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ORIGINAL ARTICLE

Changing rates of physical and psychosocial impairments over 9 years in cohorts of school beginners in Germany

Long-term trends of impairments in children

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Abstract
Objective The aim of this study was to investigate the prevalence of impairments of physical and psychosocial development in children commencing primary school and to analyse changes over 9 years in consecutive cohorts.
Patients and method We utilised a retrospective cross-sectional study design to assess the prevalence of impairments over nine consecutive cohorts of German children beginning school from 1997 to 2005. A total of 9,514 children were assessed for physical and psychosocial impairment using a manualised medical assessment.
Results There was a dramatic increase in the rates of motor and speech disorders detected among children tested over the 9-year period. We observed a seven-fold increase in motor impairments (OR 7.1; 95% CI 4.2–11.7) and almost a three-fold increase in speech disorders (OR 2.6; 95% CI 2.1–3.3) from 1997 to 2005. Males had higher rates of impairment in all domains of functioning as compared to females (26.0% vs 15.3%; $p<0.0005$). By 2005, however, girls had comparable rates of speech and motor impairments to males. No clear pattern of change in behavioural or cognitive impairments was seen.
Conclusions The data suggest a changing pattern of deficits in young children, especially girls, which is alarming and warrants close scrutiny. Potential confounding factors may have influenced the results, which should be interpreted with caution. Further research is needed to support our results and to identify the aetiologies of the observed changes. If confirmed, our data have implications for intervention and public health initiatives.

Keywords Children · School health · Developmental function · Gender · Impairments

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Introduction

Even mild childhood dysfunction may, if left untreated, predispose to significant pathology later in life (Hartung 1983). Early childhood impairments are often diagnosed late (Levy and Hyman 1993; Flender 2005) and tend towards chronicity if untreated (Hurrelmann 1995; Palentien 2000). Previous research suggests that therapy for children with speech and language delays may be effective (Law, Garrett et al. 2003).

Epidemiological studies show that over recent years, there have been marked changes in the prevalence of many childhood illnesses, such as obesity (Mo-Suwan, Junjana et al. 1993; Nestle and Jacobson 2000; Livingstone 2001), asthma (van den Hazel, Zuurbier et al. 2006), diabetes (Popkin 2001) and ADHD (Gracey 2003). In contrast, robust data on the changes in incidence and prevalence of psychological and motor developmental impairments in pre-school children is currently lacking. Accurate data on the incidence and changes of prevalence rates of such impairments may help in planning interventions.

Research in the area of childhood development has been complicated by the absence of standardised assessment tools (Michaelis, Bogner et al. 2000; Webster, Majnemer et al. 2004; Saigal, Rosenbaum et al. 2005), and concerns about the reliability of data collected in various studies have been raised (Sundelin and Vuille 1976; Sonnander 2000). For the assessment of physical and psychosocial dysfunction, few comprehensive systems are available that address the overall development of pre-school children (Saigal, Rosenbaum et al. 2005). Commonly used assessments of child development have been criticised by some researchers as lacking validity and reliability (Adams 2002). Research has tended to utilise their own assessment tools, making it difficult to compare and correlate results from different studies. Other studies in the field have been limited by small sample sizes (Laucht, Esser et al. 1993; Ministry of Health of the Federal State of Lower Saxonia, Germany; Niedersachsiches Ministerium fur Frauen 2000) and short periods of observations (Laucht, Esser et al. 1993; Steinmacher, Storck et al. 2002). Reliable estimates of rates of impairments covering larger geographical regions over an extended period of time are still required in order to detect patterns of change in the prevalence of impairments over recent years.

The goal of the study is to investigate the course of prevalence of impairments among pre-school children in consecutive cohorts over a 9-year period, addressing various developmental physical and psychosocial impairments.

Methods

Before entering primary school, all children in the Federal State of Bavaria, Germany, are examined medically in the so-called school-enrolment examination. In this analysis we retrospectively analysed the results of the screening examinations for all children in the district of Dingolfing-Landau, Bavaria, between 1997 and 2005. Since it is a legal requirement for all children to be assessed, our data set was comprehensive, and we were able to access data for nearly all children entering primary school.

