Developmental outcome measures in neonatal physiotherapy services of the United Kingdom: a survey of current use, and facilitators and barriers to their implementation

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Abstract

Background and purpose: Current guidelines recognise the need for neonatal physiotherapists to provide surveillance assessments to neonates, from birth onwards. This study explored the current use, barriers and facilitators to using developmental outcomes measures in neonatal units, in the United Kingdom.

Method: A cross-sectional, web-based survey with 32 items was piloted and distributed to members of the Association of Paediatric Chartered Physiotherapists and advertised on social media and professional discussion forums. Responses from the group of therapists who reported using outcome measures, were compared with those who reported not using them, using Mann-Whitney U tests for non-parametric data. Other findings were presented descriptively.

Results: Forty-three completed surveys were analysed. Most respondents (91%) had a positive attitude towards the use of developmental outcome measures, and many (79%) used them in their neonatal practice. These included the General Movement Assessment (n=18/34), Hammersmith Neonatal Neurological Examination (n=16/34), and Lacey Assessment of Preterm Infants (n=15/34). The high cost of acquiring certain measures was a perceived barrier (86%). The presence of a neonatal-specialist physiotherapist ($p=0.023$), active engagement in continuous professional development (0.011) and support from fellow physiotherapists ($p<0.001$) significantly influenced outcome measure utilisation.

Conclusion: Outcome measures were commonly used in the analysed units. Perceived utility and positive attitudes towards outcome measure use are in-line with current recommendations. This must be weighed up against the high acquisition cost of some measures. Further research is required to define tailored strategies for promoting best practice in the utilisation of specific developmental outcomes in neonatal care.

Introduction

Approximately 60,000 babies are born prematurely (earlier than 37 weeks gestation), in the United Kingdom (UK) every year (Office of National Statistics, 2016). There has been continued improvement in the delivery of neonatal care that has enabled an increase in survival of infants born extremely prematurely between both 1995 and 2006, and still further between 2008 and 2014 (Santhakumaran et al, 2017). However, infants who survive a premature birth are at greater risk of developmental delay with associated long-term consequences, such as cerebral palsy (Moore et al, 2012). Physiotherapists play a vital role in the treatment of neonates in the UK, particularly those who are at increased risk of developmental delay. Input from a physiotherapist may include baseline assessment, parental education and working within the multi-disciplinary team to ensure that the complex needs of the family are being met. Guidelines published by the National Institute for Health and Care Excellence (NICE) on the developmental follow-up of children and young people born prematurely, recommended that premature babies are monitored for the first two years of their lives (NICE, 2017). Physiotherapists are well placed to contribute to this monitoring process.

The physiotherapy assessment of neonates can provide an important baseline of information. This can then be used to monitor developmental evolution, identify abnormalities and predict developmental disabilities (Majnemer and Mazer, 1998). Therefore, the use of a valid, reliable, standardised tool has the potential to highlight those patients requiring early intervention, aid in decision-making processes regarding the management of the baby, and ensure optimal quality of care (CSP, 2012). However, the purpose of outcome measures in neonates varies widely, encompassing neurological, neurobehavioural and motor performance assessments. They also have different functions. These include predictive value (the ability to predict the likely future course of development), evaluation (change as a result of a specific intervention) and discriminative function (the ability to discriminate between the presence or absence of a certain impairment at a single

time-point). For these reasons, the utilisation of developmental outcome measures is likely to vary substantially between hospitals. This could be problematic when the infant is transferred between neonatal units, as 10% of hospitalised infants were in 2015 (RCPCH, 2016).

To date, no studies have investigated the current use of, or facilitators and barriers to, using outcome measures in neonatal care. A previous cross-sectional survey found that 89.1% from a sample of 97 physiotherapists used a standardised assessment tool during their neurodevelopmental follow-up programmes of neonates (Harniess and Nikopoulou-Smyrni, 2015). The inclusion criteria for this particular work specified that 'lead' neonatal physiotherapists would be recruited, therefore it remains unknown whether 'non-lead' physiotherapists have a similar approach to the use of outcome measures. Furthermore, the study concentrated on follow-up assessment, leaving the broader use of outcome measures unknown.

Although barriers to using outcome measures have been identified in some specialties of physiotherapy (Swinkels et al, 2011), the unique environment of neonatal care means that some of the challenges are likely to be specific to the assessment of neonates. It is vital that the use of outcome measures in the UK is quantified, to measure the extent to which best practice is currently being adhered to. Barriers should be identified so that strategies can be implemented to address them. 'Facilitators' (factors that enable or support therapists to utilise outcome measures), will provide researchers and clinicians with an understanding of how best to encourage others to utilise outcomes. Therefore, the aims of the study were threefold. Firstly, to capture a snapshot of current use of developmental outcome measures in neonatal care in the UK. Secondly, to identify any facilitators or barriers that supported or impeded their implementation. Thirdly, to describe differences in neonatal unit, or in attitudes and approaches between those therapists who used outcome measures, and those do did not.

