Child Ind Res
DOI 10.1007/s12187-013-9230-6

Specific Language Impairment and Early Second Language Acquisition: The Risk of Over- and Underdiagnosis

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Accepted: 17 December 2013

Abstract Child and family risk factors of Specific Language Impairment (SLI), including delayed mastery of early language milestones and family history of language impairment, have been found to affect more SLI children than typically developing (TD) children. However, little to no research has examined whether prevalence differs between monolingual and early second language (eL2) learners. Furthermore, the degree of misdiagnosis in clinical settings is unknown as well as whether monolingual and eL2 children differ in the proportion of over- and underdiagnosis. The present study compared both language groups regarding the prevalence of risk factors and (mis)diagnosis as SLI. The sample included 92 monolingual (69 TD, 23 SLI) and 74 eL2 children (55 TD, 19 SLI), aged 5–8 years, and their parents. Prevalence of child/family risk factors was assessed via parental questionnaire; misdiagnosis was calculated by comparing children's identification as (non)SLI via a standardized test with their clinical diagnosis. Except for dyslexia/dysgraphia, the rate of child and family risk factors was the same in both language groups, correctly identifying up to half of the SLI children. Correlation analyses between SLI-identification and clinical diagnosis indicated a moderate positive association. The rates of misdiagnosis in monolingual and eL2 children varied, with underdiagnosis being more frequent than overdiagnosis across groups. Moreover, the rate of overdiagnosis was marginally higher for eL2 children than for monolinguals. Summarizing, correct clinical diagnosis as SLI is difficult in both monolinguals and in eL2 learners; a correct diagnosis as unimpaired is especially challenging in eL2 children. Our results suggest that complementing standardized language assessments with parental information helps to reduce the rate of misdiagnosis in both types of learners.

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Published online: 22 January 2014

Keywords Specific language impairment · Early second language acquisition · Child risk factors · Family risk factors · Overdiagnosis · Underdiagnosis

1 Introduction

Specific Language Impairment (SLI), which affects 6 to 10 % of all children (mono- and bilingual), is known to carry a high risk of poor academic achievement (Leonard 1998). Ideally, SLI diagnosis relies on direct assessment and parental information regarding the child's early language milestones, including delayed onset of first words and of multi-word utterances, and family history of oral and/or written language impairments. Studies with monolingual children found that these child and family risk factors affect more children with SLI than typically developing (henceforth also TD) children (e.g., Dale et al. 2003; Lyytinen et al. 2001). However, little to no research has examined whether prevalence of these risk factors is the same for monolingual and bilingual, especially early second language (eL2), learners. Furthermore, the degree of misdiagnosis, resulting from divergence between clinical diagnosis and identification as SLI via standardized test procedure, is unknown. More specifically, to date it is unclear whether monolingual and eL2 children differ in the proportion of over- and underdiagnosis. In cases of underdiagnosis, children known to have SLI are not diagnosed as impaired. In cases of overdiagnosis, typically developing children are incorrectly diagnosed as SLI. Underdiagnosis is sometimes referred to as *missed identity* and overdiagnosis as *mistaken identity* (Genesee et al. 2004). The present study compared monolingual and eL2 children regarding the prevalence of risk factors and (mis)diagnosis as SLI. We examined the prevalence of child and family risk factors of SLI (late onset of single-word and of multi-word stage, family risk of SLI and/or dyslexia/dysgraphia) as well as the rate and direction of misdiagnosis. This way, investigation of eL2 children, with and without SLI, adds to the discussion of factors contributing to the present low academic achievement of bilingual compared to monolingual learners.

2 Characteristics and Diagnosis of Specific Language Impairment in Monolingual and Bilingual Children

2.1 Specific Language Impairment

Children with language development disorders are disadvantaged in their oral and/or written language development as well as in acquiring abilities that crucially depend on language. Language difficulties may result from hearing impairment, neurological impairment, autism, or general developmental delay. In these cases language problems are likely to co-occur with problems in other areas like hearing or non-verbal intelligence or motor development. However, language problems may also occur in the absence of any other problems outside the language domain (cf. ICD-10 (F80.1, F80.2)). This type of language disorder is referred to as *Specific Language Impairment* (henceforth SLI). With a prevalence of 6 to 10 %, SLI constitutes one of the most frequent developmental disorders.

It has been the topic of much linguistic research (Grimm 2003; Leonard 1998; Schwartz 2009), while diagnosis and intervention have been less studied (but cf. Botting et al. 1997; Crutchley 1999). In the following we discuss the characteristics of SLI and then address the issue of diagnosis and misdiagnosis of SLI.

Characteristics of SLI Children with SLI exhibit language difficulties without co-occurring cognitive or neurological deficits or hearing impairments severe enough to explain the language impairment (Schwartz 2009). Importantly, environmental factors such as socio-economic background, parents' educational level, and parents' communication behavior are not related to the occurrence of SLI (Leonard 1998). It is by now widely agreed that SLI has a genetic basis (Bishop et al. 1995; Plomin and Dale 2000), with boys being affected more often than girls (Dale et al. 2003; Tomblin et al. 1997). In addition, the family pattern of SLI supports the assumption that SLI is genetically transmitted: Children with siblings who are known to have SLI are four times as likely to develop SLI as children without a sibling with SLI (Schwartz 2009). In general, children with a history of SLI in their nuclear family are more likely to have SLI than children without a family history of SLI. Retrospective studies show that 40 to 50 % of the children with a family risk of SLI developed SLI (Choudhury and Benasich 2003; Spitz et al. 1997; Tomblin et al. 1997) and/or reading and spelling difficulties (Tallal et al. 1989). In addition, 35 to 50 % of the children with a family risk of written language deficits like dyslexia or dysgraphia have deficits in their written language abilities (Bishop 2000; Pennington et al. 1990; Scarborough 1990). Moreover, children with a history of dyslexia in their family are more likely to develop SLI (Bishop 2000; Pennington 1991).

