

# Motor function tests for 0-2-year-old children – a systematic review

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## ABSTRACT

**INTRODUCTION:** There is no evidence on how motor function is best evaluated in children in a low-risk setting. The method used in the Danish Preventive Child Health Examination Programme (DPCHEP) in general practise has not been validated. The objective of this review was to identify existing motor function tests for 0-2-year-old children that were validated for use in the background population and which are suitable for use in the DPCHEP.

**METHODS:** This systematic review was conducted in accordance with the PRISMA guidelines. A systematic literature search was performed in PubMed, Embase, SwedMed, PsycInfo and CINAHL in accordance with the inclusion and exclusion criteria.

**RESULTS:** Five motor function tests were identified. The Alberta Infant Motor Scale (AIMS) exclusively assesses motor function, the Harris Infant Neuromotor Assessment also assesses cognition and the Early Motor Questionnaire (EMQ) additionally assesses perception-action integration skills. The Ages and Stages Questionnaire (ASQ) and The Brigance Infant and Toddler Screen include further aspects of development. All test methods, except for the AIMS, are based on parent involvement.

**CONCLUSIONS:** For implementation in the DPCHEP, five motor function tests were potentially adequate. However, the time consumption and extensive use of tools render three of the five tests unsuitable for implementation in the existing programme. The two remaining tests, the ASQ and the EMQ, are parent questionnaires. We suggest that these should be pilot tested with a view to their subsequent implementation in the DPCHEP. It may be considered to present the test elements in a more manageable and systematic way, possibly with illustrations.

Developmental delay in motor function in 0-2-year-old children may be a sign of biological disease or psychosocial conditions. Early detection and intervention may improve the child's quality of life and potentially also the long-term prognosis.

In Denmark, all preschool children are offered a free preventive child health examination set in general practice [1]. The programme includes three examinations in the child's first year of life and yearly examinations until the child is five years old [1]. These examinations include a broad assessment of family dynamics

and the child's general health, language and gross and fine motor skills [1]. A report from 2004 showed that 85-95% of all 0-2-year-old children in Denmark participated [2].

This review focuses on how motor skills can be tested. The Danish Health Authority suggests that motor function be evaluated by muscle tone, strength, movement symmetry, reflexes and activity level [1]. However, this evaluation of motor development is not based on a standard validated test and no reference intervals for normal development are available. Hence, it is uncertain whether the general practitioner is able to identify children with developmental delay in the background population.

The aim of this systematic review is to identify motor function tests for 0-2-year-old children that were validated for use in the background population, and to evaluate whether any existing tests are suitable for implementation in the Danish Preventive Child Health Examination Programme (DPCHEP). To fulfil these criteria, a test must be accurate, time effective and easy to implement and perform. The objective of the test must be to screen normally developed children and to identify developmental delays with a high sensitivity for further evaluation by a specialist.

## METHODS

The review followed the PRISMA guidelines [3]. However, several items were not applicable for this study, e.g. no participant or study group was relevant, and no interventions or statistical analyses were carried out. The study did not receive any funding.

## SYSTEMATIC REVIEW

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## KEY POINTS

- A systematic validated test method to evaluate children's motor function development would be useful for primary care physicians doing preventive child health examinations.
- Based on our inclusion and exclusion criteria, five tests are relevant for this study.
- Two of five tests are deemed suitable for implementation in the Danish Preventive Child Health Examination Programme.
- A test based on a parent's questionnaire combined with a physician's observations and examinations, possibly organised as a checklist with illustrations, is recommended.

 TABLE 1

Characteristics of the motor function tests of 0-2-year-old children included in this systematic review.