Definition of impairments

The medical examinations at school entry are used to screen children for further assessment and in providing recommendations concerning the kind of school and specific educational needs of the child in primary school. This is a comprehensive physical, psychological and behavioural assessment that has been developed by the Public Health Service of the Dingolfing-Landau District, Bavaria. Although the examination has been used extensively in Bavaria, the psychometric properties have not been well established. The examination was designed to be simple to administer and to have high intrarater and interrater reliability. However, data are not yet available with which to compare it to other standardised developmental assessments.

The medical examinations and documentations of findings were conducted by the school-examination team from the local public health service, which remained the same over the study period. The examination criteria, the method of the examination and definitions of impairments are manualized and remained unchanged over the 9-year period. (The manual is available from the author on request.) The examination takes approximately 30–45 min to complete, and all the physical examinations were conducted by a single medical practitioner, who remained unchanged for the 9-year period. Each round of the examination started in autumn/winter and proceeded till spring of the following year.

Date of the examination and birth date of the child were used to obtain exact age at the examination. Based on the examination manual, four areas of development were assessed: motor, speech, cognitive and psychosocial functioning. Each area of development was further subdivided into more specific areas of development (see Table 1). If the examination identified any distinctive impairment in either of two single tests for motor development or in one test for speech, cognitive or psychosocial development, it was interpreted as a delay of development and counted as "impairment".

Statistical analysis

Point prevalence of impairments was stratified for age, gender and nationality. Nationality was alternatively grouped into German or non-German. Prevalence rates were compared by χ^2-test for categorical variables such as age, gender and nationality. Differences of continuous variables (i.e., age) between groups (i.e., gender) were carried out by the use of t-test. Associations between prevalence rates of impairments and time (year 1997 acted as reference) were calculated by logistic regression models that were adjusted for age, gender, obesity and nationality.

Table 1 Domains and subdivisions of developmental functioning assessed and corresponding single tests

Domains of development	Subdivisions	Single tests
Motor development	Gross motor skills	Standing on one leg; jumping on one leg; going like a rope dancer; going with clapping hands
	Fine body coordination, grapho-motor coordination	Finger-opposition-test; drawing different figures; drawing a person
Development of speech	Pronunciation	Repeating words
	Grammar	Retelling a short story; retelling a short picture story; explaining rules of a well-known game
	Rhythm of speech	Repeating sentences
Cognitive development	Memory and concentration	Repeating sentences with seven–ten words including three adjectives; repeating four single numbers in the correct sequence
	Perseverance	Discontinuity of capacity to pay attention during the examination
	Abstraction	Building pairs; finding an object among various objects belonging together
	Visual perception	Reception and knowing of simple geometric figures or silhouettes of figures and animals
	Arithmetic	Counting from 1 to 10 in the correct sequence
Psychosocial development	Behaviour	Erratic; overly bonded with mother (no separation possible during examination); hostility towards examiner
	Emotionality	Major mood swings; crying
	Psycho-motor	Agitation; unable to sit calmly for a few minutes

Since we recently published that some types of impairments in children might be related to obesity, multivariable regression models were adjusted for obesity (Mond, Stich et al. 2007) according to the definition of childhood obesity as proposed by Cole and colleagues (Cole, Bellizzi et al. 2000). All analyses were conducted with the statistical program SPSS v14.0.

Results

Study population

A total of 9,514 children with an average age of 6.04 years (*SD±0.37*) were assessed over the 9-year period. Age showed no significant variation over the 9 years of school-entry examinations both for boys and girls (age rage between 5.9–6.1 years of age). Complete assessments were not available for 94 children due to factors such as relocation to other school districts, missing developmental information or insufficient knowledge of the German language, leaving a sample of N=9,420. In this sample, younger children and male children had significantly higher rates of impairments in all four domains as compared to females (Tables 1, 2 and 3). On average, over 20.7% of children demonstrated one or more impairments according to the criteria of developmental functioning as defined in Table 1. We observed an overall increase of impairments in all domains (motor, speech, cognition, behaviour) over the 9-year study period, with the largest increase in motor impairment (Fig. 1).