Children with SLI are delayed in their onset of speech and in their subsequent language development. Longitudinal studies revealed that children who later develop SLI start producing their first words around 18 months and later, while typically developing children produce first words around 12 months (Dale et al. 2003). In addition, children later identified as SLI produce their first multi-word utterances after 24 months of age, compared to typically developing children who start around 18 months (Dale et al. 2003; Thal et al. 2004; Schulz 2007). Similarly, at age 2;0 children later identified as SLI have a very small active vocabulary, when compared to typically developing children. Rescorla (1989) coined the term *Late Talker* for children who at age 2;0 have fewer than 50 words in their active vocabulary or do not yet produce multi-word utterances. Importantly, while all children with SLI started out as late talkers (Leonard 1998), about 35 to 50 % of the late talkers—referred to as *Late Bloomers*—seem to catch up in their later language development and develop typically (Ellis Weismer 1993; Grimm 2003; Rescorla and Schwartz 1990).

Children's grammatical difficulties, i.e. deficits in the morphological and syntactic aspects of language, have been studied most extensively. These morpho-syntactic deficits have been claimed to constitute the core characteristic of SLI; they often persist up to school age. The specific area of the deficit, however, may differ depending on the target language (Leonard 1998). Moreover, SLI is a heterogeneous disorder: The specific profiles of language

deficits vary with respect to the location of the deficits and the severity of impairment (Conti-Ramsden 2008; Friedmann and Novogrodsky 2008; Schulz 2010; van der Lely 2005). Language production and comprehension may be impaired simultaneously or separately. In addition, selective deficits have been found for specific linguistic subdomains such as morpho-syntax, phonology, and lexicon (cf. Dockrell and Messer 2004; Friedmann and Novogrodsky 2008; van der Lely 2005). Recently it has been argued that children with SLI may also exhibit isolated or co-occurring semantic deficits (Penner et al. 2003; Schulz 2010; Schulz and Roeper 2011).

Diagnosis of SLI Diagnosis of SLI usually takes place around age 4 (e.g., Germany, Grimm 2003; Schulz 2007) or later (e.g., France, Prévost, personal communication, March 21, 2011). Clinical diagnosis may rest on direct assessment of the child as well as parental information. In Germany, direct assessment comprises informal or standardized tests and analysis of children's spontaneous speech samples (Voet Cornelli et al. 2012). Misdiagnosis may arise if the assessment tools do not include the area of the child's difficulty or fail to adequately measure the child's language competence (cf. Schwartz 2009). Indirect assessment includes parental information about the children's early language development and the family history of language impairments like SLI and dyslexia or dysgraphia (Dale et al. 1998; Kayser 1995). Evaluation of these child- and family-related factors results from the research findings mentioned earlier. Child risk factors include Late onset of first words (i.e. after 18 months) and Late onset of first multi-word utterances (i.e. after 24 months) (Dale et al. 2003; Thal et al. 2004). Family risk factors include having first degree relatives with SLI and/or dyslexia/dysgraphia (Choudhury and Benasich 2003; Prathanee et al. 2007). This information may help detecting children with SLI, especially in contexts in which standardized assessment tools are not readily available (Paradis et al. 2010; Restrepo 1998). However, it should be kept in mind that only 35 to 50 % of the children exhibiting one of these risk factors develop SLI. Therefore, diagnosis of SLI should preferably be complemented by adequate direct assessments.

Ideally, the assessment procedure results in correctly diagnosing all and only those children as SLI who indeed have SLI. In practice, however, high rates of misdiagnosis have been reported (Botting et al. 1997; Dollaghan and Horner 2011). As illustrated in Table 1, misdiagnosis can take two forms: underdiagnosis and overdiagnosis.

Table 1 Cross-classification of diagnosis and identification of SLI

		Identification via language test	
		SLI	TD
Diagnosis	as SLI	√	Overdiagnosis
	as TD	Underdiagnosis	√

In case of underdiagnosis, children with SLI are not diagnosed as impaired. In case of overdiagnosis, typically developing (TD) children are incorrectly diagnosed as SLI.[1] Underdiagnosis is sometimes referred to as *missed identity*, and overdiagnosis as *mistaken identity*. Researchers propose that underdiagnosis (missed identity) predominates in bilingual children (Genesee et al. 2004; Paradis 2005).

2.2 Specific Language Impairment in eL2 Learners

The age at onset of acquisition of the second language has been argued to crucially influence pace and success of acquisition (Hyltenstam 1992; Meisel 2009). Restricting the scenario to two languages, the child may acquire both languages from birth or may start learning the second language—in our case German—after she has already acquired substantial aspects of his or her first language. The former type is called *simultaneous bilingual language acquisition* and the latter *child second language acquisition* (Genesee et al. 2004). Children acquiring the second language between the ages of two and four form a subtype of child second language acquisition, referred to as *early second language acquisition* (eL2), sometimes also called *successive bilingual acquisition*. This acquisition type is the focus of our study.

eL2 Acquisition eL2 children differ from monolingual children in two respects. Their age at the onset of the acquisition of the L2 (in our case German) is higher, and their length of exposure to the L2 is shorter than that of same-aged monolingual peers. Importantly, both factors may vary within eL2 acquisition, with children of the same chronological age having different ages of onset, but equal length of exposure and vice versa. When matched for chronological age only, eL2 children typically score below monolingual children on language tests (Crutchley et al. 1997a, b; Grimm and Schulz 2012; Paradis 2010; Unsworth 2005). The existing studies indicate that, besides chronological age, age of onset and length of exposure influence eL2 children's language performance (cf. Schwartz 2004; Schulz et al. 2008; Unsworth 2005). As length of exposure to the second language increases, initial differences between age-matched monolingual and eL2 children decrease and may eventually disappear (e.g., Schulz et al. 2008; Schulz 2013, for German; Paradis 2010; Unsworth 2008). Crucially, these findings mainly rest on the study of morpho-syntax. A more comprehensive picture of acquisition pace and patterns in unimpaired eL2 acquisition is still missing. Research on impaired acquisition in bilingual children is even scarcer, but has received growing interest over the last years (cf. COST-Action IS0804, www.bi-sli.org).