	<b>The Alberta Infant Motor Scale [4, 5, 9, 26]</b>	<b>The Harris Infant Neuromotor Assessment [5, 9, 21-23]</b>	<b>The Ages and Stages Questionnaire [5, 10, 13-16, 24]</b>	<b>The Brigance Infant and Toddler Screen [17]</b>	<b>The Early Motor Questionnaire [18]</b>
Origin	Canada	Canada	USA (and Canada)	USA	USA
Year of publication	1990	1993	I: 1995, II: 1999, III: 2009	2002	2013
Standardisation	Yes; Canada 1992; 2,202 children [4, 5]	Yes; Canada 2003; 412 children [9]	Yes; USA 1996; 2,008 children [5, 10]	Yes; USA 2002; 408 children	No
Reliability	Yes [5]	Yes [22]	Yes [10]	Yes	Yes
Validation	Yes [4, 5]	Yes [9, 21-23]	Yes, US with modifications [24], Norwegian [13], Danish [15]	Yes	Yes
Sensitivity, %	86	65	75-100	76-77	-
Specificity, %	93	62	85-87	85-86	-
Positive predictive value, %	66	-	46	-	-
Negative predictive value, %	-	-	-	-	-
Target group, age, mo.s	0-18 [4, 5]	3-12 [21]	I: 4-48 [10] II: 4-60 [14]	0-24 Test elements up to 8 yrs of age are available	0-24
Test elements	Gross motor skills [4, 5]	Motor skills & cognition [21, 23]	Motor skills, problem solving, communication & personality/social development [10]	Motor skills, receptive and expressive language, self-help, and social-emotional.	Motor skills, and perception-action integration skills
Objective	To identify gross motor developmental delays, evaluate change in motor skills over time in relation to maturation or intervention, as well as to provide information for treatment planning [9]	To detect early signs of neuromotor and cognitive development delays in children at particular risk [21]	To identify children with special needs of support for their overall development and who therefore should be referred for further investigation [14] Furthermore, to create an affordable and easy alternative to the already developed test methods [5]	To identify children in need of diagnostic testing or special services, to monitor progress, and to aid in programme evaluation	To serve as a motor screener or as complement to standardised measures of early motor development A first-step screening instrument to identify children who should receive further assessments
Method	Test conducted by professional using check lists and illustrations [5]	Questionnaire for parents and test conducted by professionals using check list [21-23]	Questionnaire for parents with illustrations [10, 14]	A parent report/interview, direct elicitation/observation by a professional, or a combination of the 2	Parent-report measure of early motor development organised around different "contexts" a child encounters during everyday situations
Time frame, min.	10-20 [5]	< 30 [9]	Questionnaire 10-20 Scoring 1-5 [24]	10-15	17
Tools	Few	Few [23]	Few [14]	Many	Few
Translated editions	No	No	Norwegian [13] and Danish [15]	-	-

### Literature search

A systematic literature search was performed in PubMed, Swedmed Embase, PsycInfo and CINAHL in March 2017. The search string used for PubMed was: motor skills AND Diagnostic Techniques and Procedures [Majr] AND infant [MeSH] or child [MeSH] AND Evaluation Studies as Topic [MeSH] or validation studies [Publication Type] or motor skills AND Diagnostic Techniques and Procedures [Majr] AND infant [MeSH] or child, pre-school [MeSH] or gross motor skills children AND validity or fine motor skills children and validity.

Equivalent search strategies were used for the additional databases. A librarian at the Copenhagen University library supervised the search.

The reference lists of the included studies were studied to find original studies and information about the reliability and validity of the tests. Information about each specific test was achieved through internet searches at Google, PubMed, and Rex, The Royal Library, Copenhagen.

### Selection procedure

After removal of duplicates, CBK screened all titles and abstracts for relevance. Potentially relevant articles were assessed in full (by CBK). An article was included if 1) the test described assessed motor development in 0-2-year-old children (or the age span was included), and 2) the ability of the test to evaluate motor development was validated in children from the background population in a European or North American population.

The exclusion criteria were 1) use of sophisticated equipment such as a treadmill ( $n = 18$ ), 2) tests specifically designed for prenatals ( $< 38$  weeks) ( $n = 5$ ), 3) tests specifically designed for children with specific diseases or diagnoses, including obesity ( $n = 17$ ) or 4) tests comparing in- and excluded groups using different – not recognised – test methods ( $n = 15$ ). 5) Duration  $> 45$  minutes (combined tests) ( $n = 2$ ) or  $> 15$  minutes (single-element tests) ( $n = 5$ ). These time-based exclusion criteria were chosen since a Danish GP has 15-30 minutes to perform the full child health examination.

