Self-reported level of knowledge of clinical examinations in screening for hip dysplasia - A web-based survey of midwives and general practitioners

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Abstract

Background

The positive predictive value of clinical hip examinations performed by generalist health professionals in screening for developmental dysplasia of the hip (DDH) is low.

Aim

To assess the self-reported recognition of nationally recommended clinical hip examinations in the screening programme for DDH in Denmark among midwives, general practitioners (GPs), and GPs in training.

Design and setting

A web based open survey study among Danish midwives, GPs and GPs in training

Methods

Respondents were asked to identify which of six written statements of clinical hip examinations were featured in the national Danish guidelines on DDH screening. Three statements were the official statements of the Ortolani, Galeazzi, and hip abduction examinations from the national guidelines and three statements were false and constructed by the author group. Participants were asked to select up to six statements.

Results

A total of 178 (58 GPs, 97 midwives and 23 GPs in training) responses were included.

Eighty-nine percent of responders correctly identified the Ortolani manoeuvre and 92% correctly identified one of the constructed descriptions as being false. The remaining four descriptions had significantly lower correct answer percentages ranging from 41% to 58% with significantly lower correct answer percentages of midwives for three out of all six descriptions when compared to GPs.
Conclusion

We conclude that the recognition of two out of three recommended clinical hip examinations in the Danish screening program for DDH is overall low among current screeners. Efforts should be made to heighten the knowledge level by further education of screeners.

Keywords

Hip dislocation, congenital. Mass screening. Surveys and Questionnaires

How this fits in

The positive predictive value of clinical hip examinations made by referrers in a selective screening program of developmental dysplasia of the hip (DDH) is declining. In this study we demonstrate that the self-reported knowledge among general practitioners and midwives of recommended clinical hip examinations in the Danish national guidelines for DDH is low. These findings could partly explain the low predictive value of clinical screening and should prompt efforts to heighten the knowledge of screeners.
Introduction

Background

Developmental dysplasia of the hip (DDH) is a disorder describing abnormalities of the hip from mild underdevelopment of the acetabulum to severe deformation of the proximal femur and dislocation of the hip joint. DDH is the most common orthopaedic disorder in neonates with 0.7-1% of all newborn children affected each year (1) (2). A prerequisite for a screening program to be effective is sufficient training and education of the healthcare professionals to ensure sufficient knowledge and clinical skills to perform a valid test. In Denmark, a universal clinical screening programme for DDH is implemented nationally based on guidelines made by the Danish Health Authority (3), which recommends a clinical hip examination conducted shortly after birth by the midwife and a repeat examination by the general practitioner (GP) at the five-week post-partum appointment. The national recommendations for clinical examinations for neonatal DDH screening in Denmark follow international standards (4) (5) and include the Barlow and Ortolani manoeuvres, the Galeazzi test, and an examination of limited hip abduction (Figure 1). There are no formalised clinical education programmes for educating midwives and GPs to perform DDH tests, which are currently being taught as part of the non-formalised apprenticeship for midwives and GPs.

Knowledge and quality of primary screeners’ paediatric hip examinations is of paramount importance in a screening programme based on universal clinical hip examination (6). The positive predictive value of clinical examinations made by referrers in the United Kingdom (UK) universal clinical DDH screening programme, is as low as 4.0% (7), which may explain an earlier report of the common observation of unwarranted DDH referrals for paediatric orthopaedic consultations (8). To our knowledge, no studies have examined the self-reported knowledge of DDH screening guidelines of midwives and GPs.

Objectives
The purpose of the present study was to assess the self-reported recognition among GPs, midwives and GPs in training of written statements of nationally recommended clinical hip examination techniques recommended in the universal clinical screening programme for DDH in Denmark.

Methods

Study design

This was a cross-sectional web-based open survey study. Reporting follows the CHERRIES guideline for reporting web-based surveys. Completed questionnaires were saved directly into an online database using online-survey functionality from REDCap electronic data capture tools hosted at Aalborg University Hospital (AAUH), Denmark.