Characteristics of SLI in eL2 Acquisition Given the genetic basis of SLI, about 6 to 10 % of eL2 children are expected to be affected by this disorder. A bilingual language acquisition setting does not increase the likelihood of SLI in either of the languages; rather it affects all languages to be acquired (Armon-Lotem 2012; Håkansson et al. 2003; Paradis et al. 2003). Given the typological differences across languages, children with SLI may show different grammatical difficulties in different languages.

[1] Note that throughout this paper the term 'diagnosis' is used to refer to the procedure of clinically assessing a child's language status as SLI or as TD, and is not restricted to the diagnosis of a disorder.

The question whether bilingualism has negative or positive effects for a child's SLI is still open (cf. Paradis 2010). Some authors argue that being bilingual may reduce the impairment (e.g., Armon-Lotem 2010, 2012; Roeper 2012), others argue for increased difficulty (Horwitz et al. 2003). The existing studies on SLI in bilingual children suggest that the age at onset of acquisition of the second language influences children's acquisition patterns and profiles of impairment. Simultaneous bilinguals with SLI have been found to exhibit grammatical profiles similar to those of monolingual children (Håkansson et al. 2003; Restrepo and Gutierrez-Clellen 2004; see Paradis 2010 for an overview). In contrast, results on eL2 children with SLI are mixed. While some studies reported similar patterns of impairment in monolingual and eL2 children with SLI (Genesee et al. 2004; Håkansson et al. 2003; Paradis et al. 2003; Restrepo and Gutierrez-Clellen 2004; Rothweiler et al. 2012), others found negative effects for eL2 children when compared to monolingual-SLI children (de Jong et al. 2010). Moreover, when comparing typically developing eL2 learners with eL2 learners with SLI, similar error types were found (e.g., Paradis 2007, 2008; Rothweiler et al. 2012; Salameh et al. 2004). To date, it is unclear how the typology of the two languages, the age at onset of acquiring the second language, and the language areas investigated contribute to the language outcome.

Few studies have examined risk factors of SLI in bilingual children, and little is known about their early language development (see e.g., Paradis et al. 2010; Restrepo 1998). Given the genetic nature of the disorder, eL2 children with SLI are expected to start out as late talkers. They should exhibit a late onset of speech and start producing multi-word utterances in their first language later than their unimpaired peers. In a similar vein, more eL2 children with SLI are expected to have a family history of SLI and/or written language impairment than eL2 children who are developing typically. However, as reading and writing practices and availability of tools to assess these skills differ across languages and cultures, family risk of written language impairments may go undetected (cf. Paradis et al. 2010).

Diagnosis of SLI Language diagnosis in a bilingual setting is challenging in several respects. First, when measured against a monolingual standard, typically developing eL2 children often fail to reach that norm in the second language. Second, eL2 children vary regarding age at onset of acquisition, length of exposure, type of first language, and the richness and frequency of input in the second language. This variation raises the question of what constitutes an adequate norm for assessing language abilities in eL2 children (Crutchley 1999). For German, only one standardized test exists with separate norms for monolingual and for eL2 learners (LiSe-DaZ; Schulz and Tracy 2011; cf. section 3.2). The focus of LiSe-DaZ is on morpho-syntax, sentential semantics, and parts of the lexicon; standardized tests assessing other language domains including phonological or lexical abilities with a separate norm for eL2 children have yet to be developed. Third, error patterns (e.g., in case marking or verbal inflection) often seem to be shared between typically developing eL2 children and impaired children, at least in early stages of acquisition (Paradis 2008; Rothweiler et al. 2012). According to de Jong et al. (2010), bilingual children with SLI are predominantly characterized by error frequency. To date, it is still unclear whether some specific error types may be identified that allow disentangling typical acquisition from SLI in eL2 children. Fourth, assessing both languages may be desirable, because by definition SLI affects all languages acquired by a child, while in typical acquisition the child's first language abilities are unimpaired (e.g., Håkansson et al. 2003).

However, assessment in the child's first language often is not possible for practical reasons. For many languages, tools for assessing the child's first language are missing. In addition, even for existing tests it is unclear whether the monolingual norms can be used for non-monolingual learners who, unlike their monolingual L1 peers, acquire their first language outside their host country (e.g., Marinis and Özge 2010; Montrul 2008).

In practice, diagnosis of bilingual children may involve direct assessment including tests and/or spontaneous speech samples as well as parental information regarding children's early language development in their first (and second) language as well as the family history of SLI and/or written language impairment (Conti-Ramsden and Durkin 2012). In bilingual settings this parental information on child and family risk factors is regarded as especially useful (Paradis et al. 2010; Restrepo 1998).