All inclusions and exclusions giving rise to any doubt were discussed and agreed upon among the authors (KL, RKR and CBK).

### Evaluation

The included tests were evaluated systematically based on standardisation, reliability, validity, age, origin, test description, scoring system, time frame, evaluator and materials required to complete the tests. See **Table 1**.

### RESULTS

Of 1,512 articles screened, 46 articles were included in the review (**Figure 1**). The included articles address five relevant motor function tests for 0-2-year-old children that were validated on the background population:

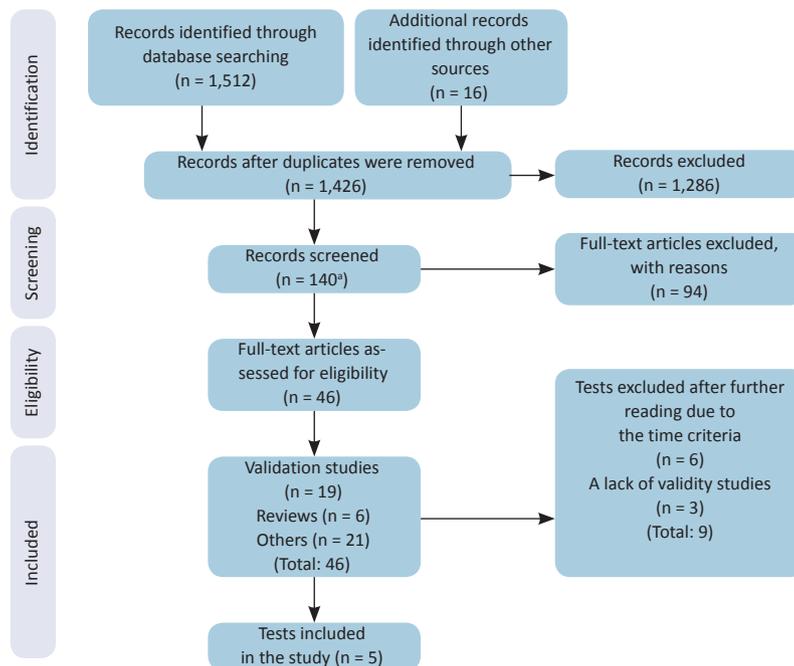
- The Alberta Infant Motor Scale (AIMS)
- The Harris Infant Neuromotor Assessment (HINT)
- The Ages and Stages Questionnaire (ASQ)
- The Brigance Infant and Toddler Screen (BITS)
- The Early Motor Questionnaire (EMQ).

The test characteristics are described in **Table 1**. **Table 2** provides an overview of the advantages and disadvantages of the five tests.

It is relevant to mention two additional tests, the Peabody Developmental Motor Scales (PDMS)-II and the Bayley Scales of Infant and Toddler Development (BSID)-III. They are both well-documented and validated tests on motor function for use in the general population. Several of the tests included in this review were validated against these two tests. Nevertheless, the PDMS-II and BSID-III were excluded from this review as they are too time-consuming to perform (cf. exclusion criteria 5).

**FIGURE 1**

Characteristics for the motor function tests of 0-2-year-old children included in this systematic review. From [3], and in addition: [4, 12, 32-34].



a) Two abstracts were duplicates.

For additional reading, the characteristics of these two excluded tests are described in **Table 3**.

### Standardisation

The AIMS is stratified by age, gender and geography, but not by ethnicity or socioeconomic status [4, 5]. It is discussed if the AIMS can be used in other parts of Canada and in other countries [5] since the reliability was tested only on children born in Alberta, Canada [6]. A study of Dutch children aged 0-12 months indicated that new cut-off scores may be needed for Dutch and other European children [7], whereas a Greek study in healthy children found that the cut-off scores were appropriate [8].

The HINT is standardised on children with diverse ethnic backgrounds [9]. However, there is no Scandinavian standardisation.