Speech development

Speech development was divided into three areas of performance: speech-sound, grammar and speech-rhythm functioning. Absolute levels of impairment were high, with 10.5% of females and 18.7% of boys meeting criteria for one or more impairments over the 9 years. Girls, however, were significantly less likely to be affected than males at the commencement of the study, with 4.1% of females and 15.1% of males demonstrating speech impairments in 1997. There was a trend for a steady increase in rates of impairments over the 9-year period for both girls and boys, but this was more marked for females (Fig. 2). Children

Table 2 Prevalence of impairments among 9,420 pre-school children between 1997-2005

Domain of impairment	Motor %	Speech %	Cognition %	Behaviour %
Age (years)				
<5.8 (N=3,136)	8.1	15.9	7.0	8.1
5.8–6.2 (N=3,143)	5.2	14.6	5.4	5.3
>6.2 (N=3,141)	5.1 ***	13.8 ***	5.0 **	4.2 ***
Gender				
Female (N=4,512)	4.1	10.5	4.5	4.6
Male (N=4,908)	8.1 ***	18.7 ***	7.1 ***	7.0 ***
German nationality				
Yes (N=8,719)	5.9	15.0	5.4	9.1
No (N=701)	8.5 **	11.6 *	11.0 ***	5.6 ***

p-value of chi-square test for differences of proportions of impairments among age groups, gender and migrant status: ** p<0.01; ***p<0.001

Table 3 Associations* between year of investigation and frequency of impairments

Domain of impairment	Motor		Speech		Cognition		Behaviour	
Year	OR; 95%CI		OR; 95%CI		OR; 95%CI		OR; 95%CI	
	Female	Male	Female	Male	Female	Male	Female	Male
1997 (Reference)	1	1	1	1	1	1	1	1
1998	0.9; 0.2–3.9	1.1; 0.5–2.3	2.8; 1.3–3.7	1.3; 0.95–1.8	3.5; 1.4–8.7	3.1; 1.7–5.4	3.0; 1.4–6.4	1.6; 1.0–2.6
1999	4.6; 1.5–13.6	4.4; 2.4–8.0	2.8; 1.7–4.8	1.3; 0.95–1.8	4.8; 2.0–11.8	3.3; 1.9–5.7	3.9; 1.9–8.2	1.7; 1.1–2.7
2000	6.9; 2.4–20.1	4.4; 2.4–8.1	2.3; 1.4–3.9	1.2; 0.8–1.6	6.6; 2.7–15.8	3.0; 1.7–5.2	3.2; 1.5–6.7	1.3; 0.8–2.1
2001	3.3; 1.01–10.3	4.9; 2.4–8.1	1.8; 1.0–3.1	1.03; 0.7–1.5	2.7; 1.03–7.1	1.7; 0.9–3.1	2.3; 1.02–5.1	1.4; 0.8–2.2
2002	4.4; 1.5–13.5	4.0; 2.2–7.4	2.0; 1.1–3.5	1.5; 1.1–2.1	2.0; 0.7–5.5	2.0; 1.1–3.5	2.6; 1.2–5.8	0.7; 0.4–1.2
2003	3.8; 1.3–11.6	4.1; 2.2–7.6	2.4; 1.4–4.0	1.2; 0.9–1.6	3.5; 1.4–8.7	1.8; 1.0–3.2	1.2; 1.01–4.9	1.2; 0.7–1.9
2004	8.3; 2.9–23.9	2.9; 1.5–5.5	5.2; 3.2–8.6	1.8; 1.4–2.4	2.5; 0.95–6.7	1.6; 0.9–3.0	2.2; 1.0–4.9	1.1; 0.7–1.8
2005	14.4; 5.1–40.4	4.5; 2.5–8.3	6.2; 3.8–10.2	1.7; 1.3–2.3	6.7; 2.8–16.1	2.5; 1.4–4.4	2.5; 1.1–5.4	1.3; 0.8–2.1

*Odds ratio adjusted for age, obesity and nationality; OR = odds ratio; CI = confidence interval

assessed in 2005 had over twice the rates of speech impairments of their peers in 1995 (odds ratio 2.6). The relative risk for the development of speech impairments actually increased far more for females than males during the study period. By 2005, males and females had almost equal rates of speech disorders (22.6% males vs 20.7% females), indicating a five-fold increase of prevalence rate in female, whereas the rates for males only slightly increased between 1997 and 2005. Such dramatic increases raise the possibility of artifact or systematic confounders, which we explore further in the discussion section.