Data protection

Study data was stored in REDCap, an online General Data Protection Regulation (GDPR) certified database. The primary author of this study had exclusive access to the survey data.

Recruitment process

We sent email invitations to GPs in the North and Central Denmark region. The GPs were asked to participate in the survey and would be financially compensated for time spent on participation per an agreed upon rate with the Centre for General Practice at Aalborg University Hospital. As initial response rates were low, invitations were later advertised in closed social media forums for midwives and physicians.

Responders recruited through social media advertising were given no financial incentives to participate. The recruitment period ran from June 2020 to September 2020.

Participants
Inclusion criteria: certified midwife, certified GP, GP in training (no restrictions on years of training) currently employed at a hospital or general practice in one of the five Danish geographical mainland regions, with independent health governance.

We excluded incomplete questionnaires and GPs or midwives with previous orthopaedic or paediatric training.

**Questionnaire development**

The questionnaire was designed based on literature review and a review of the national recommendations on DDH screening (3). It was reviewed for validity by the author group and edited for clarification, usability and technical functionality, after pilot testing by a group of three paediatric orthopaedic surgeons and two GPs.

The questionnaire started with a header describing the purpose of the study, as well as instructions to the respondents. Responders were instructed to only complete the questionnaire once. Checks of IP addresses and cookies were not used to prevent multiple entries.

The first part of the questionnaire included questions on baseline characteristic such as education and employment demographics. For the purpose of this study, respondents were asked to identify which of six statements describing clinical hip examinations were featured in the national Danish guidelines on DDH screening. Three statements were the official descriptions of the Ortolani, Galeazzi, and hip abduction examinations from the national guidelines and three statements were false and constructed by the author group (Table 1). The Barlow manoeuvre was not featured, as the illustration in the national recommendations on the Barlow manoeuvre (Figure 1) may mislead the reader to the conception that the examination should be performed in full abduction rather than mid-abduction as Barlow himself described (10). Responders were asked to select up to six statements.
Respondents participated via a public survey link. Participants were able to edit their answers until submitting. Each participant received identical questionnaires consisting of 24 items on one page, five items were dependent on previous answers and were not visible to all participants. Answer formats ranged from text, numerical input, and multiple-choice with both single and multiple answer possibilities.

Once the questionnaire was opened, respondents were instructed to provide answers with no assistance from the internet or outside help, the survey had a 30-minute time limit once opened.

All submitted questionnaires were analysed, regardless of missing answers.

**Variables**

Main outcome: Responders’ recognition of nationally recommended clinical hip exams was binarized as correct or incorrect based on answers given in the questionnaire. An answer was considered correct if one of two conditions were fulfilled: 1) The statement is a correct description of a clinical hip exam featured in the national recommendations and is selected by the responder 2) The statement is a false description of a clinical hip exam and not selected by the responder.

**Statistical methods**

Data was statistically and graphically analysed using Stata version 16.1 (StataCorp, College Station, TX, USA). Means of yearly DDH screenings were compared using one-way ANOVA analysis. All significance testing was done by comparing correct answer percentages to professions and yearly DDH screenings by fitting a generalised linear model with identity link and robust standard errors to the binary clinical exam recognition variable. We used GPs as reference group for comparison of correct answer percentages between professions and the correct Galeazzi statement as reference for comparison of correct answer percentages between options. Normality of data was evaluated by inspection of QQ-plots of yearly DDH-screenings.
Results are reported as mean correct answer percentages with 95% confidence intervals and presented graphically as a scatter plot of correct answers with error bars in figure for correct and false answer options (Figure 2). Yearly DDH screenings are reported as means stratified by profession with given standard deviations. Statistically significant outliers (p<0.05) calculated based on the generalised linear model are marked as bold in Table 2.

**Ethical considerations**

Participants were aware that they would be compared to each other and that the anonymised results of the survey would be analysed and published.