Given the challenges clinicians face when assessing eL2 children's language abilities, a high rate of misdiagnosis is expected (cf. Table 1). Up to now, few studies have examined the proportion of under- and overdiagnosis of SLI in bilinguals. Using referral to speech-language services as an indicator of having SLI, research so far provides mixed results. Bilingual children have been argued to be underdiagnosed (e.g., de Jong et al. 2010; Yağmur and Nap-Kolhoff 2010) as well as overdiagnosed (e.g., Salameh et al. 2002) in special language service institutions. Regarding the Netherlands, Yağmur and Nap-Kolhoff (2010, p. 268) conclude that "in most cases, immigrant children are stigmatized as having language impairment simply on the basis of ineffective assessment instruments". Recent surveys in Germany suggest that migrant children are underrepresented in German speech-language intervention institutions (Bahr 2007). This suggests that many eL2 children with SLI are underdiagnosed, because their (low) language abilities are not identified as SLI but incorrectly attributed to their lack of exposure to the second language or to the acquisition of two languages. If SLI is not diagnosed, eL2 learners with SLI are at high risk for poor academic and social achievement. To date, the proportion of over- and underdiagnosis for eL2 learners of German has not been studied.

3 Current Study

The study addressed the following two research questions:

1. Do monolingual and eL2 children differ regarding the prevalence of risk factors of SLI?
2. What is the rate of misdiagnosis in monolingual and in eL2 children? Do monolingual and eL2 children differ in the proportion of over- or underdiagnosis?

The first question aimed at determining the distribution of risk factors for monolingual children with and without SLI and for eL2 learners with and without SLI. Based on previous research, we expected child and family risk factors to occur more frequently in the SLI groups than in the TD groups. Furthermore, given the genetic basis of SLI, we expected prevalence rates in the monolingual group to resemble those of the eL2 learners.

The second question examined the rate of misdiagnosis as SLI or non-SLI, respectively. In lieu of a gold standard for eL2 learners, in this study the test LiSe-DaZ, which has been normed for eL2 and monolingual children, was used to identify children with SLI (procedure recommended by the ICD-10 (F80.1, F80.2)). Given the current diagnostic practice in Germany, we expected moderate associations between clinical diagnosis and identification. Misdiagnosis should affect both monolingual children and eL2 children, resulting in a medium level correlation between diagnosis and identification.

4 Method

4.1 Recruitment

Participants are part of the sample of MILA[2], a combined cross-sectional and longitudinal study of monolingual and eL2 acquisition of German. Typically developing monolingual children and eL2 learners of German were recruited between October 2008 and February 2009 in kindergartens in Frankfurt/Main. The language-impaired sample was recruited between October 2008 and September 2009 in kindergartens and language intervention centers in and around Frankfurt/Main. According to the aims and the design of the project children with language impairment were oversampled.

Information about children's language biography and their parents' language and educational background was collected via written parental questionnaires and telephone interviews. The child's language biography was assessed with questions about the child's age at the onset of first words and at the onset of multi-word utterances (in any language), and about assignment to speech-language intervention. For the eL2 sample, additional questions were included about the child's first language and the age at onset of the acquisition of German. Information about the parent's background was assessed with questions about first degree relatives with oral and/or written language impairments, language use at home, their length of residence in Germany, and their educational background, measured via years of schooling.

Children were included in the present study if they showed overall age-appropriate development and if there was no history of hearing impairment. In addition, eL2 children were included if their age of onset of acquiring German was between ages 2;0 and 4;0. In total, 92 monolingual and 74 eL2 children met the criteria.

[2] The Project MILA (The role of migration background and language impairment in children's language achievement; PI: P. Schulz) is part of the Research Centre IDeA. For more information, see Grimm and Schulz (2012) and www.idea-frankfurt.eu. The design of the project is approved by the ethics committee of the German Psychological Association (DGPs).

4.2 Measures

Risk Factors Child and family risk factors were assessed via parental questionnaire and interviews in German or the parent's first language, if necessary. Regarding the child-related risk factors of SLI we asked about the onset of the single word stage ("At what age did your child start producing the first words?") and the multi-word stage ("How old was your child when she/he started combining words?"). To assess the family risk factors of SLI, we asked about oral language difficulties ("Do you have family members who exhibit oral language deficits?") and written language difficulties ("Do you have family members who exhibit written language deficits?") and which relative was affected. Onset of the single-word stage later than 18 months of age and onset of multi-word stage later than 24 months of age were considered child-related risk factors. Family history of oral language impairment and family history of written language deficit (affecting first grade relatives) were considered family-related risk factors.

Diagnosis Information about the child's clinical language diagnosis was assessed via parental questionnaire. The group of children with the clinical SLI diagnosis comprised all children in our sample receiving speech and language intervention from a certified speech therapist at the time of testing as well as children on a waiting list for such intervention. At the time of testing, 23/92 (25.0 %) monolingual and 28/74 (37.8 %) eL2 children had a clinical diagnosis of SLI. The difference between groups and diagnosis is not significant ($\chi^2(1)=3.176$; $p=0.075$).

Identification as SLI Identification as SLI is based on the child's performance in the standardized test LiSe-DaZ, administered in German (Schulz and Tracy 2011). LiSe-DaZ offers separate norms for monolingual children (ages 3;0 to 6;11) and for eL2 learners (ages 3;6 to 7;11), allowing to evaluate an eL2 child's language abilities relative to children of the same acquisition type and hence to identify low performance. LiSe-DaZ assesses morpho-syntactic, semantic, and to some degree lexical abilities in comprehension and production. Three subtests assess comprehension of central rule-based language phenomena: verb meaning (semantics), wh-questions (syntax, semantics), and negation (syntax, semantics). Based on an elicited production task, three subscales assess the child's language production in core areas of morpho-syntax, which have been shown to be affected in SLI (cf. section 1.1, 1.2): sentence complexity, subject-verb agreement, and case marking. Five sub-scales assess word classes including main verbs, auxiliary verbs, prepositions, focus particles, and subjunctions (morpho-syntax, lexicon). T-values are provided for all sub-scales except sentence complexity and subject-verb agreement. Note that lexical abilities are only partially assessed via the sub-scale word classes, and phonological abilities are not assessed at all with this test; thus selective deficits in these areas may go undetected. In line with SLI research age-inappropriate non-verbal intelligence was used as an exclusionary criterion for SLI (cf. Leonard 1998). Non-verbal IQ was assessed via the non-verbal scales of the Kaufmann Assessment Battery for Children (K-ABC, Melchers and Preuß 2003) except for 14 children who had been tested with the CFT (Grundintelligenztest Skala 1; Cattell et al. 1997) at the time of recruitment (the teachers and parents kindly allowed use of test results for this study). All children performed within their age norms (see Table 2).