Method

Ethical approval was granted by the Chair of the UCL Research Ethics Committee on 6th June 2017 (REC reference 11151/001). UCL Data Protection and Risk Assessment registration was obtained on 26th May 2017 (reference no. Z6364106/2017/05/124). To prevent the occurrence of duplicate responses from the same hospital, participants were requested to provide demographic details of their units, which were coded to maintain anonymity in accordance with the Data Protection Act 1998.

A survey was selected as the most appropriate method for meeting the aims of the study. It comprised of 32 items divided into three domains: the use of developmental outcome measures; barriers and facilitators to their implementation; neonatal physiotherapy service provision and training (Appendix 1). Inclusion criteria for completing the survey were physiotherapists working in neonatal care in the UK, with only one response permitted per hospital site.

The survey included closed-ended multiple-choice questions, with additional free-text space for respondents to clarify their responses or add any options that were not listed (Polgar and Thomas, 2013). Perceived facilitators and barriers to implementation of outcome measures were gathered using a 5-point Likert scale, with responses ranging from ‘strongly disagree’ (1 point) to ‘strongly agree’ (5 points) in response to a range of statements. These statements were based on previous studies into the implementation of guidelines and outcome measures for general practitioners, midwives and physiotherapists (Peters et al., 2003, Van der Wees et al., 2013, Van Peppen et al., 2008). The final section of the survey was adapted from a validated questionnaire published in 2012, the aim of which was to establish a benchmark for the overall provision of neonatal physiotherapy services in the UK (Ronan and Barron, 2012). With permission from the principal author, eight questions from that questionnaire were utilised in the current study, in order to gather data regarding neonatal units, levels of expertise and training.

The questionnaire was piloted among two specialist neonatal physiotherapists who were independent of the study, and three members of UCL academic staff. This helped to identify

ambiguous questions, and any perceived biased or leading questions. The participants of the pilot study were also asked to email their comments regarding the time taken to complete the survey and the clarity, relevance and completeness of the survey in order to evaluate its face and content validity (Polgar and Thomas, 2013). Three items were added (items 14, 18 and 19, see Appendix 1) and details within the survey, in particular the order of the domains and the phrasing of the questions were modified. One specific point raised by all reviewers related to the frequent use of 'negative sentences' such as, 'the use of the developmental outcome measures is not too time-consuming.' Although reverse worded items have been shown to reduce response bias, recent evidence suggests that they are more likely to result in confusion (Sonderen et al, 2013). The reviewers also had differing opinions over how to respond to such questions. Therefore, for clarity, these were re-phrased to provide consistently positively-worded items.

The finalised electronic survey was distributed along with an invitation to all members of the APCP. Respondents were also sought using social media (Twitter and Facebook) and via on-line professional discussion forums (i-CSP) in order to reach other neonatal physiotherapists who were not members of the APCP. Data collection was conducted using the UCL Opinio web-based survey tool, and all responses were anonymised at source. Data were transferred from the Opinio software into an Excel spreadsheet for storage, which allowed data transfer into Statistical Package for the Social Sciences (SPSS) software for statistical analysis. Descriptive statistics were used to report the findings. Furthermore, responses from the group of therapists who reported using outcome measures, were compared with those who reported not using them, using Mann-Whitney U tests for non-parametric data and presented as U and p-values. This was important, since one aim of the survey was to compare differences between users and non-users in their attitudes and approaches towards outcome measures. Where questions were binary (requiring a 'yes' or 'no' response), responses were compared using Fisher's exact test after dividing the

respondents into those who reported using outcome measures and those who reported not using them.

Results

A total of 91 responses were received, from which 43 were included in this study. Respondents of the 47 remaining questionnaires did not press the final 'submit' button, and their surveys were often substantially incomplete, so these were excluded. One other completed survey was excluded as the participant was not working in the UK. Each response came from a different hospital, so no hospital-specific focus of practice was over-represented. Of the included surveys, 79.1% (n=34) of respondents reported using developmental outcome measures on their units (Table 1).

Respondents were predominantly Band 7 physiotherapists (86%, n=37), working in units which had multiple bands of physiotherapy staff. All the units (100%, n=6) that included a Band 8 physiotherapist in their skill mix, used outcomes measures. This compares with 78% (n=29) of units where the highest level of experience was Band 7. Most of the respondents (44%) worked in units providing level 3 neonatal care, although 18 physiotherapists worked across more than one level of care. 90% of physiotherapists who worked on a unit that included level 3 care, used outcome measures. This compares with 67% of those whose highest level of care was level 2. Neither band of physiotherapists present on units nor level of care significantly influenced the use of outcome measures on the unit ($U=132.5$, $p=0.513$ and $U=110.5$, $p=0.177$ respectively).