**Results**

A total of 198 responses were received, three were not marked complete, seven did not match the inclusion criteria for profession, eight were not currently employed in one of the five Danish mainland regions and none had received previous orthopaedic training leaving a total of 178 responses to be included in this study.

The professions of included responders were: 58 (33%) GPs, 97 (55%) midwives and 23 (13%) GPs in training. Responders covered all the five geographical areas in Denmark with 24 (17%) responses from North Denmark Region, 54 (38%) from Central Denmark Region, 36 (20%) from Region of Southern Denmark, 25 (18%) from Region Zealand, and 39 (28%) from Capital Region of Denmark. Mean number of infants screened yearly for DDH was significantly higher for midwives at 67/year (SD 33) when compared to GPs and GPs in training with 26/year (SD 17) and 28/year (SD 26) respectively.

Eighty-nine percent (84%;93%) of responders identified as correct the statement describing the Ortolani manoeuvre. For one of the constructed statements, 92% (87%;96%) correctly identified the statement as being false. The remaining four statements had significantly lower correct answer percentages ranging from 41% to 58% with significantly lower correct answer percentages of
midwives for three out of all six statements when compared to GPs. There was no significant differences in correct answer percentages stratified by yearly DDH exams when adjusting for profession.

Overall correct answer percentages are presented in Figure 2 and stratified by profession in Table 2. Nine respondents (5%) correctly identified all correct examination statements, seven (4%) correctly identified all false examination statements. No respondents correctly classified all correct and false answer statements.

**Discussion**

**Summary**

This study demonstrates that self-reported recognition of written statements of nationally recommended clinical hip examinations in the screening of DDH among GPs, midwives, and GPs in training was overall low (<60%) for two out of three correct statements of recommended examinations. Further, over 50% of respondents were unable to identify two out of three statements as being false.

**Strengths and limitations**

Responses were collected using an online anonymised survey as a low cost and easily accessible tool with the added benefit of increasing the reach of the questionnaire as we expanded from email invitations to include invitations via closed social media groups for health professionals. A drawback of these choices was our inability to estimate response rates for our survey invitation as we did not know the number of active users in the groups or the medical specialty of the physicians in the physician group. As a consequence, the internal and external validity of our sample population is difficult to assess.

We could not confirm the identity of each participant as recruitment was not made directly via personal email for all responders. The social media group for physicians have implemented an
identity check to verify that members hold a Danish medical authorisation and is a tightly moderated forum. In the social media group for midwives, an administrator will make an assessment of the profile before entering a new member. However, these validations will not ensure only midwives to be accepted for inclusion in the social media group and we cannot confirm the GP specialty of the included physicians. Further, we did not use IP tracking or cookie checks and were therefore not able to monitor for double entries. We instructed responders to rely on their own knowledge and not seek outside help, but no checks were made to ensure their adherence to these instructions. As midwives make up 55% of our sample, but only 34% of the background population of screeners, our study population is not an accurate representation of the background population, which should be considered when interpreting the overall correct answer percentages of this study.

Despite these limitations, participants are expected have adhered to the instructions provided in the questionnaire, thus making their answers valid.

**Comparison with existing literature**

Screening for DDH in Denmark is described in the national recommendations for neonatal DDH screening. The guidelines recommend that the neonate clinical hip examination should include the Barlow and Ortolani manoeuvres, the Galeazzi test and a test for limited hip abduction. However, it is the authors’ experience that, in reality, generally only the Ortolani manoeuvre is performed in the clinical screening by midwives and GPs. If the national recommendations are not reflected in daily clinical practice, this could explain the high overall correct answer rate for the description of the Ortolani manoeuvre but also the low correct answer rates for the Galeazzi and hip abduction tests.