Table 2 Sample characteristics: sample size, means (and standard deviations) of child and parental variables

	MON						eL2						Sign. Differences
	TD			SLI			TD			SLI			
	n	*M*		*n*	*M*		*n*	*M*		*n*	*M*		
Child													
Age (months)	69	57.9	(9.3)	23	73.8	(21.2)	55	53.6	(16.4)	19	83.8	(23.2)	A, C, D
Months of exposure to German (months)	–	–	–	–	–	–	55	27.3	(14.3)	19	45.5	(23.3)	B
First exposure to German (months)	–	–	–	–	–	–	55	35.6	(5.6)	19	37.8	(3.5)	
Non-verbal intelligence (K-ABC)	63	90.8	(11.7)	21	81.2	(11.7)	50	85.4	(12.9)	16	83.8	(17.0)	A
Non-verbal intelligence (CFT)	4	109.5	(12.2)	5	97.2	(10.9)	1	93.0		4	101.0	(10.7)	
Mother													
Length of residence (Years)	5	20.0	(14.2)	1	32.0	51	13.2	(8.1)	16	9.6	(5.8)	D	
Length of schooling (Years)	66	11.7	(1.7)	22	9.9	(1.3)	52	10.1	(3.0)	16	9.3	(3.6)	A, C

A significant difference between MON-TD and MON-SLI; *B* significant difference between eL2-TD and eL2-SLI; *C* significant difference between MON-TD and eL2-TD; *D* significant difference between MON-SLI and eL2-SLI

4.3 Participants

Children were assigned to the monolingual-SLI or the eL2-SLI group, respectively, if they fulfilled the identification criterion as SLI: performance of more than $SD=1.0$ below $T=50$ (ICD-10 (F 80.1, F80.2)) in at least two of the nine sub-tests of LiSe-DaZ providing T-values. Children who fell outside the test age norms because they were older than 6;11 (monolingual) or 7;11 (eL2) were assigned to the SLI group if their performance was 0.5 standard deviations or more below $T=50$ in at least two subtests of LiSe-DaZ.[3] The remaining children were classified as typically developing (TD). In sum, 23 out of 92 (25.0 %) monolingual and 19 out of 74 (25.7 %) eL2 children were identified as SLI. The differences between groups and identification were not significant ($\chi^2(1)=0.010$; $p=1.000$). In the monolingual-TD group ($n=69$), 50 children performed well on all subscales, and 19 children scored below $T=40$ in one subscale of LiSe-DaZ. In the eL2-TD group ($n=55$), 39 children performed well on all subscales, and 16 children scored below $T=40$ in one subscale. Table 2 summarizes the sample characteristics.

4.4 Further Participant Information

Typically Developing Monolinguals (MON-TD) The monolingual-TD group consisted of 31 girls and 38 boys. All children were born in Germany. In 57/69 cases, their parents were also born in Germany. In one family, both parents were born outside of Germany and in 11 families one parent was born outside of Germany. In all families German was the only home language.

Typically Developing eL2 Learners (eL2-TD) The eL2-TD group consisted of 26 girls and 29 boys. Except for one child, all children were born in Germany. In 51/55 families, both parents were born outside of Germany. In 48/55 families, both parents were born in the same foreign country (most frequently Turkey, Afghanistan, Bosnia/Serbia); in three families, the parents were born in different countries; in four families, the father was born in Germany and the mother outside of Germany. At the time of testing, all 55 families predominantly used their first language(s) with each other. Three of the 55 families used German in addition to the L1.

Monolinguals with SLI (MON-SLI) The monolingual-SLI group included 8 girls and 15 boys. All children were born in Germany. In 14 families, both parents were born in Germany. In one family, both parents and in seven families one parent was born outside of Germany. In all families German was the only home language.

[3] In the monolingual-SLI group, 15 children scored below $T=40$ in two subscales, six in three subscales, one in four subscales and one in six subscales. In the eL2-SLI group, six children scored below $T=40$ in two subscales, seven in three subscales, one in four subscales, two in five subscales, two in six subscales, and one child in seven subscales of LiSe-DaZ.

eL2 Learners with SLI (eL2-SLI) The eL2-SLI group included 10 girls and 9 boys. All children except for one child were born in Germany. In 14 families, the parents came from the same country (most frequently Turkey, Morocco, Jordan, Pakistan) and in one family, the parents came from different countries. In three families, either the mother or the father was born in Germany. In one family, both parents were born in Germany (with their first language being Turkish). As in the eL2-TD group, 18/19 families predominantly used their first language to communicate with each other, one family also used German.

4.5 Procedures

Testing The tests LiSe-DaZ and K-ABC were administered to the children individually in their kindergartens or at home. All test sessions were video-recorded by trained research assistants. Later analysis was carried out by different research assistants trained on data analysis.

Statistical Analysis Descriptive statistics were calculated for the study sample characteristics and over- and underdiagnosis. Chi-square or one-way analysis of variance was used to determine whether the groups (TD/SLI, monolingual/eL2) varied in age, nonverbal IQ, educational background of the mother, and diagnosis. Chi-square tests were used to examine over- and underdiagnosis.