Of the 43 units included in the study, 58.1% (n=25) had input from a neonatal-specialist physiotherapist. 'Neonatal-specialist' was a self-reported term to differentiate from physiotherapists who would normally work with either paediatrics or adult patients. Where a neonatal-specialist physiotherapist was involved on the neonatal unit, 92% (n=23/25) of the respondents reported using outcome measures (Table 1). The presence of a neonatal-

specialist on the unit was significantly related to the use of outcome measures (Fisher's exact test: p=0.023).

Nearly all the respondents (n=40/43) participated in continuing professional development related to neonatal care. This included self-directed learning (90.7%) and peer learning and support within each NHS trust (81.4%) as part of their specialist training. 53% of physiotherapists also took part in postgraduate education with a neonatal component. The number of continuing professional development opportunities, training and support sources accessed by physiotherapists was significantly higher in the group who reported using outcome measures (U=71.5, p=0.011).

Current use of outcome measures

The most frequently utilised outcome measures were the Hammersmith Neonatal/Infant Neurological Examination (HNNE/HINE), the Lacey Assessment of Preterm Infants (LAPI) and the Prechtl's Method of Qualitative Assessment of General Movements (GMs) (Table 2). Physiotherapists with greater years of experience in the use of developmental outcome measures, or who received specific training in their use were significantly more likely to utilise a measure on their unit (Table 1).

Facilitators to using developmental outcome measures

The majority of respondents (n=39/43, 91%) had a positive attitude towards the use of outcome measures in clinical practice (item 8, 'I feel that I have a positive attitude towards the use of developmental outcome measures'). The same number of respondents recognised the utility of outcome measures in providing insight for parents into their child's physical functioning (item 21) (Table 3). Indeed, four physiotherapists specified in the 'comments' section that the use of outcome measures gave them the opportunity to have a discussion with the parents about different aspects of infant development, developmental support and the function of follow up clinics.

Barriers to using developmental outcome measures

Finding the opportune moment for completing a developmental assessment (item 18) was challenging for most of the physiotherapists (81.4%). Funding issues were reported by six respondents and were confirmed by 86.1% (n=37/43) of physiotherapists who considered the costs related to outcome measure acquisition (such as courses and materials) (item 16) an obstacle to using them, indicating the main barrier to their implementation (Table 3).

Differences in perceived barriers and facilitators between respondents using, and not using, developmental outcome measures on units

There were some significant differences between those respondents who used outcome measures and those who did not. There were significantly different responses to the statements 'the use of a developmental outcome measure fits into my way of working at my unit' (item 9) ($U=18.5$, $p<0.001$), and 'I regard the use of a developmental outcome measure to be a good starting point for my physiotherapy interventions and for further referrals' (item 10) ($U=46$, $p<0.001$). Those who used outcome measures tended to agree with these statements (with the exception of one respondent), whereas those who didn't tended to disagree or be neutral (Table 3).

Regarding the outcome measures' adaptability to the individual needs of infants (item 20), there was a significant difference between the two groups ($U=79.5$, $p=0.016$) and although 73.5% of the physiotherapists who utilised outcome measures agreed with the statement (n=25/34), one reported the difficulty of using non-completed data when transferring patients between units and for longitudinal data collection.

With regards to the environment, physiotherapists who had support from fellow physiotherapists (item 22) and other professionals (item 23) were significantly more likely to utilise outcome measures than those who did not (with $U=34$, $p<0.001$ and $U=70$, $p=0.005$ respectively) (Table 3).

Discussion

Existing guidelines recognise the need for neonatal physiotherapists to provide surveillance assessments and developmental support to neonates, from birth to age of two years (NICE, 2017; CSP, 2017). From the results gained, it is encouraging that developmental outcome measures were utilised by 79% of the 43 respondents to the survey, facilitating the majority of the surveyed physiotherapists to provide a good-quality physiotherapy service and appropriate follow-up (Grol and Grimshaw, 2003; King et al., 2011). The most frequently used outcome measures were HNNE/HINE, GMs and LAPI. This study found that the presence of a band 8 clinical specialist physiotherapist and/or input from a neonatal specialist physiotherapist on the unit, were significant indicators for the use of developmental outcome measures. Those physiotherapists who engaged with a variety of continuing professional developmental opportunities from a number of different sources were also more likely to use outcome measures in clinical practice.

The most representative neonatal service care was level 3 (44%). Although there was no significant relationship between the level of care and the use of outcome measures, most physiotherapists working on a unit that included level 3 care used outcome measures (89.5%). This suggests that outcome measures hold particular clinical importance for infants with more complex conditions, who require closer monitoring and tend to have longer length of stay; thus, greater priority may be given to using outcome measures to monitor these infants.

The band of physiotherapy staff most present on units was Band 7 (86%), which is aligned with the previous findings (72.8% n=43/59, without missing data), (Ronan and Barron, 2012). Again, despite no significant relationship being found between the band of physiotherapists present on the unit and outcome measures utilisation, all units that included a Band 8 physiotherapist used outcome measures. This, combined with the findings regarding the use of outcome measures and involvement of a neonatal-specialist physiotherapist on the

neonatal unit (Fisher exact test: p=0.023), suggests that the presence of a clinical specialist results in close monitoring of neonates.