These findings present a challenge, as clinical screeners are generally able to recognise the examination they have been taught and are using in clinical practice but are unable to recognise recommended examinations which are, in our experience, rarely used outside orthopaedic consultations. The Barlow and Ortolani manoeuvres have high negative predictive values but low positive predictive values (11) when used exclusively, but when combining these manoeuvres the
sensitivity and specificity increases to 74-99% and 98-99%, respectively, with variation depending on the examiner’s skill level (12). Reliance on a single clinical hip examination is therefore inadvisable as it decreases the predictive value of the screening.

The positive predictive value of clinical screening in referrals in the UK, where a screening programme for DDH similar to the Danish screening is implemented, is low, and has been steadily declining over the past 20 years from a positive predictive value of clinical examinations of referrers at 28% in 1997 to 4.0% in 2015 and has been attributed to an expansion and fragmentation of the pool of screeners (13) (7). Düppe and Danielsson found a correlation between delegating clinical hip examinations to screeners not involved in the treatment or specialised diagnostics of DDH and an increase in referral and treatment rates without lowering the rate of late diagnosis of DDH in newborns (1).

There exists no formalised training in DDH screening for midwives and GPs in Denmark, even though all Danish midwives and GPs take part in the primary clinical screening and it has been established that clinical hip examinations are difficult to perform and interpret correctly, even for hip specialists (14).

The aforementioned British and Swedish studies (13) (7)(1) conclude, that including professions not specialised in paediatric hip diseases lowers the efficacy of a DDH screening programme. Our survey suggests that a possible explanation could be, that the training of clinical screeners may be inadequate in giving screeners the necessary knowledge of which hip examinations to perform, which lowers their chances of a true positive examination result.

Further, the Danish screening for DDH is not centralised to examiners with specialist training in hip examination and treatment. Similar to the programme in the UK, it is performed by generalist health professionals. The number of screeners, combined with the reported yearly DDH screenings from respondents in this study, means that with an underlying incidence rate of DDH of 0.7-1%, an examiner in the Danish screening programme for DDH will rarely experience a positive hip
examination. Additionally, if a screener detects a positive result, contrary to hip specialists, an immediate follow-up ultrasound examination is not available and validation of a positive clinical result is therefore not possible.

**Implications for research and practice**

These findings provide a possible partial explanation of the observed low predictive value of clinical hip examinations performed by primary DDH screeners and suggest a need for efforts to be made to revise the training of DDH screeners in Denmark in order to increase their level of knowledge.

**Conclusion**

We conclude that the recognition of written descriptions of two out of three recommended clinical hip examinations in the Danish screening program for DDH is overall low among current screeners. Efforts should be made to further educate screeners in order to increase the efficacy of clinical screening for DDH.

**Additional information**

The authors declare that they have received no funding for this study and have no conflicts of interest.

Ethical approval was not required in accordance with the guidelines of the Danish National committee on health research ethics for non-interventional studies.

**References**


Tables and figures
### Table 1 – Multiple choice question and interpretation

Which of these examinations are recommended in the national clinical screening program for developmental dysplasia of the hip?

<table>
<thead>
<tr>
<th>Option</th>
<th>Answer text</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hips and knees are bent 90 degrees, legs are spread and the examiner examines if the hip is relocated</td>
<td>Correct (Ortolani)</td>
</tr>
<tr>
<td>2</td>
<td>Hips and knees are kept straight, during simultaneous spreading of the legs, the examiner examines the hip for a “click”</td>
<td>False #1</td>
</tr>
<tr>
<td>3</td>
<td>Hips and knees are bent 90 degrees and the length of the thigh bone is compared</td>
<td>Correct (Galeazzi)</td>
</tr>
<tr>
<td>4</td>
<td>The examiner compares the amount of skin folds around the hips on both sides</td>
<td>False #2</td>
</tr>
<tr>
<td>5</td>
<td>Hips and knees are bent 90 degrees and the examiner examines if the hip abduction is good and symmetrical</td>
<td>Correct (Hip abduction)</td>
</tr>
<tr>
<td>6</td>
<td>By moving the hip, the examiner tries to provoke an audible “click” from the hip joint</td>
<td>False #3</td>
</tr>
</tbody>
</table>

Table 1: Multiple choice question, answer options and interpretation in the original order. Translated to English from the original Danish.