5 Results

5.1 Risk Factors of SLI

Four risk factors were assessed via parental information. The prevalence of risk factors ('yes'-responses) across the four participant groups is summarized in Table 3. Recall

Table 3 Prevalence of risk factors in absolute numbers and percentage for monolingual and eL2 children for each of the groups TD and SLI

	MON				eL2			
	TD		SLI		TD		SLI	
	n	%	*n*	%	*n*	%	*n*	%
Child-related risk factors								
Late onset single-word stage	10/57[a]	17.5	3/21	14.3	6/49	12.2	1/16	6.3
Late onset multi-word stage	14/56	25.0	8/20	40.0	14/50	28.0	8/17	47.1
Family-related risk factors								
Family history of SLI	11/68	16.2	9/23	39.1	8/54	14.8	6/17	35.3
Family history of written language deficits	17/69	24.6	12/23	52.9	5/52	9.6	1/17	5.9

[a] different totals due to missing data for single variables

that identification as SLI was based on children's performance in the standardized language test LiSe-DaZ (cf. section 3.2).

Monolingual-TD vs. Monolingual-SLI Consistent with our expectation, the three risk factors Late onset of multi-word stage, Family history of SLI, and Family history of written language deficits were attested less frequently in the TD (25.0 %, 16.2 %, and 24.6 %, respectively) than in the SLI (40.0 %, 39.1 %, and 52.9 %, respectively) group. Unexpectedly, the reverse pattern was found for the factor Late onset of single-word stage: slightly more TD (17.5 %) than SLI (14.3 %) children were reported to have entered the single word stage late.

eL2-TD vs. eL2-SLI As expected, the two risk factors Late onset of multi-word stage and Family history of SLI were attested nearly twice as often in the SLI (47.1 % and 35.3 %) than in the TD (28.0 % and 14.8 %) group. The factors Late onset of single-word stage (TD: 12.2 %; SLI: 6.2 %) and Family history of written language deficits (TD: 9.6 %; SLI: 5.9 %) showed the reverse pattern, with a risk attested more frequently in the TD than in the SLI children.

Monolingual vs. eL2 Children Consistent with our expectations, prevalence rates were similar for monolingual and eL2 children, both for the TD and for the SLI groups. The risk factors Late onset of multi-word stage (monolingual-TD: 25 %; eL2-TD: 28 %; monolingual-SLI: 40.0 %; eL2-SLI: 47.1 %), and Family history of SLI (monolingual-TD: 16.2 %; eL2-TD: 14.8 %; monolingual-SLI: 39.1 %; eL2-SLI: 35.8 %) were attested more frequently in SLI than in TD children. Late onset of single word stage was attested more frequently in TD (monolingual: 17.5 %; eL2: 12.2 %) than SLI (monolingual: 14.3 %; eL2: 6.3 %) children. Prevalence of the risk factor Family history of written language deficits, in contrast, differed between monolingual and eL2 children. While it was rarely attested in eL2 children, both with SLI (5.9 %) and with TD (9.6 %), it was observed in 52.9 % of the monolingual children with SLI and 24.6 % of the monolingual-TD children.

In sum, the risk factors Late onset of multi-word stage, Family history of SLI, and Late onset of single-word stage occurred with a similar prevalence in monolingual German-speaking children and in eL2 learners of German. This is consistent with our expectation regarding Question 1: Given the genetic basis of SLI differences in language acquisition type should not result in different prevalence rates for child- or family-related risk factors of SLI. The different prevalence rate for the risk factor Family history of written language deficits requires further investigation. The question was about deficits in any of the participant's family's language(s) and thus differences cannot be attributed to different levels of language competence. In addition, given the genetic base for written language impairments such as dyslexia and dysgraphia the prevalence rate should be the same. The observed difference between monolingual and eL2 children may result from the use of different diagnostic procedures or lack of adequate diagnostic tools in some of the participants' first languages. It may also be due to different literal practices across languages and cultures (Paradis et al. 2010).

Table 4 TD children: Correct diagnosis and overdiagnosis as SLI

	MON		eL2	
	n	%	*n*	%
Correct diagnosis	59/69	85.5 %	40/55	72.7 %
Overdiagnosis	10/69	14.5 %	15/55	27.3 %

Our findings are consistent with previous studies on family risk factors, indicating that 3 to 46 % of children with SLI do not have a family risk (Bishop and Edmundson 1987; Tallal et al. 1989) and that 50 % to 65 % of children with a family history of language impairments do not develop SLI (Bishop 2000; Pennington 1991). This also supports previous research on the relation between early and later language development (Bishop et al. 2003; Dale et al. 2003; Lyytinen et al. 2001) suggesting that some children may have a late start into language, as evidenced by the late onset of the single and multi-word stage, but then catch up later (Rescorla and Schwartz 1990). Finally, the risk factors Late onset of multi-word stage and Family history of SLI (and Family history of written language deficits for monolinguals) were attested nearly twice as often in the SLI than in the TD groups. For this subset of factors, between 35 and 53 % of the children with SLI were identified by applying one of these risk factors. This finding suggests that parental information about the child's language biography and family risks cannot replace but complement a careful diagnosis via direct assessment.

5.2 Misdiagnosis

This section examines the rate of misdiagnosis in monolingual and in eL2 children and the proportion of over- and underdiagnosis in the two language groups (Question 2). As for the analysis of risk factors, identification as SLI is based on the child's performance in the standardized language test LiSe-DaZ; information on the child's diagnosis as SLI or TD was obtained via parental questionnaire.[4] A diagnosis is correct if clinical diagnosis and identification via the language test are congruent. Misdiagnosis is defined as incongruity between diagnosis as (non)SLI and identification as (non)SLI. In cases of underdiagnosis, an SLI child has not been diagnosed as SLI. In cases of overdiagnosis, a TD child is incorrectly diagnosed as SLI (see Table 1).