Level and amount of training and support sources had a significant influence in outcome measure utilisation (higher levels of training and multiple training sources being related to outcome measure usage). These findings are in keeping with previous studies (Jette et al., 2009; Wedge et al., 2012). However, previous studies also argue that physiotherapists with greater clinical expertise tended to use informal outcome measures, relying on their own judgement and experience, whilst newly graduated physiotherapists were more familiar with integrating standardised outcome measures into their practice (King et al., 2011; Wedge et al., 2012). In contrast to these findings, in the current study, the neonatal physiotherapy role is an advanced clinical sub-speciality that requires a relevant postgraduate education and an appropriate professional experience (Brady and Smith, 2015), and physiotherapists with greater years of experience of using the tools, were more likely to implement standardised outcome measures on their neonatal unit. In addition, there is a difference between using a developmental outcome measure to track or anticipate changes over time, and using a short-term outcome measure to evaluate the effectiveness of a single treatment or course of treatments. As a result, the use of 'informal outcomes' by expert practitioners in other non-neonatal specialties may reflect the use of the outcome tools for a different purpose. In neonatal care, the tracking of development over a longer period may demand a more standardised approach.

The most frequently used outcome measures were HNNE/HINE, GMs and LAPI. These tests, which have a discriminative and predictive function, evaluate posture, tone and the quality of movements in premature infants. The main differences are related to the administration time, infant handling involvement, equipment and training requirements (Kant, 2013). The tendency of utilising more than two outcome measures (67.7%, n=23/34), confirms the need for further studies to evaluate whether the concurrent use of those tools would increase the ability to detect or discriminate typically developing preterm infants to

ensure the resources are targeted. In addition, size of caseload or local trust policies could be influencing factors in outcome measure preference and frequency of use, since Ronan and Barron (2012) identified that 39% of level 2 and 3 units (n=22/57, excluding 13 units that did not offer a neonatal physiotherapy service) had an ad hoc service, which was offered after a direct referral only.

The overall positive attitude towards the use of outcome measures (39/43) and the strong consensus regarding the utility of outcome measures to provide insight for parents into their child's physical functioning (39/43) differed from findings by King et al. (2011). Those authors suggested that paediatric physiotherapists perceived the utilisation of outcome measures to be less important to parents. King et al. (2011) undertook a thorough literature review regarding barriers and facilitators to outcome measure use in paediatric physiotherapy, summarising that the unwillingness of physiotherapists to utilise standardised measurements may be related to the incapacity of those tools to detect small changes in children with physical and developmental disabilities. Thus, they preferred an individualised approach that celebrated small achievements in order to maintain the children's motivation and parents' appreciation for long-term therapies. These differences between paediatric and neonatal fields might be related to the type of condition and care. Although both fields adopt a family-centred approach, particular attention has been directed to parent-child interactions, parent education and early parent-administered physiotherapy on neonatal units in recent years (Ustad et al., 2016; Sweeney et al., 2009; Sweeney et al., 2010). In addition, the predictive nature of developmental tools might assume particular importance to parents at this early stage.

High costs were described as significant limitations to the use of outcome measures on neonatal units, which reflected former findings from other physiotherapy specialist areas including musculoskeletal, neurological and paediatric fields (Jette et al., 2009; Wedge et al., 2012; Van Peppen et al., 2008; King et al., 2011). Moreover, finding the opportune moment for outcome measure use was perceived as a barrier by the majority of respondents

(81.4%). From the literature, it seems that this limitation is specific to the neonatal setting and might partially explain the physiotherapists' tendency to integrate different tools, some of which involve purely observational assessment, into the neonatal assessment.

Significant differences were found between those physiotherapists that used outcome measures and those that did not. In particular, there was strong consensus among respondents who used outcome measures that they 'fit into the way of working on units' (94.1%) and are a 'starting point for physiotherapy intervention and further referrals' (94.1%).

There were also significant differences between respondents using outcome measures and those not, in terms of the level of support offered by fellow physiotherapists and other professionals. Those respondents using outcome measures felt significantly more supported by their colleagues and peers, ($p<0.001$ and $p=0.005$ for therapists and other professionals respectively). As opposed to former studies, which identified culture and organisation as determining factors in outcome measure implementation (Jette et al., 2009; King et al., 2001; Wedge et al., 2012), interdisciplinary support assumed significant importance in the neonatal physiotherapy field. This suggests that where a supportive environment exists, physiotherapists feel comfortable utilising outcome measures.