Motor development

We assessed deficits of both fine motor skills, gross motor skills and graph-motor skills. A total of 6.1% of children demonstrated a deficit in at least one area of motor development. There appears to be a clear trend of increasing rates of impairment of motor development in subsequent cohorts over the 9-year period (Fig. 2). In 1997 the prevalence for any motor impairment was 1.7%; however, by 2005 this had risen to 11%. The odds ratio for the presence of motor impairments was over seven times higher for children assessed in 2005 compared to those in 1997. Boys overall had almost twice the rate of motor impairments over the whole study period (8.1% vs 4.1%) with an odds ratio of 2.1 (95% CI 1.8.2.6). An extremely unexpected result was that, by 2005, girls actually demonstrated higher rates of motor impairment than males (11.1% vs 10.9%). The trend for an increase in motor impairments over the study period was therefore more prominent in females, whose risk rose from 0.85 to 11.1% compared to males, whose risk rose from 2.5% to 10.9% over the 9-year period.

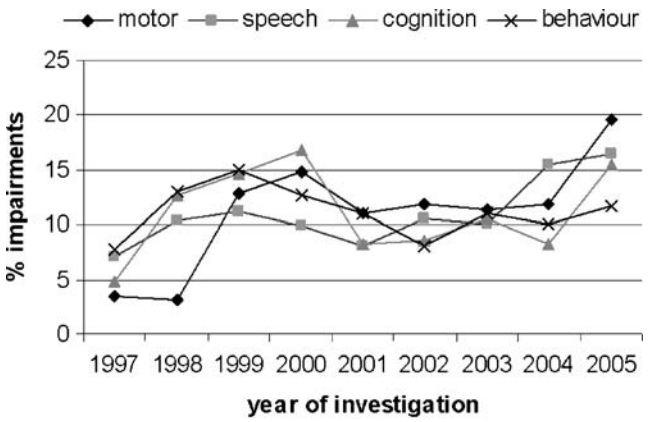

Fig. 1 Trends of impairments among preschool children over 9 years

Cognitive development

Five areas of cognitive functioning were assessed: memory and concentration, abstraction, perseverance, visual perception and arithmetic. Once more, boys suffered from higher rates of cognitive impairments with almost twice the rate of their female counterparts (7.1% vs 4.5%).

While as a whole there appeared to be a trend towards increasing rates of impairments over the 9-year periods, there were significant fluctuations, which complicated our assessment. There was a steady increase in relative risk for cognitive impairments in the cohorts of 1998 (3.1), 1999 (3.6) and 2000 (4.1). From 2001 to 2004 there was then a reduction in relative risk, which then increased again to 3.8 in 2005. Overall, therefore, there was not a clear trend in rates of impairments in any single direction, though the implication is that, at least in the cohort of 2005, there has been a relative increase in cognitive impairments. This held true for both female and male children (Figs. 2 and 3).

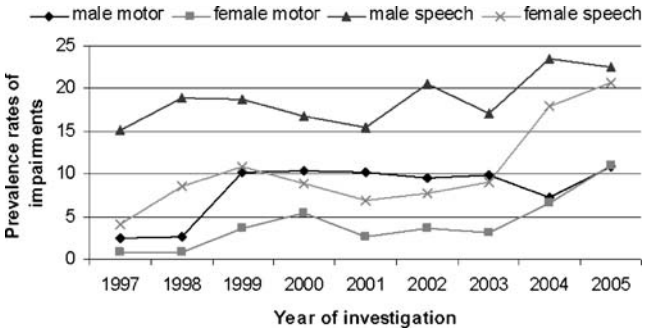

Fig. 2 Trends of impairments in motor function and speech among preschool boys and girls over 9 years

Psychosocial development

Over the 9-year period, on average 4.6% of boys and 7.0% of girls were assessed as having a behavioral problem. There did appear to be a statistically significant increase in rates for all cohorts as compared to 1997, except in 2002 and 2004; however, the overall trend was not significant for either gender. Overall, therefore, there did not appear to be a consistent direction of change for the prevalence of behavioral disorders over the study period.

Discussion

In this study, we report high prevalence rates of impairment in speech (14.8%), motor functioning (6.1%), behaviour (5.9%) and cognition (5.8%). In all assessed areas, males were significantly over represented. Overall, over the 9-year period, we observed an increase in rates of speech and motor disorders, but no clear pattern of changes in cognitive and behavioural disorders. The marked increase in motor and speech disorders in girls, who appeared to "catch up" to boys, was perhaps the most striking and unexpected finding.

