

## COMMENTARY ARTICLE

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**Title: International variation in programmes for assessment of children's neurodevelopment in the community: understanding disparate approaches to evaluation of motor, social, emotional, behavioural and cognitive function**

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**Word count: 3330**

## **ABSTRACT**

### **Background**

Few areas of medicine demonstrate such international divergence as child development screening/surveillance. Many countries have nationally mandated surveillance policies, but the content of programmes and mechanisms for delivery vary enormously. The cost of programmes is substantial but no economic evaluations have been carried out. We have examined critically the history, underlying philosophy, content and delivery of programmes for child development assessment in five countries with comprehensive publicly-funded health services (Denmark, Finland, Norway, Scotland and Sweden). The specific focus of this article is on motor, social, emotional, behavioural and global cognitive functioning including language.

### **Findings**

Variations in developmental surveillance programmes are substantially explained by historical factors and gradual evolution although Scotland has undergone radical changes in approach. No elements of universal developmental assessment programmes meet World Health Organisation (WHO) screening criteria although some assessments are configured as screening activities. The roles of doctors and nurses vary greatly by country as do the timing, content and likely costs of programmes. Inter-professional communication presents challenges to all the studied health services. No programme has evidence for improved health outcomes or cost-effectiveness.

### **Conclusion**

Developmental surveillance programmes vary greatly and their structure appears to be as much driven by historical factors as by evidence. Consensus should be reached about which surveillance activities constitute screening, and the predictive validity of these components needs to be established and judged against WHO screening criteria. Costs and consequences of specific

programmes should be assessed, and the issue of inter-professional communication about children at remediable developmental risk should be prioritised.

**KEYWORDS**

Paediatrics, screening, child development, parents, organisation of care, health surveillance, general practice, primary (health) care; community nurse, well-child checks

## **Background: the scope of developmental surveillance**

There is limited international consensus on the provision of screening for brain development problems in preschool children, despite many countries dedicating substantial resources to developmental assessments. Brain development or neurodevelopmental problems are defined broadly here to include global or specific forms of developmental delay, neuropsychiatric problems such as autism, motor problems and emotional and behavioural problems such as depression or conduct disorder. The presentation of these problems may have contributions from constitutional or environmental components, including the social environment of the family. We have used the term 'screening' to encompass all scheduled specific developmental assessments with pass/fail criteria, while recognising that 'surveillance' or the less precise term 'assessment' might be preferred by some. This matter of nomenclature, and the associated lack of clarity in discussions about the purpose of routine developmental assessments, is discussed in more detail below. The Research Inventory of Child Health in Europe (RICHE) project <sup>1</sup> was designed to identify gaps in European child health research and to provide justified guidance on priorities for future investments in research. RICHE highlighted the poor quality of research into preventive child health services and proposed research into variations between services internationally as well as into the identification of the most effective means of identifying problems and treating them. A recent systematic review reinforces the need for high quality studies of child health assessments with the inclusion of clinical end-points <sup>2</sup>.

The evidence for net benefit from routine child development assessments is weak <sup>3-5</sup> but this may largely reflect lack of evidence of effectiveness rather than evidence of insufficient effectiveness. We have found no economic evaluations of universal child developmental surveillance programmes although official sources may make claims for economic benefit (see for example <sup>6</sup>). Consequently, authorities are forced to make decisions regarding preschool checks without an evidence base, being mindful of the United Nations Declaration on the Rights of the Child's strong emphasis on access to

preventive health care <sup>7</sup>. Varying approaches in different countries have led to families being offered preschool child health surveillance services ranging from a single post-neonatal preschool developmental assessment in Scotland between 2006-14 <sup>8</sup> to at least 14 scheduled assessments currently in Denmark, Finland and Norway. Not only the number and timing, but also the content of developmental screening assessments varies widely between health services <sup>9</sup>.

Although routine child health assessments seek to identify a wide range of conditions, our focus here is on the domain which appears to display the greatest variance between nations, namely neurodevelopmental assessment. Screening for sensory impairments is not considered specifically in this article. In the developed world, it is possible that problems in neurodevelopment may be more amenable to intervention than most physical health problems <sup>10</sup>. They also have serious long-term health implications. Early childhood behavioural problems have been shown to precede and increase the risk of a wide range of poor outcomes associated with substantial cost and impact on society as a whole <sup>11-14</sup>, and variations in childhood language, social, behavioural and cognitive development predict long-term health. For example, early conduct problems predict antisocial behaviour, psychopathic personality traits, psychiatric problems, substance dependence, large family size, financial problems, work problems, and drug-related and violent crime at age 26 <sup>15</sup>.