Table 4 provides the proportions of correct diagnosis and overdiagnosis of TD children for monolinguals and eL2 learners. Overdiagnosis was found in 14.5 % of the monolingual children (10/69) and in 27.3 % of the eL2 children (15/55). The difference between the groups is marginally significant ($\chi^2(1)=3.105$; $p=0.08$).

Table 5 illustrates the proportions of correct diagnosis and underdiagnosis of SLI children for monolinguals and eL2 learners. With respect to underdiagnosis, 43.5 % of the monolingual-SLI children (10/23) and 31.6 % of the eL2 children (6/19) were not recognized as having SLI. There is no significant difference between the groups (χ^2 $(1)=0.625$; $p=0.40$).

[4] Recall that here diagnosis is not used in the medical sense of diagnosing a disorder, but simply as a result of a diagnostic procedure.

Table 5 SLI children: Correct diagnosis and underdiagnosis as TD

	MON		eL2	
	n	%	*n*	%
Correct diagnosis	13/23	56.5	13/19	68.4
Underdiagnosis	10/23	43.5	6/19	31.6

In the monolingual group, subsequent statistical analyses showed significant differences between identification (yes/no) and clinician's diagnosis (yes/no) between TD and SLI children ($\chi^2(1)=16.251$; $p<0.001$), with a moderate correlation between identification and diagnosis ($\varphi=0.420$; $p<0.001$). Specificity of clinical diagnosis was better than its sensitivity: While 85.5 % (59/69) of the monolingual-TD children were correctly diagnosed as unimpaired, only 56.5 % (13/23) of the monolingual-SLI children were correctly diagnosed as having SLI. A comparable pattern was observed in the eL2 group: Significant differences were found between identification (yes/no) and clinician's diagnosis (yes/no) between TD and SLI children ($\chi^2(1)=10.166$; $p=0.002$); the correlation between identification and diagnosis was moderate ($\varphi=0.371$; $p<0.001$). Specificity of clinician's diagnosis was similar to its sensitivity: 72.7 % (40/55) of the eL2-TD children were correctly diagnosed as unimpaired; 68.4 % (13/19) of the eL2-SLI children were correctly diagnosed as having SLI.

Monolingual vs. eL2 Groups We observed a high rate of misdiagnosis in monolingual and eL2 children, ranging from 14.5 % to 43.5 %. Underdiagnosis was more frequent than overdiagnosis in both groups. Correlation between identification and diagnosis was moderate for monolinguals and for eL2 learners. The degree of under- and overdiagnosis, respectively, differed depending on language acquisition type. Regarding the two SLI-groups, the rate of underdiagnosis did not significantly differ between the monolingual children (43.5 %) and the eL2 children (31.6 %). Comparing the two TD groups, the rate of overdiagnosis was marginally higher for eL2 children (27.3 %) than for monolingual children (14.5 %). Taken together, these results suggest that in current clinical practice correct diagnosis as TD is more difficult with eL2 than with monolingual children.

6 Discussion

This article compared the prevalence of risk factors of SLI and of SLI (mis)diagnosis in monolingual children and eL2 learners. Two main questions were addressed: (1) Do monolingual and eL2 children differ regarding the prevalence of risk factors of SLI? (2) What is the rate of misdiagnosis in monolingual and in eL2 children, and do both language groups differ in the proportion of over- or underdiagnosis? Our study extends previous work by examining eL2 learners who have hardly been studied with respect to the two research questions. Parental questionnaires were used for information about child and family-related risk factors and clinical diagnosis; a standardized German language test with separate norms for the two language groups was administered to identify children with SLI. The sample included 92 monolingual (TD: 69; SLI: 23) and 74 eL2 children (TD: 55; SLI: 19). Results on monolingual and on eL2 children were

similar in many respects. First, regarding the prevalence of risk factors of SLI, except for the factor Family history of written language deficits, the remaining risk factors under investigation Late onset of multi-word stage, Family history of SLI, and Late onset of single-word stage occurred with similar frequency in monolingual and in eL2 children. Second, rate of misdiagnosis was high and correlation between diagnosis and identification as (non)SLI only moderate in both groups. Finally, for both monolingual and eL2 children underdiagnosis was more frequent than overdiagnosis, but the degree of under- and overdiagnosis differed between language groups. These results and their implications are discussed below.

6.1 Risk Factors of SLI

The predictive value of the SLI risk factors Late onset of single-word stage, Late onset of multi-word stage, Family history of SLI, and Family history of written language deficits has been studied extensively for monolingual acquisition (see overview in Prathanee et al. 2007). Given the genetic basis of SLI, we expected these factors to play a comparable role in eL2 acquisition. Our results largely confirmed this prediction. We found similarities between monolinguals and eL2 learners with respect to the risk factors Late onset of single-word and of multi-word stage, and family history of SLI. Consistent with previous research (e.g., Lyytinen et al. 2001; Paradis et al. 2010; Restrepo 1998), prevalence of the risk factors was not uniform. For the SLI groups, Late onset of multi-word stage (monolingual: 40.0 %; eL2: 47.1 %) and family history of SLI (monolingual: 39.1 %; eL2: 35.3 %) were most frequently attested, while the factor Late onset of single-word stage was rarely observed (monolingual: 14.3 %; eL2: 6.3 %). These findings are in line with previous studies showing that 35 to 50 % of the monolingual children with an early risk factor developed SLI (Spitz et al. 1997; Tomblin et al. 1997) and that 30 to 40 % of children with a family history of SLI or written language deficits develop SLI (Choudhury and Benasich 2003; Lyytinen et al. 2001; Pennington et al. 1990; Scarborough 1990). For eL2 children with SLI, our data support Paradis et al. (2010), who also found early language (and motor) milestones to be the best discriminator between typical and atypical development in eL2 learners (opposed to other factors including current first language abilities, behavior patterns, activity preferences, and family history of SLI or literacy problems). Like Paradis et al. (2010) we observed group differences in the prevalence of the factor Family risk of written language deficits (monolingual: 52.2 % vs. eL2: 5.9 %). The difference may result from undetected literacy problems, for example because special education services or assessment tools are not accessible in some countries, or because parents may have had comparatively brief periods of schooling (e.g., due to wars or economic hardships), or because of cultural barriers to report on information about relatives (Paradis et al. 2010, p. 481). In our eL2 sample, the latter factor played a minor role; most of the eL2 children's parents were willing to report on their family history of SLI.

