50)		
20 Token					
use n (%)	1 (3.4)	20 (68.9)	8 (27.6)	16 (55.2)	
use mean (sd)	0.03 (0.19)	0.69 (0.47)	0.28 (0.45)	0.55 (0.51)	
scored confidence, mean (sd)		2.41 (0.59)		2.65 (0.61)	
scored frequency of use, mean (sd)		3.05 (0.76)		3.20 (0.77)	
21 Morphology mastering adverbial forms					
use n (%)		3 (10.3)	19 (65.5)	1 (3.4)	
use mean (sd)		0.10 (0.31)	0.66 (0.48)	0.03 (0.19)	
scored confidence, mean (sd)			2.55 (0.60)		
scored frequency of use, mean (sd)			3.25 (0.85)		
22 Morphology mastering comparative forms					
use n (%)		3 (10.3)	19 (65.5)	2 (6.9)	
use mean (sd)		0.10 (0.31)	0.66 (0.48)	0.07 (0.26)	
scored confidence, mean (sd)			2.63 (0.68)		
scored frequency of use, mean (sd)			3.26 (0.87)		
23 Morphology mastering superlative forms					

24	use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)		3 (10.3) 0.10 (0.31)	18 (62.1) 0.62 (0.49) 2.65 (0.75) 3.25 (0.85)	2 (6.9) 0.07 (0.26)	
25	Morphology mastering present tense use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)		3 (10.3) 0.10 (0.31)	18 (62.1) 0.62 (0.49) 2.60 (0.60) 3.25 (0.85)	1 (3.4) 0.03 (0.19)	
26	Morphology mastering past tense use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)		3 (10.3) 0.10 (0.31)	18 (62.1) 0.62 (0.49) 2.65 (0.59) 3.25 (0.85)	1 (3.4) 0.03 (0.19)	
27	Morphology mastering relative forms use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)		3 (10.3) 0.10 (0.31)	18 (62.1) 0.62 (0.49) 2.70 (0.66) 3.25 (0.85)	1 (3.4) 0.03 (0.19)	
28	Test of Rapid serial naming. colours use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	6 (20.7) 0.21 (0.41)	1 (3.4) 0.03 (0.19)		1 (3.4) 0.03 (0.19)	4 (13.8) 0.14 (0.35)
	Test of Rapid serial naming. pictures					

use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	6 (20.7) 0.21 (0.41)		1 (3.4) 0.03 (0.19)	1 (3.4) 0.03 (0.19)	1 (3.4) 0.03 (0.19)
29 Test of Rapid serial naming. numbers use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	4 (13.8) 0.14 (0.35)		1 (3.4) 0.03 (0.19)	1 (3.4) 0.03 (0.19)	1 (3.4) 0.03 (0.19)
30 Test of Rapid serial naming. letters use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)	1 (3.4) 0.03 (0.19)		2 (6.9) 0.07 (0.26)	1 (3.4) 0.03 (0.19)	1 (3.4) 0.03 (0.19)
31 Test of Rapid serial naming. colours. numbers and letters use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd))	2 (6.9) 0.07 (0.26)		1 (3.4) 0.03 (0.19)	1 (3.4) 0.03 (0.19)	
32 Face motor functions use n (%) use mean (sd) scored confidence, mean (sd) scored frequency of use, mean (sd)		1 (3.4) 0.03 (0.19)			13 (44.8) 0.45 (0.51) 2.79 (0.89) 2.86 (0.66)
33 Jaw motor functions					

<p>use n (%)</p> <p>use mean (sd)</p> <p>scored confidence, mean (sd)</p> <p>scored frequency of use, mean (sd)</p>						<p>18 (62.1)</p> <p>0.62 (0.49)</p> <p>2.61 (0.85)</p> <p>2.74 (0.73)</p>
<p>34</p> <p>Palatal motor functions</p> <p>use n (%)</p> <p>use mean (sd)</p> <p>scored confidence, mean (sd)</p> <p>scored frequency of use, mean (sd)</p>						<p>16 (55.2)</p> <p>0.55 (0.51)</p> <p>2.76 (0.75)</p> <p>3.41 (0.66)</p>
<p>35</p> <p>Tongue motor functions</p> <p>use n (%)</p> <p>use mean (sd)</p> <p>scored confidence, mean (sd)</p> <p>scored frequency of use, mean (sd)</p>						<p>18 (62.1)</p> <p>0.62 (0.49)</p> <p>2.47 (0.84)</p> <p>2.16 (0.96)</p>
<p>36</p> <p>Repetition of syllables</p> <p>use n (%)</p> <p>use mean (sd)</p> <p>scored confidence, mean (sd)</p> <p>scored frequency of use, mean (sd)</p>					<p>4 (13.8)</p> <p>0.14 (0.35)</p>	<p>21 (72.4)</p> <p>0.72 (0.45)</p> <p>2.45 (0.74)</p> <p>2.52 (0.73)</p>
<p>37</p> <p>Repetition of words</p> <p>use n (%)</p> <p>use mean (sd)</p> <p>scored confidence, mean (sd)</p> <p>scored frequency of use, mean (sd)</p>					<p>8 (27.6)</p> <p>0.28 (0.45)</p>	<p>22 (75.9)</p> <p>0.76 (0.44)</p> <p>2.30 (0.70)</p> <p>2.17 (0.76)</p>
<p>38</p> <p>Repetition of nonwords</p>						

use n (%)					9 (31.0)	19 (65.5)
use mean (sd)					0.31 (0.47)	0.66 (0.48)
scored reliability, mean (sd)						2.60 (0.68)
scored frequency of use, mean (sd)						2.86 (0.79)