Participants in the 1958 British birth cohort who were rated by their teachers as being in the highest quartile for emotional and behavioural problems had double the mortality by age 46 years compared with the lowest quartile <sup>16</sup>. ADHD predicts problems with substance use <sup>17</sup> and smoking <sup>18</sup>; and language delay predicts mental health problems at age 7 <sup>19</sup> and at age 34 <sup>20</sup>. Motor problems including tics and developmental coordination disorder are also associated with a range of adverse mental health and educational outcomes <sup>21</sup>. Global intellectual function is a strong predictor of long-term health and longevity <sup>22, 23</sup>.

As with the development of visual and auditory function, there is evidence for ‘critical’ or ‘sensitive’ periods in language acquisition, social-emotional development and behavioural regulation<sup>24</sup> so there may be a specific case for identification of these early signs of vulnerability so that resources can be used to benefit the children who most need them. Furthermore, targeted early psycho-educational and other interventions have the potential to influence long-term health outcomes<sup>25, 26</sup>. There is nevertheless wide international variation in public health approaches to screening in relation to child development, in particular to disorders of language, social functioning and behaviour, and there is certainly no academic consensus on the optimal approach.

### **Screening or surveillance?**

Terminology in the field of preventive child health is confusing, with the terms developmental screening, surveillance, assessment and case-finding often being used interchangeably. We consider that universal scheduled specific examinations of children designed to identify previously undiagnosed conditions falls under the definition of screening adopted by Wilson and Jungner in 1968: "the presumptive identification of unrecognized disease or defect by the application of tests, examinations, or other procedures which can be applied rapidly. Screening tests sort out apparently well persons who probably have a disease from those who probably do not"<sup>27</sup>. We therefore refer to developmental screening here while acknowledging that this activity may have other functions. In general, screening tends to be an event occurring at a single time, using a single screening test, and has a rigid pass/fail threshold, with those individuals lying above the threshold being referred for further more definitive assessment. In contrast, "surveillance conveys rather the sense of a long-term vigil over the health of an individual or of a population"<sup>27</sup> and has tended to indicate a repeated or longitudinal process that can be informed by a wider range of assessment methodologies including developmental history, elicitation of parental concerns, structured observation of children’s abilities, etc., and may elicit a wider or more flexible range of responses from watchful waiting, to support and reassessment, to formal referral<sup>28</sup>. When validated developmental assessment questionnaires with cut-off scores are incorporated into the surveillance

process, the distinction between surveillance and screening can become more blurred. Furthermore, surveillance can indicate gathering of information on a population without necessarily leading to any intervention. Lack of interventions in turn may be due to lack of resources, lack of local availability, lack of demonstrable effectiveness or simply lack of intervention development. There is therefore no completely satisfactory unifying term to describe the philosophy that underpins universal developmental checks, but screening is certainly a key component of many universal scheduled developmental assessments. Most developed countries have systems for determining their universal screening policies based upon the nine essential World Health Organisation (WHO)/Wilson and Jungner screening criteria<sup>27</sup>. In relation to assessment of development, the key criteria against which screening tests should be tested are that: there should be a test that is easy to perform and interpret, acceptable, accurate, reliable, sensitive and specific; there should be an accepted treatment recognised for the disease; treatment should be more effective if started early, and diagnosis and treatment should be cost-effective<sup>10</sup>.

### **Evolution of preventive child health services in the Nordic countries and Scotland**

Although earlier local initiatives existed in the United Kingdom and Norway, universal preventive health services for children began in each of the countries under consideration in the first half of the 20<sup>th</sup> century. The initial focus of these services was nutrition (particularly in Finland and Sweden) and infectious diseases and hygiene (particularly in Norway and the UK). By the middle of the 20<sup>th</sup> century, nationally mandated services existed in each of the studied nations, under the aegis of local authorities (Finland, Scotland, Norway, Sweden), or general medical practices (Denmark). The origins of the Danish GP-based system differ from the others discussed here because from the 1870s, health insurance providers and general practice had firm contractual relationships which were formalised on a national basis in 1946 in relation to preventive child health.