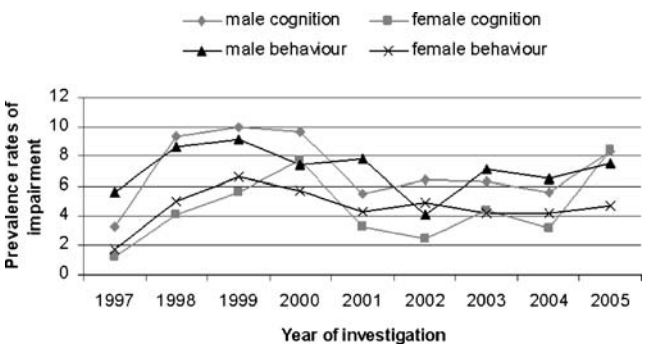

Fig. 3 Trends of impairments in cognition and behaviour among preschool boys and girls over 9 years

Before the results are discussed in more detail, we will address the limitations of the study. Criteria such as developmental delay or impairment lack clearly outlined definitions, and normative values are not well established. To our knowledge, there are no data comparing this school entry examination to other measures or criteria of impairment. Thus, caution must be taken in interpreting absolute rates of impairment and in attempting to compare them to other cohorts. The data are perhaps better suited to describing relative rates between different years of our cohort.

The marked changes we observed may indicate the presence of artefact or bias. It must be noted that many of the tests, even when manualised, are subjective. Other limitations of the assessments, such as their psychometric properties, have been discussed in the methods section. Even with manualisation, many of the assessment criteria are difficult to standardise. Certain tests, such as hand clapping, finger-opposition test or retelling a short story, are qualitative and subjective. Measures of behavioural problems appear especially subjective and difficult to objectively compare. However, a strength of this study is that all the examinations were carried out by a single practitioner over the study period. It cannot be ruled out that a systematic classification bias introduced by a single rater affected the results. Data on intra-rater reliability are not available for these examinations. Lack of availability of reliability measures of the assessment tools used in this study, but also in comparable studies, clearly raises the need to study and introduce these measures into the literature for future studies. Moreover, the experience gained in carrying out the medical examinations during the study period might also have had some effect on the results, especially in the late cohorts. It seems, however, unlikely that a change as dramatic as the increase in motor impairment between 1997 and 1998 can be wholly explained by practice effects, when the examination protocol remained unchanged. In our particular study, definitions and criteria of impairments did not change during the study period. This would make it unlikely that the changes observed between 1997 and 1998 are solely attributable to a classification bias. In addition, artifactual effects do not easily explain the gender differences we observed. Any systematic bias could be expected to be equally distributed among both girls and boys. The fact that changes in rates of motor and speech disorders were so different for girls compared to boys makes it difficult for any measurement bias alone to explain. While the possibility of some systematic biases is not ruled out, there is evidence for genuine differences between subsequent cohorts, which warrants further exploration.

If we assume that at least some of the observed changes are genuine, then this study yields very valuable and interesting data. Other epidemiological studies in Germany

have detected comparable rates of speech disorders in children. Steinmacher et al. detected impairments of receptive speech in 14.5% of children and deficits of expressive speech in 20% of children (Steinmacher, Storck et al. 2002). Prevalence rates for speech and language delays have been reported across wide ranges, with data summarised in a recent Cochrane review (Law, Boyle et al. 1998). International studies have consistently shown language delays to be the single most common childhood problem (Law 1989). A study in the United States detected specific language impairments in 8.5% of boys and 6% females (Tomblin, Records et al. 1997). Most likely, variations between differing locations are best explained by methodological differences and by the lack of agreed-upon criteria for impairment.

Of concern in our study is the trend towards increasing impairment in speech over the study period. While the changes we observed appear dramatic, there are a number of health reports in Germany that have also detected such trends. According to a health report of Lower Saxony (Ministry of Health of the Federal State of Lower Saxonia, Germany; Niedersachsiches Ministerium fur Frauen 2000), speech disorders increased from 15.6% in 1994 to 19.0% in 1996 up to 20.9% in 2000. We were not able to locate international studies that confirmed similar findings.

The rate of motor impairments in our study (6.1%) was similar to that of other German health reports (Baden-Wurtemberg. 2000; Ministry of Health of the Federal State of Lower Saxonia, Germany, Niedersachsiches Ministerium fur Frauen 2000). International studies have utilised very differing methodologies, but on face value at least seem to have produced comparable results. A Swedish study of 7-year-old children detected severe and moderate motor disorders in 4.9% and 8.6%, respectively (Kadesjo and Gillberg 1999). A Chinese survey found motor problems in 9.9% of children from 3 to 5 years of age (Chen, Li et al. 2003).