The ASQ is standardised on an assorted group of children with (81%) and without (19%) particular risk of developing delays, as well as in children with diverse ethnicity and socioeconomic status [5, 10]. The ASQ was developed in 1995. Additional questions and an extended age range were added to the ASQ-II in 1999 [5]. The ASQ-III from 2009 [11] is standardised on a representative sample of children [12]. A Norwegian translation of the test is available with reference data from a representative sample of Norwegian children [13]. The average and dispersion values of the area score are simi-

 TABLE 2

Suitable for general practice? An overview of advantages and disadvantages of the five tests, which summarises some of the findings from the literature search made to determine whether the specific tests are suitable for implementation in the Danish Preventive Child Health Examination Programme.

	The Alberta Infant Motor Scale	The Harris Infant Neuromotor Assessment	The Ages and Stages Questionnaire	The Brigance Infant and Toddler Screen	The Early Motor Questionnaire
<i>Advantages</i>					
Standardisation	Standardised on a large group	Standardised on an ethnically diverse group	Standardised in a large group	-	-
Reliability and validity	Strong reliability and validity	Strong reliability and validity	Reliability 94% Norwegian and possibly Danish validation	Good reliability	Good test-retest reliability
Checklists	Yes, with illustrations	Yes	Yes, with illustrations	Yes	Yes
Age range	-	-	Wide age range: 4 mo.s-5 yrs	-	-
Tools	Few tools necessary	Few tools necessary	Cost-effective as parents can perform the test	-	Few tools Cost-effective as parents can perform the test
Scoring system	-	Includes assessment of neuro-motor skills and cognition	Contains several elements beyond motor function	Contains several elements beyond motor function	Divided into 3 categories, gross motor function, fine motor function and perception-action
Additional advantages	Manageable scoring system	Prior to the survey, questions are asked about the child and the parents' background as well as the parents' ideas about the child's development	Norwegian translation is likely comparable to Danish standards Danish translation for children age 48 months [15] and for the ASQ-III	An extended version of BITS exists for children aged 2-8 yrs Not very time consuming	Manageable scoring system Motor development assessment is based on everyday situations
<i>Disadvantages</i>					
Standardisation	The standardisation is more than 20 years old Uncertainty about whether it can distinguish in relation to ethnicity and socioeconomic status	Uncertainty as to whether the standardisation based on Canadian children is valid for Danish children	-	Standardisation is based on a sample representative of the US population comprised by about 2/3 whites and 1/3 Afro-Americans or Hispanics This probably does not correspond to the Danish population	No standardisation is available
Validity	-	-	-	Only 1 validity study is known to exist	Only 1 validity study is known to exist and it was carried out by the author of the test
Children at risk?	Designed for children at risk of developmental delays because of pre-, peri- or postnatal factors	Designed to examine children at particular risk of development delays	It is uncertain whether the test is aimed at high-risk or low-risk children	-	In all, 59% of the children in the test sample were siblings of a child with an autism spectrum disorder However, authors adjusted for this fact, and the majority of the participating children had test scores within the normal range
Age range	There may be reduced accuracy for children around 3 mo.s and > 9 mo.s, upper age limit is 18 mo.s	Applies only to children aged 3-12 mo.s	An additional test is needed for the first 4 mo.s of life	-	-
No professional involvement			The test is designed to be carried out by the parents themselves This may bias the answers Not suitable for all families as there may be problems related to reading, language and more		The test is designed to be carried out by the parents themselves This may bias the answers Not suitable for all families as there may be problems related to reading, language and more
Time frame	Study of gross motor skills only takes 10-20 min.	Time consuming	-	-	Study of motor skills alone takes 17 min.
Lack of guidelines	No guidelines for expected performance in relation to age	No guidelines for expected performance in relation to age	-	-	-
Additional disadvantages	Narrow spectrum Only deals with the assessment of gross motor skills	No illustrations or other guidelines for the use of performance score	Sensitivity and specificity are acceptable, but not convincing	Many tools	-

ASQ = The Ages and Stages Questionnaire; BITS = The Brigance Infant and Toddler Screen.