In general, apart from in Scotland, there has been a gradual evolutionary process in the specifications of universal child health assessments. There have been national initiatives to increase the amount of universal child health assessment activity: for example in 2011 it became a family's right to be offered extended child health examinations in Finland <sup>29,30</sup>, and Norway <sup>31</sup> and Sweden <sup>32</sup> have both recommended additional assessments in recent years. In Denmark funding for a specific preventive consultation was introduced in 2006 enabling the GP to arrange for an extension of the child health assessment, for example in relation to growth. This service was however withdrawn in 2011. The history of preventive child health in Scotland differs markedly from that in the other nations. Until the 1970s, preventive child health services were provided in line with services in Norway, Sweden and Finland in local authority clinics run by community child health nurses (health visitors) and physicians (community medical officers). In the 1970s and 1980s, health visitors increasingly became attached to primary health care teams based in general practice, and from 1990 child health assessments (neonatal, 6-8 weeks; 8-9 months; 22-24 months; 39-42 months; and pre-school) were conducted mainly by health visitors and GPs in general practices with specialist support when required from community paediatric teams based in child development centres <sup>33</sup>. This pattern continued until the recommendations of UK guidance from the Royal College of Paediatrics and Child Health <sup>3</sup> were interpreted in Scotland as indicating that universal child health surveillance beyond six weeks of age was a poor use of resources. The arguments for this position, leading to a targeted rather than a universal approach, were that uptake of preventive services was inversely related to socioeconomic need <sup>34,35</sup>, and there was a view that vulnerable children could be identified early. If early identification failed, it was thought that parental concern combined with parental education would act as a 'safety net' <sup>8</sup>. The bases for these assumptions were challenged by a number of studies <sup>36-39</sup> as well as by political pressure from organisations such as "Baby in the Bathwater" <sup>40</sup> and an extensive programme of routine developmental assessments was re-introduced between 2012 and 2017 <sup>41</sup>.

With the exception of Scotland, therefore, there has been a gradual trend over the past 30 years towards increasing activity. Guidelines for universal scheduled developmental assessments are produced in each nation, but the level of adherence to these guidelines is variable. Only in Scotland has there been a fundamental challenge to the need for universal developmental assessments, but the policy decision in 2006 to abolish routine assessments has been reversed.

### **Current organisation of developmental screening in the five nations**

The organisation of delivery of child health assessments varies somewhat across the studied nations. In Finland, Sweden and Norway, assessments after the first month of life are made in maternal and child health centres which are organized by municipalities. These community health centres generally employ physicians working in collaboration with community health nurses. In many cases, the physicians also work as local family doctors (general practitioners – GPs) but in Sweden some are community paediatric specialists. Some child health centres, especially in Finland, have close working relationships with physiotherapists, psychologists, speech therapists and occupational therapists. In Norwegian cities, small child health centres are linked to larger centres with multi-disciplinary teams including physiotherapists. Denmark has a markedly different system in which GPs, or less frequently their practice nurses or midwives, deliver scheduled health assessments in their practices, while community nurses conduct home visits specifically in the first year of life.

Physicians have played a minimal role in child health surveillance in Scotland since 2006, conducting a single assessment at 6-8 weeks focussed entirely on physical examination. Other universal contacts are generally delivered by community nurses in family homes. In all countries, the role of physicians tends to be focussed more on physical examinations, while nurses tend to have a greater focus on growth, nutrition, social development and parenting.

Summary data on the delivery of universal preschool neurodevelopmental assessments in the studied nations are presented in table 1.

## TABLE 1 ABOUT HERE

Uptake of child health assessments is generally high, particularly where immunisation and health assessments are timed to coincide. In Finland, uptake of developmental assessments is estimated to be 99.5%<sup>42</sup>, in Norway over 90%, in Denmark more than 90% in the first year, declining in following years to around 85% at age four years, where the assessment is accompanied by an immunisation. Non-participation in the Danish assessment program is more common among young and single-parent families, those of low socioeconomic status and those with older children in the home<sup>43</sup>. In Sweden uptake is 95-99% depending on region, and in Scotland there is also a declining attendance pattern with age, ranging from 99% at the 10 day contact, to 95% at the 6-8 week contact, to 88% for the 27-30 month contact<sup>35,44</sup>. There is lower uptake among the most deprived families, but this social differential has reduced in recent years. There is some evidence that children of families who have not taken part in health screening are at particularly high risk of educational failure<sup>45</sup>.

