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Development and validation of Scale for Prediction of Ambulation in Indian Children with Cerebral Palsy- The SPAIC scale

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ABSTRACT

The most frequently observed disability in children is Cerebral Palsy (CP). Identifying the capacity and prognosis of ambulation in children with CP is very important for therapists and rehabilitation professionals to determine these children's therapy and rehabilitation needs. However, there is no definitive instrument for predicting ambulation in these children. Therefore, there is a definite need for a tailored measure to predict ambulation that will consider all the factors that may influence the ambulation prognosis in children with CP in the Indian scenario. This mixed-methods study employed individuals from different backgrounds, such as academic professionals, pediatric rehabilitation professionals, pediatric physiotherapists, pediatric neurologists, parents, and children with CP. Two rounds of focused discussions were conducted, domains were identified and experts were invited for the Delphi method. Then alpha scale version was designed and the Delphi questionnaire Round 1 was created and sent to the experts. Based on their suggestions, a corrected beta version was created and the Delphi questionnaire was evaluated in Round 2. Statistical analysis was performed using Cronbach's alpha and the scale was validated. In conclusion, the Scale for Prediction of Ambulation in Indian Children with CP (SPAIC) scale was validated and can be used for further data collection.

Keywords: Cerebral palsy, ambulation, Delphi, scale for prediction of ambulation in indian children, physiotherapy, rehabilitation.

1. INTRODUCTION

Cerebral palsy (CP) is disorders of movement and posture that result in activity limitations due to non-progressive brain disorders that occur early in development. In childhood, the motor disability that is more common is Cerebral Palsy (Braun et al., 2016; Kariya et al., 2022). Around the world, there are 2 to 2.5 cases of CP for every 1000 live births. It is estimated that there are

3 instances per 1000 live births in India. The actual number in India, a growing nation, could be far greater than the estimated numbers (Joshi et al., 2023). According to the latest statistics, there are about 2.5 million CP children in India. Disabilities associated with CP affect the achievement of developmental motor milestones, which include ambulatory capacity (Vyas et al., 2013).

Ambulation is the first milestone in standing and is required for all activities of daily living. Therefore, ambulation prediction is critical for therapists and parents or caregivers. It is important to predict whether a child with CP will walk to plan the goals for therapy and overall rehabilitation of the child and to make parents aware of the future functional prognosis of a child with CP. Many clinical practice professionals have developed criteria for predicting the future of walking in children with CP. These criteria to some extent may guide walking prognosis but not accurately neither predict the ambulation of all children with CP. Hence, there is a need to develop a scale that will have good reliability, validity and transferability and allow families of these children a more reliable prediction of ambulation.

Once the patient's ambulation status is predicted, parents can set their goals and expectation limits and make future decisions regarding the continuation of appropriate interventions according to their child's needs and abilities (Fedrizzi et al., 2000). Many research articles are available on predicting ambulation in children with CP. Few researchers have reported that many factors, such as cognitive development, visual-perceptual disorders, postural reactions, primitive reflexes, type of cerebral palsy and gross motor functions, influence ambulatory status. In addition, they reported that the age at which gross motor milestones are reached is one of the prognostic factors for ambulation. This research also proved that if a child with CP reaches the milestone of sitting before the age of two years, the prognosis for ambulation is good (Watt et al., 1989; Sala and Grant, 1995; Fedrizzi et al., 2000).

CP has also been demonstrated that a positive correlation exists between achieving sitting by 2 years of age and achieving walking by 8 years (Bleck, 1975; Badell-Ribera, 1985). Bleck, (1975) studied the scoring method for predicting walking in children with CP. This scoring system has seven primitive reflexes and postural responses as predictors and was divided into good, guarded and poor prognoses (Bleck, 1975).

In addition, a correlational study in Japan in 2010 showed no difference in Bleck, (1975) scores between the ambulation and non-ambulation groups (Begnoche et al., 2016). The study of Thai children revealed that independent sitting at two years of age and independent eating with hands were significant positive predictors for ambulation. CP type (spastic hemiplegia, ataxia, spastic diplegia, dyskinesia, hypotonia and mixed type) was also a significant positive predictor (Keeratisiroj et al., 2016; Patel et al., 2023). In order to establish the criteria for ambulation prognosis based on the age at which children with CP achieve significant gross motor milestones, a retrospective study involving 272 patients with spasticity was carried out.