Previous studies on monolingual and bilingual acquisition found that the best predictability values for SLI were obtained if information about risk factors was combined with direct language measures (Lyytinen et al. 2001; Restrepo 1998). Our findings indicate that information about child- and family-related risk factors can complement but not replace a diagnosis based on a standardized test: At most half of the SLI group could have been identified via a risk factor. Consequently, to distinguish typical and atypical development,

children's language abilities should ideally also be assessed directly via standardized tests. In settings and countries that to date lack standardized measurements for monolingual and bilingual learners, children's language skills may be judged based on informal measurements (e.g., parent and teacher information) combined with observation and qualitative error analyses of spontaneous speech.

6.2 Misdiagnosis in Monolingual Children and eL2 Learners

Our second research question focused on the rate of misdiagnosis in monolingual and in eL2 children, and on the proportion of over- or underdiagnosis across both groups. We found a high rate of misdiagnosis in both monolinguals and eL2 learners. In the monolingual group underdiagnosis was more frequent than overdiagnosis. In the eL2 group, underdiagnosis was more frequent than overdiagnosis as well, although the difference was much smaller than for the monolinguals. These findings indicate that monolingual and eL2 learners differ in the proportion of over- and underdiagnosis. Subsequent statistical analyses revealed significant, medium correlations of diagnosis and identification for monolingual and for eL2 children. In both groups, specificity of clinical diagnosis (monolingual: 85.5 %; eL2: 72.7 %) was superior to sensitivity (monolingual: 56.6 %; eL2: 68.4 %). This is consistent with Botting et al. (1997) reporting agreement levels of about 66 % for lexical and morpho-syntactic tasks and even lower agreement rates (39 to 53 %) if semantic/pragmatic abilities were examined. The low sensitivity value indicates that a correct clinical diagnosis is more challenging for SLI than for TD children. This is not surprising given high variation in the patterns of SLI. In that respect, TD children are 'an easier group to define' (Botting et al. 1997:326).

In sum, our findings are consistent with previous literature reporting that children's language abilities are subject to misdiagnosis (Botting et al. 1997; Paradis 2005). Bilingual children have been argued to be underdiagnosed as well as overdiagnosed. Our data provide first empirical evidence that eL2 learners of German are subject to overdiagnosis (i.e. mistaken identity) and underdiagnosis (i.e. missed identity) as well. Correct clinical diagnosis as SLI is difficult in both monolinguals and eL2 learners; a correct diagnosis as unimpaired is especially challenging in eL2 children.

6.3 Limitations and Conclusions

Following the aims of the project MILA, we oversampled children with SLI by recruiting participants in special needs institutions as well as kindergartens, and thus, the proportion of children with SLI in our sample is intentionally higher (25 %) than reported to hold for representative samples. Nevertheless, our study is limited in that our SLI sample (23 monolinguals and 19 eL2 learners) is still relatively small; our findings should therefore be taken with a note of caution. Future studies should substantiate our findings by recruiting bigger samples. Moreover, in the present study identification of SLI was based on the child's performance on one standardized test in the L2 (LiSe-DaZ), in addition to exclusion of impairments including low non-verbal IQ, hearing problems, etc. By testing receptive and productive morpho-syntactic, semantics and to some degree lexical abilities, LiSe-DaZ assesses core abilities often affected in SLI (Grimm 2003; Leonard 1998); phonology and noun vocabulary were not tested, as to date there are no standardized tests available providing separate norms

for eL2 learners of German and for German monolinguals. Thus, unlike Botting et al. (1997) for English, we could not investigate rates of misdiagnosis across different standardized tests. Consequently, since up to now other language tests with separate eL2 norms in German still need to be developed, further research is required to validate SLI identification via LiSe-DaZ by comparison across different standardized tests.

In conclusion, the present study is the first to compare risk factors and misdiagnosis in German monolingual and eL2 children. As expected, the prevalence of the risk factors Onset of single-word stage, Onset of multi-word stage, and Family history of SLI was similar for both groups. We argued that the differences regarding the prevalence of the risk factor Family history of written language deficits is due to differences in literacy practices and availability of assessment tools across different countries. Misdiagnosis was high in both monolinguals and eL2 children, with underdiagnosis being predominant in both language groups. We suggested that the higher rate of overdiagnosis in eL2 compared to monolingual learners results from attributing a bilingual child's often lower language abilities in the L2 to impairment rather than to the second-language learning setting. It may also result from current clinical practice in which assignment to speech-language intervention for children with SLI and to language support programs for bilingual children are confounded (Voet Cornelli et al. 2012). Future research should thus consider children's specific language learning context and the possibility of over- and underdiagnosis of language abilities when evaluating the academic achievement of children, bilingual and migrant as well as monolingual.

Acknowledgments The research presented here is part of the project MILA and was carried out at the Research Center IDEA, funded by the LOEWE program for excellency from the State of Hesse. We thank Magda Wojtecka and Rabea Schwarze for their help with data collection and analysis, and Judith Dirk and Wolfgang Woerner for statistical support. We also acknowledge the help of the research assistants. We are grateful to the children, their parents and the teachers in kindergartens and in special needs centers for their participation in the study. We thank the two anonymous reviewers for their helpful comments on previous versions of the paper.

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