It is difficult to comment on the quality of developmental screening or surveillance programmes since no appropriate metrics exist. One descriptive evaluation of child examinations in Danish general practice estimated that abnormal findings are made in one out of seven examinations<sup>46</sup> and recent data from Scotland suggest that 18% of children undergoing their 27-30 month review in 2015/16 were identified as having a pre-existing or newly identified concern about their development, with concerns most commonly affecting the speech and language domain<sup>47</sup>.

There is considerable variation within individual countries and between clinicians in terms of the practice of developmental screening, with the greatest internal variation probably being found in Denmark where data recording is not standardised<sup>46,48,49</sup>. Nevertheless there are specific policies determined at a national level in each of the studied nations, detailed in table 2. In all nationally-

recommended assessments, clinicians are advised to discuss and assess parental concerns, but only specific mandated items for universal assessment are discussed here.

#### **TABLE 2 ABOUT HERE**

All of the studied countries aim, through provision of child health services, to support good parenting practices, to offer health promotion, immunisations and accident prevention advice as well as to screen for problems in child development and evidence of child maltreatment. In Scotland, which arguably has the greatest economic differential between affluent and deprived families in the countries described here, there is also an explicit aspiration to reducing social inequalities through “Proportionate universalism”<sup>50</sup>.

#### **Communication between services: data sharing in the child’s interest Vs family privacy**

Although all the countries under consideration have strong and well-established primary care/general practice services, and children with significant developmental problems may be referred from child health centres or community nurses to GPs for further investigation (although less commonly in Sweden where GPs do not generally have a gatekeeping function), there appears to be minimal formal communication between community child health services and family practice (GP) care systems. This applies to the majority of children in all the studied countries, except in a substantial part of Finland. In each country there are unresolved tensions between data protection/patient confidentiality considerations and inter-agency communication in the interests of the child<sup>51-53</sup>. Calls for improved inter-agency communication often follow public failures in child protection processes<sup>54, 55</sup> and national guidelines regularly promote the development of communication protocols, particularly for vulnerable children<sup>31, 56</sup>. Within countries there are also regional differences in communication patterns.

There are practical consequences of poor collaboration. In Denmark the GP system and community nurse systems work in parallel and there is a long history of 'firewalls' between the two systems. As a result, there is, for example, no interaction between the electronic growth charts kept by the GP and the community health nurses. Parent-held records can help with this problem, and they exist in Finland, Scotland and parts of Sweden but completion levels are variable. Nevertheless, some important "soft" information such as suspected parental problem substance use (most likely to be brought to the attention of a GP) is unlikely to be recorded in a parent-held record. Whether or not this information is passed on to community child health nurses is likely to depend on the closeness of professional relationships. In some smaller communities GPs and community child health nurses may know each other well, but in others there may be no communication between these key professionals with responsibility for child health. One GP's patients may have many different community nurses and vice versa. Community health nurses in Scotland were commonly part of the primary care team based in general practices until around 2005, but this has become unusual in recent times. In our view this type of service integration, supported by the World Health Organisation<sup>57</sup> has much to commend it but it is uncommon. In Finland, both primary health care and child health centres are currently organized by municipalities and for this reason there is usually good inter-agency cooperation as well as shared access to electronic patient records. In Norway, recent national guidelines impose duties on child health services to establish routines for cooperation with the child's GP<sup>31</sup>, but it remains to be seen how effective these guidelines will be. Formalised collaboration between developmental assessment services and child care facilities or kindergartens is relatively uncommon in all the studied countries.

## **Main findings**

- Policy and practice on the assessment (surveillance or screening) of pre-school children's development as part of wider national child health programmes in each nation has evolved over many decades
- The amount and method of developmental assessment, the professional groups responsible, and the settings in which assessment takes place varies greatly between nations
- The integration of developmental assessment within broader primary healthcare services varies between nations, and links between health led developmental assessment and early education services appear weak in all the countries we studied
- Whilst scientific understanding of early child development, and the conditions and interventions that support healthy development, has expanded over time, there remains extremely little direct evidence on the specific costs of and outcomes from developmental assessment