In the study, the researchers analyzed three variables: Age at the last clinical assessment, the clinical type of CP and the age at which the individual reached gross motor milestones. A favourable walking prognosis was predicted by maintaining head balance before nine months and a bad prognosis was predicted by achieving it after 20 months. A positive prognosis was predicted by sitting at 24 months of age and by crawling with good motor control at 30 months of age (Paz-Júnior et al., 1994). Strong evidence was presented by a meta-analysis published in 2016 indicating independent sitting at age 2, the absence of intellectual disability, the absence of visual impairment and the absence of epilepsy or seizures were all favorable predictors of walking ability in children with CP (Keeratisiroj et al., 2018).

A chart has been developed to predict the ability of walking in Thai children with CP, but it is not comprehensive. It does not take into account all the elements that influence the walking ability of children with CP (Keeratisiroj et al., 2016). Moreover, no instrument considers all prognostic factors for predicting ambulation in CP. Therefore, there is a definite need for a comprehensive gold standard instrument for predicting walking ability in Indian children with CP that considers all factors, such as gross motor skills, cognition, vision, primitive reflexes, the role of parents in India, family, environmental factors, etc. Thus, the Scale for Prediction of Ambulation in Indian Children with CP (SPAIC) was developed for children with CP, where the Delphi method was used to develop the scale.

2. MATERIALS AND METHODS

The study was ethically approved with the reference number NIMSUR/IEC/2022/249. This open-ended Delphi method was conducted from June 2022 to December 2022. The initial phase of qualitative development involved an extensive literature review, whereby articles published 50 years before the development of the scale were screened out and domains were identified using deductive and inductive methods. A focused discussion meeting was then conducted with 10 participants, including experts in pediatric rehabilitation and parents of children with CP along with physiotherapists. During this meeting, the need for scale development was discussed and justified and the domains and content to be included in the study were thoroughly deliberated.

The experts provided valuable input, including factors such as age limits of CP children for scale application and why the SPAIC scale was necessary, given the availability of other tools, such as the Gross Motor Function Measure (GMFM) and Gross Motor Function Classification System Expanded and Revised (GMFCS-ER). The justification was given that factors not considered in the GMFCS and GMFM, such as environmental factors, vision, cognition and seizures, would be included, as they significantly contribute to the prediction of ambulation. Furthermore, objective scoring would be given to these scale items and the GMFCS would serve as an objective tool for classifying ambulation in CP (Bleck, 1975; Badell-Ribera, 1985; Watt et al., 1989; Sala and Grant, 1995; Fedrizzi et al., 2000; Vyas et al., 2013).

After considering the experts' recommendations, the items to be included in the scale were finalized and thematic analysis was conducted to cluster these items. A second focused discussion meeting was later held with the same participants to finalize the scoring system for the items on the scale. In Phase 2 of scale development, Delphi rounds with experts were conducted. Initially, 10 experts in pediatric rehabilitation from five different continents were identified and contacted through the mail for their contribution to the development of the scale. Those who were ready to participate were included after receiving their consent, they were sent the alpha version of the SPAIC scale and the Delphi Round 1 questionnaire based on the included items.

Expert opinions were received and based on their suggestions, items, scoring system, the importance of environmental-specific factors, social and economic status, family support, availability of orthosis and aids were included in the scale. They also recommended breaking down the scale into direct and indirect factors. These changes were incorporated into the scale and a beta version was developed. The beta version of the scale (with direct and indirect factors) and Delphi Round 2 questionnaire were also developed and sent to all experts for Round 2.

During Round 2, the experts questioned why the "achieved and not achieved" section of gross motor functions was scored separately. The justification was given that patients may be scored inappropriately within the given timeframe while applying the scale. For example, the neck holding component of gross motor function in a nine-month-old patient who has not achieved head holding to date may receive a score of '0' (poor) and may be scored as 'poor' for the prediction of ambulation, despite having a good capacity for ambulation. After this justification, experts agreed on the achieved and not achieved scoring system.

3. RESULTS

After a focused discussion meeting that was conducted with 10 participants, including experts in pediatric rehabilitation and parents of children with CP followed by an open-ended Delphi Round 1 with experts, it was confirmed that an objective instrument is needed to predict ambulation in children with CP. The personal characteristics of study participants is in (Table 1). Experts suggested including seizure control and postural responses as factors in this instrument.

In Delphi Round 2, the validity of the SPAIC scale was analyzed using 44 items and experts provided their opinions on the listed items. The values for Cronbach's Alpha and item-total correlation were then analyzed to evaluate the validity and reliability of the respondents. The overall Cronbach's Alpha was 0.958, indicating good consistency and statistically excellent validity. The responses of the Delphi Round 2 is in (Figure 1 to 44).