Overall, we observed rising rates of motor impairments during the study period, culminating in 2005, when almost one in five children demonstrated a motor deficit. It is difficult to explain such dramatic increases over such a short period, and methodological issues are implicated. As a whole, however, our figures appear consistent with studies in other German cohorts. A study of children in Lower Saxony (Ministry of Health of the Federal State of Lower Saxonia, Germany; Niedersachsiches Ministerium fur Frauen 2000) detected delays in motor development in 13.7% of all school starters in 1996, in 14.8% in 1999 and in 15.6% in 2000. We were not able to locate comparable international cohort studies with which to compare our findings.

Several authors have reported an association between language and motor impairments in school-age children (Webster, Erdos et al. 2006). Impaired motor function appears to be an important co-morbidity of developmental language impairment (Webster, Majnemer et al. 2005). A recent study of Finnish children found that language and motor disturbance often co-occurred and that when they did, the difficulties tended to be more severe (Kadesjo and Gillberg 1999). The finding in our study that both speech and motor impairments increased would support the assertion of an association between the two, though it could also indicate a measurement bias affecting both domains. The exact nature and manner of the relationship between language and motor functioning in children is unclear. Certain motor and cognitive dimensions are associated in children (Planinsec 2002), perhaps through shared developmental, neurological or even social pathways.

The marked gender differences detected in our study are perhaps the most concerning aspects of our report. Gender differences in prevalence are reasonably well documented in the literature. Boys have higher rates of speech and language disorders (Tomblin, Records et al. 1997), motor disorders (Mond, Stich et al. 2007) and behavioural disorders (Prior, Smart et al. 1993). Girls as a group have better receptive language skills (Locke, Ginsborg et al. 2002) and better developmental outcomes (To, Guttmann et al. 2004; Hintz, Kendrick et al. 2006). While at the commencement of our study, girls had lower rates of motor and language impairments, by 2005 girls had rates comparable to boys. To our knowledge this is the first study that has demonstrated a "catch up" effect of females in consecutive cohorts. Though it cannot be excluded, it is difficult to explain this finding by artefact or measurement bias, which would generally be expected to affect both males and females equally. Our results therefore await replication in other cohorts.

While we detected significant variations in incidence of behavioural and cognitive dysfunction from year to year, we did not find a clear direction of change over the 9-year period, nor did we find a "catch up" effect in girls comparable to that seen in speech and motor impairments. This suggests that there are important aetiological differences and complex associations between the different areas of development we tested.

Children today grow up in a social and technological environment very different to their predecessors. Urbanisation is having dramatic impacts on disease patterns of children (Gracey 2003). Children in the modern world are more sedentary (Mo-Suwan, Junjana et al. 1993), are exposed to greater pollution (Gracey 2003), have higher rates of obesity (Lakdawalla, Bhattacharya et al.; Mo-Suwan, Junjana et al. 1993; Livingstone 2001; Popkin 2001) and have very different diets (Lakdawalla, Bhattacharya et al.) than their predecessors. Obesity (Mond, Stich et al. 2007), socioeconomic disadvantage (To, Guttmann et al. 2004), maternal depression (To, Guttmann et al. 2004) and non-

attendance of pre-school (Stich, Baune et al. 2006) are among an extensive list of risk factors associated with poorer developmental outcomes. Our hypothesis is that these or an array of other social, environmental, technological or biological factors may be responsible for some of the changes seen in our study. Multivariate analysis looking at these factors could be helpful in identifying causative factors. Understanding the aetiologies of changing childhood impairments might help us understand why girls in our study demonstrated a "catch up effect" and, most importantly, in planning interventions.

The cross-sectional nature of our sample does not allow us to make any clear hypothesis on aetiological factors. Our study was not designed to detect or assess potential aetiological factors, only to document changes. A longitudinal study would also have allowed us to better assess the natural history of the identified deficits. Our study also used rating tools specific to Germany, and these may not be easily comparable to assessments in other jurisdictions. The methodological limitations of the school entry examination have already been discussed in some detail. Unfortunately, at this stage there are no internationally agreed upon gold-standard assessment protocols or interviews to assess impairments in pre-school children.