It is acknowledged that this survey has several limitations. The non-standardised term, 'developmental outcome measure', was utilised to group different neurological, behavioural or motor performance tests, since they assess various areas of neonatal development and they were designed for serial/longitudinal use to track the developmental evolution of infants (Brazelton and Nugent, 2011; Dubowitz et al., 1999; Einspieler, 2004, Lacey, 2004). The lack of consensus regarding this terminology may have impacted on the interpretation of questions and statements, leading to ambiguity of findings. There were a significant number of non-responses to certain individual items, which could have impacted on the validity of findings. These may have been reduced with a longer piloting process. However, the study was undertaken within the context of a fairly limited time-frame and the findings remain a useful addition to the literature. The use of an electronic survey may explain some of the

problems in completeness, consistency and a lower response rate compared to the epistolary method (Bethlehem, 2009; Ritter et al., 2004; Sivo et al., 2006). However, given that neonatal physiotherapy is a fairly small subspecialty, the response rate was deemed to be sufficient and representative of this group.

Conclusion

The results of this study suggest that outcome measures are commonly used by neonatal physiotherapists in the UK. The most frequently used outcome measures were HNNE/HINE, GMS and LAPI. There was generally a positive attitude towards outcome measure usage, but with some barriers to their implementation including the high cost. The non-use of outcome measures could be attributed to the level of expertise, type of training and a lack of interdisciplinary support. This provides a useful discussion point for experts in the field, when considering the impact that staff development and support could have on outcome measure utilisation in the future.

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List of Tables

Table 1: Summary of participants

	Use of OMs (YES) n=34 (79%)	Non-use of OMs (NO) n=9 (21%)	Total n=43 (100%)	Significance
Highest level of neonatal care provided				
1	4 (12%)	0	4 (9%)	
2	8 (24%)	4 (44%)	12 (28%)	U = 110.5 p = 0.177
3	17 (50%)	2 (22%)	19 (44%)	
Other	1 (3%)	1 (11%)	2 (5%)	
Not reported	4 (12%)	2 (22%)	6 (14%)	
Physiotherapy band levels present on the neonatal unit				
Band 6	1 (3%)	1 (11%)	2 (5%)	
Band 7	15 (44%)	2 (22%)	17 (40%)	
Band 8	3 (9%)	0	3 (7%)	
Bands 6 & 7	12 (35%)	5 (56%)	17 (40%)	U = 132.5 p = 0.513
Bands 6 & 8	1 (3%)	0	1 (2%)	
Bands 7 & 8	1 (3%)	0	1 (2%)	
Bands 5, 6 & 7	0	1 (11%)	1 (2%)	
Bands 4, 6, 7 & 8	1 (3%)	0	1 (2%)	
Number of years using developmental outcome measures				
no years	0	3 (33%)	3 (7%)	U = 90 p = 0.041
< 2 years	6 (18%)	2 (22%)	8 (19%)	
2-5 years	9 (26%)	1 (11%)	10 (23%)	
> 5 years	19 (56%)	3 (33%)	22 (51%)	
Training received in the use of developmental outcome measures				
Yes	30 (88%)	3 (33%)	33 (77%)	p = 0.002
No	4 (12%)	6 (67%)	10 (23%)	
Whether therapists have read the APCP competence framework for working in neonatal care				
Yes	31 (91%)	8 (89%)	39 (91%)	p = 1.00
No	3 (9%)	1 (11%)	4 (9%)	

OMs: developmental outcome measures; APCP: Association for Paediatric Chartered Physiotherapists; Statistical Significance $p<0.05$; 'Other' refers to: n=1 'unsure'; n=1 consultant level therapist

Table 2: Frequency of the use of developmental outcome measures

OMs	Never n (%)	<5 times n (%)	5-10 times n (%)	11-25 times n (%)	>25 times n (%)	Response rate[a] n (%)
HNNE/HINE	4 (11.8%)	4 (11.8%)	4 (11.8%)	4 (11.8%)	12 (35.3%)	28 (82.4%)
GMs	5 (14.7%)	3 (8.8%)	1 (3%)	6 (17.6%)	12 (35.3%)	27 (79.4%)
LAPI	8 (23.5%)	2 (5.9%)	1 (3%)	1 (3%)	14 (41.2%)	26 (76.5%)
NBAS	11 (32.4%)	7 (20.6%)	1 (3%)	0	3 (8.8%)	22 (64.7%)
NIDCAP	17 (50%)	0	0	1 (3%)	2 (5.9%)	20 (58.8%)
TIMP	17 (50%)	1 (3%)	0	0	0	18 (53%)
NAPI	19 (55.9%)	0	0	0	0	19 (55.9%)
Others: AIMS	0	0	0	0	5 (14.7%)	5 (14.7%)
Others: Bayley	0	2 (5.9%)	0	0	1 (3%)	3 (8.8%)

OMs: developmental outcome measures; HNNE/HINE: Hammersmith Neonatal Neurological Examination/Hammersmith Infant Neurological Examination; GMs: Prechtl's Method of Qualitative Assessment of General Movements; LAPI: Lacey Assessment of Preterm Infants; NBAS: Brazelton Neonatal Behavioural Assessment Scale; NIDCAP: Newborn Individualised Care and Assessment Program; TIMP: Test of Infant Motor Performance; NAPI: Neurobehavioural Assessment of the Preterm Infant; AIMS: Alberta Infant Motor Scale; Bayley: Bayley Scales of Infant and Toddler Development