TABLE 3

Test characteristics of two excluded, but relevant tests.

	The Peabody Developmental Motor Scales-II, 2000 [26, 32, 35-37]	The Bayley Scales of Infant and Toddler Development-III, 2006 [14, 26, 35, 38]
Origin	USA	USA
Standardisation	Yes; USA unknown year; 2,003 children	Yes; USA 2004; 1,700 children
Reliability	Yes	Yes
Validation	Content: yes [33] Concurrent: disagreement [34-36]	Yes, but not convincing for children < 12 mo.s [35]
Target group, mo.s	0-72	1-42
Test elements	Motor skills	Motor skills, cognition, language, social/emotional & adaptive development
Objective	To assess the child's motor skills, comparing the fine and gross motor inequalities, give qualitative and quantitative aspects of individual skills, to evaluate the child's progress and to develop a research tool [37]	To investigate the child's strengths and weaknesses in different types of development areas [38]
Method	Test conducted by professionals using extensive check list	Test conducted by professionals using extensive check list
Time frame, min.	45-60	50-90
Tools	Many	Many
Translated edition	No	Danish

lar [14], and the domain scores may be interpreted in the same way in Norway and the United States [12]. These findings may well be generalised to other Western settings [13]. In 2004, a Danish translation of the ASQ was made for children aged 48 months; however, it was never published [15]. In 2016, a Danish translation of the ASQ-III was published [16].

Standardisation of the BITS was based on a representative sample of the US population [17].

We found no literature indicating that the EMQ has been standardised [18].

### Validity

The validity of the AIMS was confirmed by comparing the PDMS and the BSID based on normally developing children aged 0-13 months [4, 5]. The comparison should be interpreted with caution since the AIMS assesses only gross motor skills, whereas the PDMS also assesses fine motor skills and the BSID assesses child development in broader terms [5]. Studies indicate that the test is valid only in children who are 6-9 months old [19, 20].

The HINT has been validated on several occasions; content validity [21] and concurrent validity in relation to BSID-II [22], AIMS [9] and ASQ [23].

The ASQ development chart is validated [14]. Concurrent validity is confirmed for ASQ-I and ASQ-II in relation to BSID-I and -II, respectively, with certain modifications, however. According to Gollenberg et al, the ASQ II is valid only for identifying serious development delays in two-year-old children [10, 24], and a validation of the test in larger and more diverse populations is recommended [24]. The Norwegian version of the ASQ has construct validity [13]. In Denmark, the validity of the

ASQ was examined in a population of 48-month-old children born at term [15]. The ASQ was compared with an intelligence test, but never with another motor function test [15]. Due to lack of information on the ASQ-III, all further discussion regarding the ASQ is limited to the first and second edition [24, 25].

The BITS was validated on 2-24-month-old children in the USA [17]. Concurrent validity was among other assessed by gathering concurrent test scores administered on the same day, using the Bayley Scales and the AIMS. These measures correlated highly with the results of the BITS (17).

The EMQ is a parent-reported measure of early motor development in 0-2-year-old children [18]. It is based on observations from everyday situations [18]. The validity study concerned 94 children, aged 3-24 months and their parent/caretaker. The majority were Caucasians. The validity of the EMQ was established by comparing EMQ scores with PDMS-II scores, among others [18]. About 59% of the children were younger siblings of a child with a confirmed diagnosis of autism spectrum disorder (ASD) and therefore at increased risk of developing ASD. Nevertheless, the study adjusted for the increased ASD risk, and the majority of participating children had test scores within the normal range [18].

## DISCUSSION

### Main findings

In this systematic review, we found five validated motor function tests suitable for implantation in the DPCHEP (Table 1). Two tests evaluate solely motor skills (AIMS and EMQ); one also evaluates cognition (HINT), whereas two tests furthermore include elements such as lan-

guage, communication and social abilities (ASQ and BITS). Four out of five tests involve parents.

#### **Our findings compared with earlier reviews**

To the best of our knowledge, no previous study has systematically evaluated motor function tests for 0-2-year-old children that were validated for use in the background population.