Despite its limitations, this is, to our knowledge, the longest and largest cross-sectional cohort study of school beginners utilising such comprehensive assessment tools. Our study indicates that there may be changes occurring in the physical, cognitive and developmental well-being of subsequent cohorts that warrant further investigation.

Conclusions

The study suggests that patterns of impairment in children, especially girls, may have been changing in the past 9 years. The data suggest that this pattern among girls appears to be a steady increase in impairment over time, but needs replication in other studies considering some of the potential confounders in this study. Clearly the process of monitoring childhood development needs to be an ongoing process for the purposes of health needs assessment and to identify health areas for prevention. Of great importance is the understanding of the long-term outcome for children with such impairments and the interventions that can change outcomes.

Conflict of interest statement The authors disclose any relevant associations that might pose a conflict of interest.

References

Adams C (2002) Practitioner review: the assessment of language pragmatics. J Child Psychol Psychiat 43(8):973–87

Baden-Wurtemberg (2000) Kindergesundheit in Baden-Wurtemberg., Land Baden-Wurtemberg

Chen C, Li I, Chien L (2003) Developmental status among 3- to 5-year-old preschool children in three kindergartens in the Peitou District of Taipei City. J Nurs Res 11(2):73–81

Cole TJ, Bellizzi MC, Flegal KM, Dietz WH (2000) Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ 320:1240–1243

Flender J (2005) Early recognition of children with specific developmental impairments. (German) [Früherkennung von Kindern mit umschriebenen Entwicklungsstörungen]. Kinder- und Jugendarzt 36:154–159

Gracey M (2003) Child health implications of worldwide urbanization. Rev Environ Health 18(1):51–63

Hartung G (1983) Historical review on medical and public health services for school health. (German) [Geschichtlicher Rückblick auf die Arbeit des schulärztlichen Dienstes]. Soz Päd 5:476–483

Hintz S, Kendrick D, Vohr B, Poole K, Higgins R (2006) Gender differences in neurodevelopmental outcomes among extremely preterm, extremely-low-birthweight infants. Acta Paediat Scand 95(10):1239–48

Hurrelmann K (1995) Foundations of prevention. (German) [Grundlagen der Prävention]. Social pediatrics. Health - illness - life circumstances. (German) [Sozialpädiatrie. Gesundheit - Krankheit - Lebenswelten]. H. Schlack. Stuttgart:53–59

Kadesjo B, Gillberg C (1999) Developmental coordination disorder in Swedish 7-year-old children. J Am Acad Child Adolesc Psychiatry 38(7):820–8

Lakdawalla D, Bhattacharya J, Goldman D (2004) Are the young becoming more disabled? Health Aff (Millwood) 23(1):168–176

Laucht M, Esser G, Schmidt M (1993) Mental difficulties of children at early stages. (German) [Psychische Auffälligkeiten im Kleinkind- und Vorschulalter]. Child and Development. (German) [Kindheit und Entwicklung] 2:143–149

Law J (1989) Surveillance - shifting priorities. Health Visit 62(5):155

Law J, Boyle J, Harris F, Harkness A, Nye C (1998) Screening for primary speech and language delay: a systematic review of the literature. Int J Lang Commun Disord 33(Supp):21–23

Law J, Garrett Z, Nye C (2003) Speech and language therapy interventions for children with primary speech and language delay or disorder. Cochrane Database Syst Rev(3)

Levy S, Hyman S (1993) Assessment of the child with development delay. Pediatic Clinics of North America 40(3):465–477

Livingstone M (2001) Childhood obesity in Europe: a growing concern. Pub Health Nutr 4(1A):109–116

Locke A, Ginsborg J, Peers I (2002) Development and disadvantage: implications for the early years and beyond. Int J Lang Commun Disord 37(1):3–15

Michaelis R, Bogner D, Gey W (2000) Documentation and tools for the assessment of learning disabilities and developmental disorders of children between the age of 4 years and primary school. (German) [Anamnese- und Dokumentationsbogen zur Erfassung früher Lernstörungen und Entwicklungsstörungen schulischer Fertigkeiten ab 4. Lebensjahr bis Grundschulalter]. Kinder- und Jugendarzt 31:791–795

Ministry of Health of the Federal State of Lower Saxonia (Germany) [Niedersachsiches Ministerium fur Frauen, A. u. S (2000) Health Report of children and adolescents. (German) [Niedersachsicher Kinder- und Jugendgesundheitsbericht]. Hannover, Land Niedersachsen