[a][Total number of responses: n=34]

Table 3: Summary of barriers and facilitators questionnaire section

Items	Use of OMs	Strongly disagree n (%)	Disagree n (%)	Do not agree nor disagree n (%)	Agree n (%)	Strongly agree n (%)	Total n (%)	Mann-Whitney U test p-value
8. I feel that I have a **positive attitude** towards the use of developmental outcome measures [Barrier (1) → Facilitator (5)]	Yes	2 (5.9%)	0	0	14 (41.2%)	18 (53%)	34 (100%)	U = 115
	No	0	0	2 (22.2%)	4 (44.5%)	3 (33.3%)	9 (100%)	p = 0.208
9. The use of a developmental outcome measure **fits into my way of working** at my unit [Barrier (1) → Facilitator (5)]	Yes	1 (3%)	0	1 (3%)	13 (38.2%)	19 (55.9%)	34 (100%)	U = 18.5
	No	0	4 (44.5%)	4 (44.5%)	1 (11.1%)	0	9 (100%)	**p < 0.001**
10. I regard the use of a developmental outcome measure to be a good starting point for my **physiotherapy interventions** and for further referrals [Barrier (1) → Facilitator (5)]	Yes	1 (3%)	0	1 (3%)	10 (29.4%)	22 (64.7%)	34 (100%)	U = 46
	No	0	0	6 (66.7%)	2 (22.2%)	1 (11.1%)	9 (100%)	**p < 0.001**
11. It is important that developmental outcome measures can be **used before 38-40 weeks postmenstrual age** [Barrier (1) → Facilitator (5)]	Yes	1 (3%)	3 (8.8%)	3 (8.8%)	16 (47.1%)	11 (32.4%)	34 (100%)	U = 117
	No	0	1 (11.1%)	2 (22.2%)	5 (55.6%)	1 (11.1%)	9 (100%)	p = 0.246
12. I consider that a complex **layout** of a developmental outcome measure can be an obstacle to using it [Facilitator (5) ← Barrier (1)]	Yes	0	4 (11.8%)	4 (11.8%)	19 (55.9%)	7 (20.6%)	34 (100%)	U = 145.5
	No	0	0	2 (22.2%)	5 (55.6%)	2 (22.2%)	9 (100%)	p = 0.804
13. The need for additional **equipment** (such as a video camera) can be an obstacle to using the developmental outcome measure in my unit [Facilitator (5) ← Barrier (1)]	Yes	1 (3%)	6 (17.6%)	4 (11.8%)	14 (41.2%)	9 (26.5%)	34 (100%)	U = 123.5
	No	0	1 (11.1%)	0	5 (55.6%)	3 (33.3%)	9 (100%)	p = 0.35
14. The number of items that require infant **handling** can be an obstacle to using a developmental outcome measure [Facilitator (5) ← Barrier (1)]	Yes	0	6 (17.6%)	2 (5.9%)	16 (47.1%)	10 (29.4%)	34 (100%)	U = 96
	No	0	3 (33.3%)	1 (11.1%)	5 (55.6%)	0	9 (100%)	p = 0.067

15. I feel that the use of developmental outcome measures can be too **time-consuming** [Facilitator (5) ← Barrier (1)]	Yes	6 (17.6%)	17 (50%)	3 (8.8%)	6 (17.6%)	2 (5.9%)	34 (100%)	U = 108
	No	0	4 (44.5%)	2 (22.2%)	2 (22.2%)	1 (11.1%)	9 (100%)	p = 0.15
16. The **cost** of acquiring certain developmental outcome measures (such as courses and materials) can be an obstacle to using them [Facilitator (5) ← Barrier (1)]	Yes	1 (3%)	1 (3%)	3 (8.8%)	20 (58.8%)	9 (26.5%)	34 (100%)	U = 124.5
	No	0	0	1 (11.1%)	4 (44.5%)	4 (44.5%)	9 (100%)	p = 0.341
17. It is difficult to understand the use of developmental outcome measures in patients who seem **healthy** [Facilitator (5) ← Barrier (1)]	Yes	12 (35.3%)	16 (47.1%)	4 (11.8%)	1 (3%)	1 (3%)	34 (100%)	U = 120
	No	1 (11.1%)	6 (66.7%)	2 (22.2%)	0	0	9 (100%)	p = 0.281
18. **Finding the right moment** (such as infant awake) for the developmental assessment is often challenging [Facilitator (5) ← Barrier (1)]	Yes	0	5 (14.7%)	1 (3%)	22 (64.7%)	6 (17.7%)	34 (100%)	U = 148
	No	0	0	2 (22.2%)	5 (55.6%)	2 (22.2%)	9 (100%)	p = 0.863
19. The use of developmental outcome measures in neonatal units is **too stressful for the infant** [Facilitator (5) ← Barrier (1)]	Yes	5 (14.7%)	19 (55.9%)	5 (14.7%)	3 (8.8%)	2 (5.9%)	34 (100%)	U = 127.5
	No	0	5 (55.6%)	4 (44.5%)	0	0	9 (100%)	p = 0.399
20. Developmental outcome measures **can be adapted to the individual needs** of the infants [Barrier (1) → Facilitator (5)]	Yes	0	3 (8.8%)	6 (17.7%)	20 (58.8%)	5 (14.7%)	34 (100%)	U = 79.5
	No	0	3 (33.3%)	3 (33.3%)	3 (33.3%)	0	9 (100%)	**p = 0.016**
21. Developmental outcome measures **give parents an insight** into their child's physical functioning [Barrier (1) → Facilitator (5)]	Yes	0	1 (3%)	1 (3%)	18 (53%)	14 (41.2%)	34 (100%)	U = 96
	No	0	0	2 (22.2%)	6 (66.7%)	1 (11.1%)	9 (100%)	p = 0.055
22. **Fellow neonatal physiotherapists cooperate** in applying the developmental outcome measures [Barrier (1) → Facilitator (5)]	Yes	0	0	6 (17.7%)	20 (58.8%)	8 (23.5%)	34 (100%)	U = 34
	No	1 (11.1%)	1 (11.1%)	6 (66.7%)	1 (11.1%)	0	9 (100%)	**p < 0.001**
23. **Other professionals support** the use of developmental outcome measures	Yes	0	0	2 (5.9%)	22 (64.7%)	10 (29.4%)	34 (100%)	U = 70