### **Recommendations**

- Nations should systematically monitor the provision and outcomes of developmental assessment as part of their wider child health programme, the services subsequently provided to children, and their final developmental outcomes. The Nordic countries and Scotland all have excellent linked or linkable administrative data systems that could be used to this end.
- The performance of assessments that could be considered as screening tests should be measured against the WHO screening criteria and all existing data on test performance should be collated and reviewed as part of an exercise to improve the international evidence base.
- Opportunities should be taken to evaluate the relative costs and effectiveness of different approaches to developmental assessment implemented in different countries

- The impact of strategies designed to improve inter-professional communication about children at remediable developmental risk should be tested
- Similarly the non-specific benefits of developmental surveillance programmes require characterisation: health education opportunities, 'signposting' towards potential sources of support, support for positive parenting behaviours, and in Denmark strengthening the GP's relationship to and knowledge of the family among other factors. We know little about whether programmes support or impair parents' role and sense of responsibility or whether they increase or decrease parental anxiety.

### **Specific testable hypotheses**

A number of hypotheses could be tested in the Nordic countries or Scotland using cluster randomised trial designs with follow up through linkage to routine health and educational records could inform this debate. For example:

- Does incorporation of validated, parent-completed developmental questionnaires (in addition to more traditional developmental history taking, enquiry about parental concerns, and unstructured observation) as part of developmental assessment lead to a higher proportion of children identified as having developmental delay, earlier and more effectively targeted provision of developmental support, and improved developmental outcomes?
- Does increasing the number of assessment points over the preschool period lead to earlier identification of developmental delay and what are the costs and consequences? Is there a negative impact on social inequalities?
- Does the professional background (nurse, doctor) of the professional conducting developmental assessment and the setting in which it is done (home, clinic) influence outcomes?

## **List of abbreviations**

GP- general practitioner

WHO – World Health Organisation

## **Declarations**

*Ethics approval and consent to participate*

Not applicable

*Consent for publication*

Not applicable

*Availability of data and material*

All data generated or analysed during this study are included in this published article [and its supplementary information files].

*Competing interests*

Merethe Kirstine Andersen, Anette Graungaard, Ruth Ertmann, Merja Hietanen and Per Lagerløv undertake child health surveillance checks as part of their employment in general practice or child health clinics. The authors have no other competing interests to declare.

*Funding*

This study received no external funding.

*Authors' contributions*

PW wrote the first draft of this article and contributed to subsequent drafts. All other authors contributed to subsequent drafts and approved the final manuscript. Specific data on child health surveillance policies in their own countries was provided by RW, PL, KL, EA, MM, MH, AV, SC and PS.

*Acknowledgements*

In addition to the named authors, the members of the Nordic Research Network for Children and Adolescents in General Practice contributing to this article were: Frøydis Gullbrå (Norway), Anne-Kristi Brodwall (Norway), Marit Hafting (Norway), Sofie Cedermark (Sweden), Peter Stålhammar



(Sweden). We are also grateful to Ann Jansson, Child Health Unit Göteborg & Södra Bohuslän, Sweden, for providing additional information.

**Table 1. National minimum schedules for universal child development assessments.**

	Denmark <sup>58</sup>	Finland <sup>59</sup>	Norway <sup>31</sup>	Scotland <sup>60</sup>	Sweden <sup>61</sup>
First month	1 to 2 Community nurse home visits	Community nurse home visit	Community nurse home visit	2 Community nurse home visits	Community nurse home visit and public health centre visit
4-8 weeks	General practitioner Community nurse home visit	Doctor and nurse at public health centre	Doctor and nurse at public health centre (nurse assessments at 4 and 6 weeks)	2 Community nurse home visits Joint nurse/GP assessment at 6 weeks	Doctor and nurse at public health centre plus 2 nurse assessments
3 months		Nurse at public health centre	Nurse at public health centre	Community nurse home visit	Nurse at public health centre
4 months	Community nurse home visit	Doctor and nurse at public health centre *	Nurse at public health centre	Community nurse home visit	Nurse at public health centre
5 months	General practitioner	Nurse at public health centre	Nurse at public health centre		Nurse at public health centre
6 months		Nurse at public health centre	Doctor and nurse at public health centre		Doctor and nurse at public health centre
7 months	Community nurse				
8 months		Doctor and nurse at public health centre	Nurse at public health centre	Community nurse home visit	Community nurse home visit
10 months	Community nurse		Nurse at public health centre		Nurse at public health centre
1 year	General practitioner	Nurse at public health centre	Doctor and nurse at public health centre		Doctor and nurse at public health centre