Mo-Suwan L, Junjana C, Puetpaiboon A (1993) Increasing obesity in school children in a transitional society and the effect of the weight control program. Southeast Asian J Trop Med Public Health 24(3):590–594

Mond J, Stich HP, Hay P, Kraemer A, Baune B (2007) Associations between obesity and developmental functioning in pre-school children: a population-based study. Int J Obes 31(7):1068–1073

Nestle M, Jacobson M (2000) Halting the obesity epidemic: a public health policy approach. Pub Health Rep 115(1):12–24

Palentien C (2000) Potential contributions of Public Health to clinical practice. Assessment of special groups: children and adolescents (German) [Was kann Public Health in der Praxis leisten? Problemzugang Bevölkerungsgruppen. Kinder und Jugendliche]. The Public Health Book - Health and Health Service. (German) [Das Public Health Buch - Gesundheit und Gesundheitswesen]. Schwartz F, Badura B, Leidl R, Raspe H, Siegrist J. München, Urban & Fischer:498–506

Planinsec J (2002) Relations between the motor and cognitive dimensions of preschool girls and boys. Percept Mot Skills 94 (2):415–423

Popkin B (2001) Nutrition in transition: the changing global nutrition challenge. Asia Pac J Clin Nutr(Supp 10):S13-S18

Prior M, Smart D, Sanson A, Oberklaid F (1993) Sex differences in psychological adjustment from infancy to 8 years. J Am Acad Child Adolesc Psychiatry 32(2):291–304

Saigal S, Rosenbaum P, Stoskopf B, Hoult L, Furlong W, Feeny D, Hagan R (2005) Development, reliability and validity of a new measure of overall health for pre-school children. Qual Life Res 14(1):243–257

Sonnander K (2000) Early identification of children with developmental disabilities. Acta Paediatr Suppl 434:17–23

Steinmacher J, Storck M, Fingerle J, Gräßle A, Kupferschmid C, Bode H (2002) The elephant bites the lion…diagnostic tools for the assessment of developmental impairments of 5-year-old children - advances in the "Ulmer" test battery. (German) [Der Elefant beißt den Löwen… Diagnostik von Teilleistungsstörungen bei 5-jährigen Kindern - Weiterentwicklung der Ulmer Testbatterie zur U9]. Kinder- und Jugendarzt 33:638–642

Stich H, Baune B, Caniato R, Krämer A (2006) Associations between attending a kindergarten and the individual development of pre-school children: a retrospective survey over 6 years. BMC Public Health 6:260

Sundelin C, Vuille J-C (1976) Health screening of 4-year-olds. III. Variation of effectiveness among examining teams. Acta Paediat Scand 65:193–200

To T, Guttmann A, Dick P, Rosenfield J, Parkin P, Tassoudji M, Vydykhan T, Cao H, Harris J (2004) Risk markers for poor developmental attainment in young children: results from a longitudinal national survey. Arch Pediatr Adolesc Med 158:643–649

Tomblin J, Records N, Buckwalter O, Zhang X, Smith E (1997) Prevalence of specific language impairment in kindergarten children. J Speech Lang Hear Res 40:1245–60

van den Hazel P, Zuurbier M, Babisch W, Bartonova A, Bistrup M, Bolte G, Busby C, Butter M, Ceccatelli S, Fucic A, Hanke W, Johansson C, Kohlhuber M, Leijs M, Lundqvist C, Moshammer H, Naginiene R, Preece A, Ronchetti R, Salines G, Saunders M, Schoeters G, Stilianakis N, ten Tusscher G, Koppe J (2006) Today's epidemics in children: possible relations to environmental pollution and suggested preventive measures. Acta Paediat Suppl 95(453):18–25

Webster R, Majnemer A, Platt R, Shevell M (2004) The predictive value of a preschool diagnosis of developmental language impairment. Neurology (63):2327–2331

Webster R, Majnemer A, Platt R, Shevell M (2005) Motor function at school age in children with a preschool diagnosis of developmental language impairment. J Pediatr 146(1):80–85

Webster R, Erdos C, Evans K, Majnemer A, Kehavia E, Thordardottir E, Evans A, Shevell M (2006) The clinical spectrum of developmental language impairment in school-aged children: language, cognitive and motor findings. Pediatrics 118(5):1541–149