In our search of the literature, we found only one systematic review [26]. This Dutch study of neuromotor functioning in infancy (3-18-month-old children) found 15 tests that were suitable for discriminating between infants with deviant neuromotor function and infants falling in the range of typical development. The tests were also evaluated for inclusion in our study, but all except the AIMS, the BSID II and the PDMS II were excluded, cf. the above exclusion criteria. Compared with our study, the Dutch search included only three databases, and instruments used for screening purposes only were excluded [26]. Our systematic review is based on a five-database search, and screening tools were included. The inclusion of the AIMS in the Dutch study underlines that this test is valid also for detecting developmental delay in a more selected population. The identified unsystematic reviews differed from our analysis by comparing specific tests [5] or by reviewing single tests and their strength and limitations [27].

#### **Strengths and limitations of this review**

The main strength of our study is the comprehensive, systematic and targeted literature search conducted in five different databases and online search in general. The study included a detailed assessment of the five tests' relevance and their strengths and weaknesses. As it has not been a criterion that tests were dedicated exclusively to motor skills, but simply contained a motor part, a wide range of testing options have been available for evaluation.

Due to budget restrictions, we did not have access to the original test manuals. This is a limitation of the study. However, the content of the tests was well described elsewhere, and the evaluation of the tests is not included in the original manuals.

The evaluated literature did not contain information about the sensitivity and specificity or positive and negative predictive values of all five tests. Concurrent validity for several of the five tests is based on comparison with one of the other tests included in this review. This is a weakness of the test evaluation performed previously rather than a weakness of the present study. It is notable that none of the tests included were evaluated against long-term outcomes. Of notice, only few publications evaluated the BITS and the EMQ. However, they are both fairly recently developed test methods, and

more evaluation studies may be upcoming. Additionally, it is notable that all five tests are from the US or Canada. However, clinical experience shows that US standards are equivalent to the clinical impression of Danish children's functioning [14].

#### **Motor function tests suitable for use in The Danish Preventive Child Health Examination Programme**

The objective of all five tests was in line with the purpose of the DPCHEP. The participants in the DPCHEP are from the background population, i.e., mainly healthy children. The AIMS, HINT, BITS and EMQ (after correlation for ASD risk) are all validated in a low-risk group of children, while it is uncertain whether the ASQ has been validated accordingly [10, 24].

Squires et al have defined three key principles of the development of a test method worth taking into account [10]:

1. Screening devices should be dynamic and designed to follow a child's development over time.
2. Those who know the child best, i.e. the parents, must be present at the screening.
3. Tests that are used widely and frequently should be inexpensive.

We find these principles highly relevant for the DPCHEP, and the following discussion is structured in accordance with these principles.

#### *The Alberta Infant Motor Scale*

1. The AIMS evaluates a child's motor development over time (0-18 months) [9].
2. The test is completed by a professional [9].
3. Few tools are needed, but the test only covers the child's gross motor development and this takes 10-20 minutes [5].

It is thus time consuming and therefore less suitable for use in the DPCHEP.

#### *The Harris Infant Neuromotor Assessment*

1. The HINT is designed to detect early signs of neuromotor and cognitive development delays in children at particular risk (evaluated at age 2-12 months) [21].
2. Parents complete a questionnaire prior to the examination, containing valuable observations by those who know the child best [23].
3. Few tools are needed [23], but the test requires up to 30 minutes to complete [9], making it time consuming and therefore less suitable for use in the DPCHEP.

### *The Ages and Stages Questionnaire*

1. The ASQ is designed to identify children in need of further assessment of their development (evaluated at age 4-60 months) [14], and the development of the test is inspired by the three principles proposed by Squires et al, stated above [10].
2. The test is based on parent questionnaires. It is documented that parents are able to perform the test properly [10, 28], even despite reading, cognitive or other difficulties [10].
3. The test is both time-effective and cost-effective since few tools are needed [14] and the test covers several areas of development besides motor function [10] in less than 25 minutes (including both the parents' and the evaluator's part) [24].