13-15 months	Community nurse home visit in some communities		Nurse at public health centre	Community nurse home visit**	
18 months		Doctor and nurse at child health clinic*	Nurse at public health centre		Nurse at public health centre
2 years	General practitioner	Nurse at public health centre	Doctor and nurse at public health centre		Doctor and nurse at public health centre
27-30 months				Community nurse home visit**	Nurse at public health centre
3 years	General practitioner	Nurse at public health centre			Doctor and nurse at public health centre
4 years	General practitioner	Doctor and nurse at public health centre *	Nurse at public health centre	Community nurse home visit**	Nurse at public health centre
5 years	General practitioner	Nurse at public health centre			Nurse at public health centre

Table 1. National schedules for universal child development assessments.

\*Health checks in Finland at 4 months, 1.5 years and 4 years involve an extended health examination. Both parents are invited to attend for a multi-professional assessment involving individual and family welfare.

¶In Norway and Denmark, some of the nurse-delivered health checks can be group consultations. Most, but not all contacts with nurses in Denmark are in the home and practices vary by region,

\*\*These home visits by community nurses in Scotland are specifically designated to involve an assessment of development and wellbeing

**Table 2. National policies for universal scheduled neurodevelopmental assessments.**

	Denmark <sup>58</sup>	Finland <sup>59</sup>	Norway <sup>62, 63</sup>	Scotland <sup>60</sup>	Sweden <sup>61</sup>
First month		Movement, social interaction, tonus, primitive reflexes, posture, motor skills, family's wellbeing and functioning	Motor development, tonus, sleep, social interaction, temperament, family functioning, psychological well-being, parent-child relationship,	"Physical developmental check" – detail not specified	Movement symmetry, motor, mental and social development, family functioning, psychological well-being, parent-child relationship,
4-8 weeks	Motor, mental and social development and well-being. family well-being and parent-child relationship. attachment, sleep. primitive reflexes, tonus, eye contact.	Eye contact, movement, gross motor function, tonus, primitive reflexes, parent-child interaction, assessment of neurological development	Motor development, tonus, sleep, social interaction, temperament, crying, vocalisation, social smile, movement symmetry, Moro and primitive reflexes,	"Observe developmental status", "evidence of attachment", Joint nurse/GP assessment at 6 weeks includes tonus, head control, social smile	mental and social development, family functioning, psychological well-being, parent-child relationship, primitive reflexes, head control, hand movement, eye contact
3 months		Movement, social interaction, communication, skin, eye contact, primitive reflexes, vocalisation	Vocalisation, motor development, self-regulation, communication, sleep, attention, social smile	Observe child's developmental progress"	Speech/language development, Communication, social interaction, attention, vocalisation, movement, self-regulation, parent-child interaction, sleep
4 months		Head control, hand movement gross motor function, tonus, primitive reflexes, parent-child interaction, movements, eye contact, features, assessment of neurological development		"Observe child's developmental progress"	Speech/language development, "observe child's developmental progress"
5 months	Motor, mental and social development and well-being. family well-being and parent-child relationship, primitive reflexes, tonus.	Sleep, eye contact, body position, movements (roll over, grasping objects), tonus, disappearing of primitive reflexes, parent-child interaction, oral motoric skills and vocalisation	Communication, motor development, sleep,		"Observe child's developmental progress"
6 months		Eye contact, body position, movements (roll over, grasping objects), tonus, protective reflexes, parent-child interaction, oral motoric skills and vocalisation	Attention, communication, , sleep, motor development (movement, postural control).		mental and social development, family functioning, psychological well-being, parent-child relationship, primitive reflexes, Speech/language development, rolling, sitting, object grasp, hand/eye coordination,
7 months					
8 months		Abilities for sitting	Attachment, , motor	"Observe child's	"Observe child's