[Barrier (1) → Facilitator (5)]	No	2 (22.2%)	1 (11.1%)	2 (22.2%)	3 (33.3%)	1 (11.1%)	9 (100%)	**p = 0.005**
24. **Managers/directors support** the use of developmental outcome measures	Yes	0	1 (3%)	7 (20.6%)	17 (50%)	9 (26.5%)	34 (100%)	U = 92.5
[Barrier (1) → Facilitator (5)]	No	2 (22.2%)	0	3 (33.3%)	3 (33.3%)	1 (11.1%)	9 (100%)	p = 0.053

OMs: developmental outcome measures
Statistical significance (**p<0.05**)

Appendix 1: Questionnaire

Developmental outcome measures

Following are a couple of questions about the utilisation of developmental outcome measurement.

1.	**Do you currently use a developmental outcome measure on your unit?**	☐Yes ☐No: Please go to question number 4				
2.	**How often have you used the following developmental outcome measures?** *If you use other developmental outcome measures, please specify in the text boxes*					
		Never	<5 times	5-10 times	11-25 times	>25 times
	Hammersmith Neonatal/Infant Neurological Examination (Dubowitz or NANI)	☐	☐	☐	☐	☐
	Lacey Assessment of Preterm Infants (LAPI)	☐	☐	☐	☐	☐
	Brazelton Neonatal Behavioural Assessment Scale (NBAS)	☐	☐	☐	☐	☐
	Neurobehavioural Assessment of the preterm Infant (NAPI)	☐	☐	☐	☐	☐
	Newborn Individualised Care and Assessment Program (NIDCAP)	☐	☐	☐	☐	☐
	Prechtl's Method of Qualitative Assessment of General Movements (GMs)	☐	☐	☐	☐	☐
	Test of Infant Motor Performance (TIMP)	☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐
		☐	☐	☐	☐	☐
	Other/further comments					
3.	**What is the youngest postmenstrual age range (weeks) that you would assess a baby using a developmental outcome measure?** *(please add additional comments in the box provided)* *Please go to question number 5*	☐24-27 ☐28-29 ☐30-31 ☐32-34 ☐35-37 ☐38-40 ☐>40: Please Specify ……				
		Other/further comments:				

4.	**If it were possible, which outcome measure/s would you like to introduce** *(tick all that apply on the list)*	☐Hammersmith Infant Neurological Examination (Dubowitz or NANI) ☐Lacey Assessment of Preterm Infants (LAPI) ☐Brazelton Neonatal Behavioural Assessment Scale (NBAS) ☐Neurobehavioural Assessment of the preterm Infant (NAPI) ☐Newborn Individualised Care and Assessment Program (NIDCAP) ☐Prechtl's Method of Qualitative Assessment of General Movements (GMs) ☐Test of Infant Motor Performance (TIMP) ☐I don't know ☐None ☐Other: Please Specify ……
		Other/further comments:
5.	**What is your level of experience with the use of developmental outcome measures**	☐I have no experience ☐<2 years of experience ☐2-5 years of experience ☐>5 years of experience
		Other/further comments:
6.	**Have you received training in the use of developmental outcome measures?**	☐Yes ☐No
		Please state the outcome measure/s that you have been trained to use, and the type of training that you undertook (e.g. inservice training, APCP course, etc):

Barriers and facilitators to the implementation of tests of infant development
The Association of Paediatric Chartered Physiotherapists (APCP) published on 2011 and updated on 2015 "A Competence Framework and Evidenced-Based Practice Guidance for the Physiotherapist working in the Neonatal Intensive Care and Special Care Unit in the United Kingdom", in which is recommended the use of developmental outcome measures.