We regard ASQ as compatible with the conditions for the DPCHEP and a Danish translation is available. An implementation of the ASQ questionnaires prior to health checks may be suggested. This was described in a UK study from 2012 [29] where 82% of the parents were satisfied using the ASQ and 70% felt sufficiently informed about the ASQ. The parents valued face-to-face discussions with their health visitor, were more likely to engage in the test if they felt well informed, and were reassured to know that the ASQ did not replace, but was a supplement to, the health professional's assessment [29]. To our knowledge, the ASQ III has not yet been validated in a Danish population. Even though several measures indicate that an American validation can be used in other Western settings, e.g. Norway [12-14], population-specific norms are recommended [30]. The ASQ II is validated in Scandinavian populations. This speaks for pilot testing the ASQ III on the DPCHEP before a Danish validity study is carried out.

### *The Brigance Infant and Toddler Screen*

1. BITS [17] aims to identify children in need of further evaluation and for monitor progress (during age 0-24 months).
2. The test is based on both parent and evaluator's inputs, separately or as a combination.
3. BITS is testing several items besides motor function and the test can be completed within 10-15 minutes.

However, the test is less economic and less suitable for DPCHEP since many tools are needed.

### *The Early Motor Questionnaire*

1. EMQ [18] serves as a first-step screening instrument to identify children in need of further assessments (evaluated at age 0-24 months).

2. The parent-completed test uses everyday situations for the parent to assess their child's motor behaviour.
3. Therefore, only few tools are needed, and the test is cost-effective. The EMQ can be carried out by parents in 17 minutes, and it solely assesses motor function development.

Compared with the PDMS-II, the parents' assessment with EMQ provides valid information about early motor and cognitive development. In order to avoid the assessment of the child relying entirely on the parents' information, the EMQ could be used as an add-on to the existing DPCHEP, as suggested above for the ASQ. However, prior to an implementation, a standardisation of the test is necessary.

The EMQ, ASQ, and AIMS are based on parental observations. A study supported that parent reports are reliable in assessing children's motor development compared with observers' use of the AIMS. The result indicated that the parents provided reliable reports regarding sitting, crawling, and walking milestone attainment [31]. This is supported in two other studies, as mentioned above [10, 28]. According to Squires et al, strong parent-professional agreement existed [10]. The parent involvement (and less professional involvement) makes the tests economic.

The costs of a potential implementation in the DPCHEP would include purchase of test material, time for training, examination, consults and evaluation. Benefits are hopefully better parent compliance, understanding and participation, comparable examinations and thereby improved research opportunities. In addition, we might discover some children at an earlier point allowing an intervention to begin sooner to benefit the child and family.

### **Recapitulation and recommendations**

The purpose of this systemic review was to identify motor function tests for 0-2-year-old children that have been validated on a background population, and to evaluate whether any existing tests were suitable for implementation in the DPCHEP.

In our opinion, two out of five tests are directly suitable for use in the DPCHEP; the ASQ and the EMQ. We recommend piloting the feasibility of one or both of the methods in the Danish general practice setting among parents and GPs. A Danish validity study should be conducted if the feasibility study shows potential, and the EMQ needs standardisation.

Of notice, assessment of motor skills is only part of the more holistic evaluation of the child and family carried out by the GP during the DPCHEP. Large parts of this

evaluation are not performed systematically. To improve quality, more research is needed to review available tests for assessing language, cognition, family dynamics and general health in the different age groups.

## CONCLUSIONS

Five motor function tests for 0-2-year-old children that have been validated for use in the background population were identified and evaluated in this study. Our results show that none of the tests were perfect for use in general practice with respect to age span, time frame, tools needed etc. The ASQ and the EMQ may be suitable for implementation in the DPCHEP. They are both parent-involving, time saving and economical tests that can potentially help parents prepare for the DPCHEP.

This review may serve as a frame of reference for improving the existing DPCHEP. We suggest that the first step should be a feasibility study of the ASQ and the EMQ in the existing DPCHEP. Furthermore, it may be considered to present the test elements in a more manageable and systematic way, possibly with illustrations.

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