		(protective reflexes), standing (while held beneath arms) and to locate sound, dorsiflexion of ankles, pincer grip Gross motor function, tonus, crawling, parent-child interaction, movements, contact (smiling and vocalisation in interaction with examiner), oral motor skills and vowel sounds	development (pincer grip), communication, play, sleep, attention	developmental progress". Achievement of age appropriate developmental milestones	developmental progress", family functioning, psychological well-being, speech/language development,
10 months			Attachment, sleep, play, communication, motor development, temperament		Speech/language development, motor development: 'cruising', pincer grip, play "peek-a-boo", knocking bricks against each other
1 year	Motor, mental and social development and well-being, family well-being and parent-child relationship, development of autonomy, babbling.	Communication and interaction with parent and with a stranger, language (words), eye contact, pincer grip, movements (walking with one hand support), use of hands (throwing, use of objects)	Motor development, sleep, communication, Social function, attention, social interaction, language, Movement pattern and tonus, Sitting, pulling to standing, pincer grip		mental and social development, family functioning, psychological well-being, parent-child relationship, speech/language development
13-15 months			Sleep, language, motor development, social and emotional development	Formal review with observation. Assess quality of parent - child relationship, developmental and wellbeing review, Ages & Stages Questionnaires: (ASQ:3)*, Emotional, behavioural, attention problems	
18 months		Speech (recognizable words, understand brief instructions), hand co-ordination, stacking 2 bricks, movements, communication and interaction with parent and with a stranger, eye contact, pincer grip, standing up and walking without support			Speech/language development, (understand and speak 10 words), walking, building tower, drawing, points to body parts, retrieves items, 'hide and seek'
2 years	Motor, mental and social development and well-being. family well-being and parent-child relationship. development of autonomy. language	Speech Communication and interaction with parent and with a stranger, speech, eye contact,	Activity and play, self-image, independence, language development, sibling rivalry, sleep, communication, behaviour, motor development,		
27-30				As at 13-15 month	Mental, social and

months				review. Ages & Stages Questionnaires: (ASQ:3)*	motor development, family functioning, psychological well- being, Speech/language development, jumps, kicks ball, draws circle, listens to stories, play behaviours
3 years	Motor, mental and social development and well-being. family well-being and parent-child relationship. development of autonomy. language. attention and behaviour.	LENE (validated screening for neurological impairments) gross motor skills, evaluate any abnormal body movements, child's ability to maintain attention, speech, understanding of heard information and eye-hand-co- operation child's ability to play with objects and take independent initiatives, social interaction.¶]			mental and social development, family functioning, psychological well- being, parent-child relationship, language, Speech/language development, jumps, kicks ball, draws circle, listens to stories, plays with toy car
4 years	Motor, mental and social development and well-being. family well-being and parent-child relationship. language, attention and behaviour. hearing and vision.	LENE, speech, motor skills, ability to take and stay in contact, independent initiative skills in everyday actions (dressing up, eating, playing etc), language, gross motor skills, evaluate any abnormal body movements, eye-hand co-ordination, child's ability to play with objects, social interaction.¶]	Motor development, sleep (walking, running, jumping, drawing, social and emotional development. Evaluation of language / speech	As at 13-15 month review. Ages & Stages Questionnaires: (ASQ:3)*, cognitive/problem solving, social, emotional and behavioural, speech and language, attention problems	Speech/language development, balances, threads beads, drawing/copying, social play, knows colours, counts to 3
5 years	Motor, mental and social development and well-being. Family well-being and parent-child relationship. language, attention and behaviour.	LENE: gross motor skills, seek abnormal body movements, child's ability to maintain attention, speech, understanding of heard information and eye-hand-co- operation coordination, hearing memory and visual perception¶]			Speech/language development, stands on 1 leg, cuts around a circle, copies figures, social play, draws people, turn-taking (selective assessment in some areas)

**Table 2. National policies for universal scheduled neurodevelopmental assessments.**

Scottish national data are collected on the results of assessments at 11-14 days, 6-8 weeks, 13-15 months, 27-30 months and 4-5 years <sup>64</sup>.

\*The Ages and Stages Questionnaire covers the following domains: Communication, gross motor, fine motor, problem solving, personal-social. If problems are identified, further questionnaires may be used.

\*\* For all the seven Danish GP assessments, the child's development is assessed in relation to defined milestones for fine and gross motor, cognitive, mental and social function <sup>58</sup>

¶¶In Finland, a specific and lengthy test routine, 'LENE' (Leikki-ikäisen neurologinen kehitys, or toddler's neurological development test) is used at 3, 4,5 and 6 years <sup>65, 66</sup>. It is designed to identify developmental problems that can lead to learning difficulties at school entry. Individual items are scored and there are clear criteria for borderline and clear test failure.

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