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**Figure 1:** Recommended clinical hip examinations from the Danish Health Authority guidelines on screening for developmental dysplasia of the hip. A) Galeazzi test and examination of hip abduction B) Ortolani’s manoeuvre C) Barlow’s manoeuvre. Images borrowed with permission from Ortopædisk Kirurgi 7th ed, FADL’s Forlag, illustrations by Birgitte Lerche.
<table>
<thead>
<tr>
<th>Profession</th>
<th>N</th>
<th>Interpretation</th>
<th>Mean correct answer (%)</th>
<th>95% CI</th>
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<tbody>
<tr>
<td>GP</td>
<td>58</td>
<td>Ortolani</td>
<td>84</td>
<td>[73,93]</td>
</tr>
<tr>
<td>Midwife</td>
<td>97</td>
<td>Ortolani</td>
<td>92</td>
<td>[84,96]</td>
</tr>
<tr>
<td>GPiT</td>
<td>23</td>
<td>Ortolani</td>
<td>91</td>
<td>[72,99]</td>
</tr>
<tr>
<td>GP</td>
<td>58</td>
<td>Galeazzi</td>
<td>59</td>
<td>[45,71]</td>
</tr>
<tr>
<td>Midwife</td>
<td>97</td>
<td>Galeazzi</td>
<td>41</td>
<td>[31,52]*</td>
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<td>23</td>
<td>Galeazzi</td>
<td>57</td>
<td>[34,77]</td>
</tr>
<tr>
<td>GP</td>
<td>58</td>
<td>Hip abduction</td>
<td>43</td>
<td>[30,57]</td>
</tr>
<tr>
<td>Midwife</td>
<td>97</td>
<td>Hip abduction</td>
<td>41</td>
<td>[31,52]</td>
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<td>GPiT</td>
<td>23</td>
<td>Hip abduction</td>
<td>35</td>
<td>[16,57]</td>
</tr>
<tr>
<td>GP</td>
<td>58</td>
<td>False #1</td>
<td>98</td>
<td>[91,100]</td>
</tr>
<tr>
<td>Midwife</td>
<td>97</td>
<td>False #1</td>
<td>88</td>
<td>[79,93]*</td>
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<td>GPiT</td>
<td>23</td>
<td>False #1</td>
<td>96</td>
<td>[78,100]</td>
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<tr>
<td>GP</td>
<td>58</td>
<td>False #2</td>
<td>50</td>
<td>[37,63]</td>
</tr>
<tr>
<td>Midwife</td>
<td>97</td>
<td>False #2</td>
<td>56</td>
<td>[45,66]</td>
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<tr>
<td>GPiT</td>
<td>23</td>
<td>False #2</td>
<td>52</td>
<td>[31,73]</td>
</tr>
<tr>
<td>GP</td>
<td>58</td>
<td>False #3</td>
<td>67</td>
<td>[54,79]</td>
</tr>
<tr>
<td>Midwife</td>
<td>97</td>
<td>False #3</td>
<td>47</td>
<td>[37,58]*</td>
</tr>
<tr>
<td>GPiT</td>
<td>23</td>
<td>False #3</td>
<td>83</td>
<td>[61,95]</td>
</tr>
</tbody>
</table>

Table 2: mean correct answer percentages of correct and false statements stratified by profession of responder. GP = general practitioner, GPiT = General Practitioner in training. Significant results are marked as bold *Significance testing done by general linear modelling with GP as reference professions.
Figure 2 Scatter plot with 95% CI error bars of correct answer percentages for correct and false descriptions of nationally recommended hip examinations in the screening of developmental dysplasia of the hip among all responders (n=178).
Self-reported knowledge of national guidelines for clinical screening for hip dysplasia: a web-based survey of midwives and general practitioners in Denmark

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