7.	**Which of the following statement is true?**	☐I read the APCP guidance ☐I am aware of the APCP guidance, but I have not read them yet ☐I am not aware of the APCP guidance

Following are a couple of statements about the use of developmental outcome measures. We would like to know whether you agree with the statement or not and in what degree. If you do not have a strong opinion, please try to find out if it is more like 'agree' or more like 'disagree'. If you really do not know, you can select the option 'do not agree nor disagree'.

	Strongly disagree	Disagree	Do not agree nor disagree	Agree	Strongly agree
8. I feel that I have a positive attitude towards the use of developmental outcome measures	☐	☐	☐	☐	☐
9. The use of developmental outcome measures fits into my way of working at my unit	☐	☐	☐	☐	☐
10. I regard the use of a developmental outcome measure to be a good starting point for my physiotherapy interventions and for further referrals Other/further comments:	☐	☐	☐	☐	☐
11. It is important that developmental outcome measures can be used before 38-40 weeks postmenstrual age Other/further comments:	☐	☐	☐	☐	☐
12. I consider that a complex lay-out of a developmental outcome measure can be an obstacle to using it Other/further comments:	☐	☐	☐	☐	☐
13. The need for additional equipment (such as a video camera) can be an obstacle to using the developmental outcome measure in my neonatal unit Other/further comments:	☐	☐	☐	☐	☐
14. The number of items that require infant handling can be an obstacle to using a developmental outcome measure Other/further comments:	☐	☐	☐	☐	☐
15. I feel that the use of developmental outcome measures can be too time-consuming Other/further comments:	☐	☐	☐	☐	☐
16. The cost of acquiring certain developmental outcome measures (such as courses and materials) can be an obstacle to using them Other/further comments:	☐	☐	☐	☐	☐

17. It is difficult to understand the use of developmental outcome measures in patients who seem healthy Other/further comments:	☐	☐	☐	☐	☐
18. Finding the right moment (such as infant awake) for the developmental assessment is often challenging Other/further comments:	☐	☐	☐	☐	☐
19. The use of developmental outcome measures in neonatal units are too stressful for the infant Other/further comments:	☐	☐	☐	☐	☐
20. Developmental outcome measures can be adapted to the individual needs of the infant Other/further comments:	☐	☐	☐	☐	☐
21. Developmental outcome measures give parents an insight into their child's physical functioning Other/further comments:	☐	☐	☐	☐	☐
22. Fellow neonatal physiotherapists cooperate in applying the developmental outcome measures Other/further comments:	☐	☐	☐	☐	☐
23. Other professionals support the use of developmental outcome measures Other/further comments:	☐	☐	☐	☐	☐
24. Managers/directors support the use of developmental outcome measures Other/further comments:	☐	☐	☐	☐	☐

Neonatal physiotherapy service provision and training

Following are a couple of questions about your neonatal physiotherapy service and training.

25.	**What is the name of the hospital in which you work?** This question is to account for multiple responses from the same unit. The name of the unit will NOT be revealed in the analysis or dissemination of findings	
	How many beds does your neonatal unit have, and at what level are these beds?	**26.** Level 1: **27.** Level 2: **28.** Level 3:
		Other/further comments:
29.	**What bands of physiotherapy staff work on the neonatal unit?** *(tick all that apply)*	☐Band 3 assistant ☐Band 4 assistant / T.I ☐Band 5 ☐Band 6 ☐Band 7 ☐Band 8
		Please specify approximately how many hours per week your physiotherapy team spends on the neonatal unit:
30.	**Where does your physiotherapy input come from?** *(tick all that apply)*	☐Neonatal-specialist physiotherapist ☐Predominantly paediatric physiotherapists from acute trust ☐Predominantly adult or general physiotherapists from acute trust ☐Paediatric physiotherapists from community trust
		Other/further comments:
31.	**What types of physiotherapy interventions are your neonatal physiotherapists involved with?** *(tick all that apply)*	☐Neuro-developmental evaluation ☐Neuro-developmental interventions ☐Respiratory / chest clearance ☐Orthopaedic – e.g. OBPP, Talipes (Obstetric Brachial Plexus Palsy) ☐Psychosocial meetings ☐Neonatal follow-up clinics ☐Parent's education/collaboration
		Other/further comments:

32.	**As a neonatal physiotherapist, what specialist training and support have you undertaken?** ***(tick all that apply)***	☐I am a member of APCP (Association of Paediatric Chartered Physiotherapists) neonatal group ☐I have attended courses related to neonatal care ☐I have undertaken postgraduate education, which included neonatal care ☐I have been involved in peer learning and support within the trust ☐I have received teaching/training from senior colleagues ☐I have undertaken my own self-directed learning ☐Other (please state)