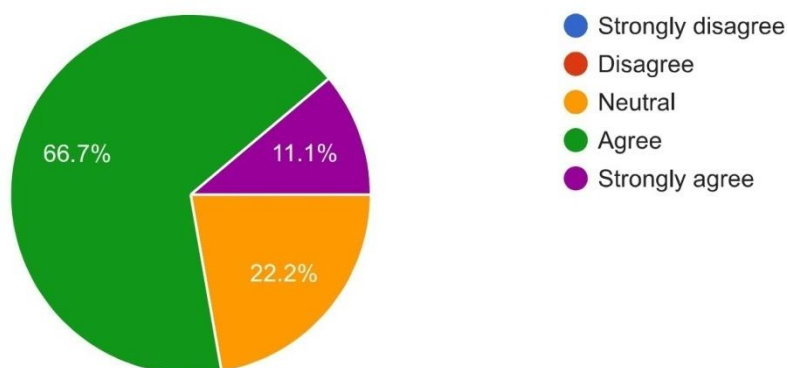


Figure 1 Do you think that the division of SPAIC Scale for prediction of ambulation in Indian Children with Cerebral Palsy in Direct and Indirect factors is appropriate?

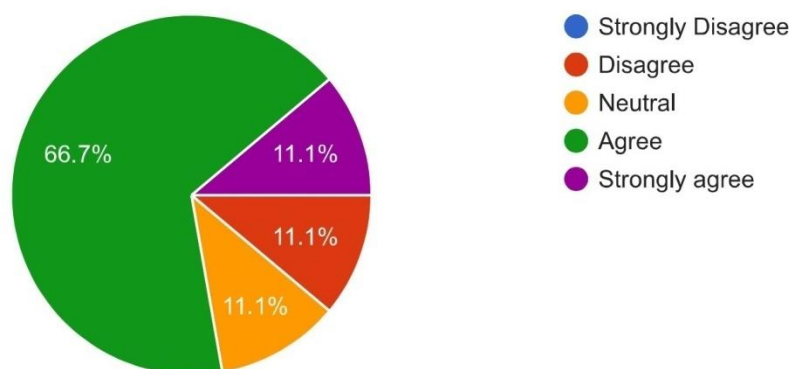


Figure 2 Do you find 80% weightage given to direct factors and 20% weight age given to indirect factors in beta version of SPAIC Scale appropriate?

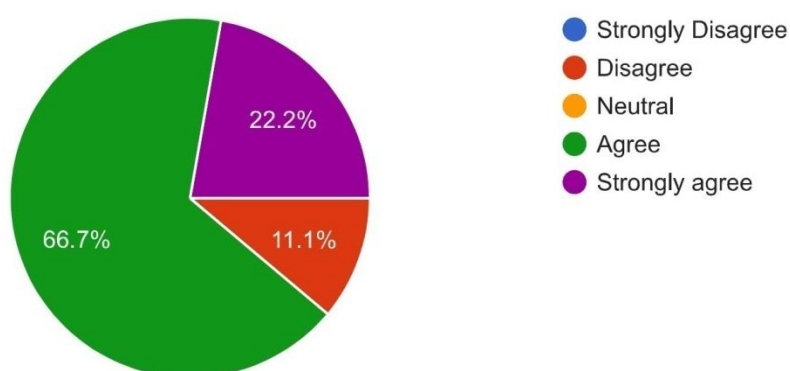


Figure 3 Do you find the A1 disease specific component of 'Type of cerebral palsy' and its scoring system mentioned in SPAIC scale appropriate?

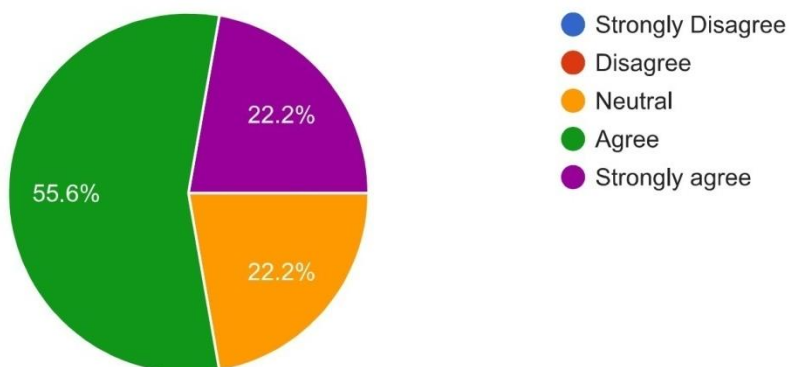


Figure 4 Do you find the A2 disease specific component of 'Tone' and its scoring system mentioned in SPAIC scale appropriate?

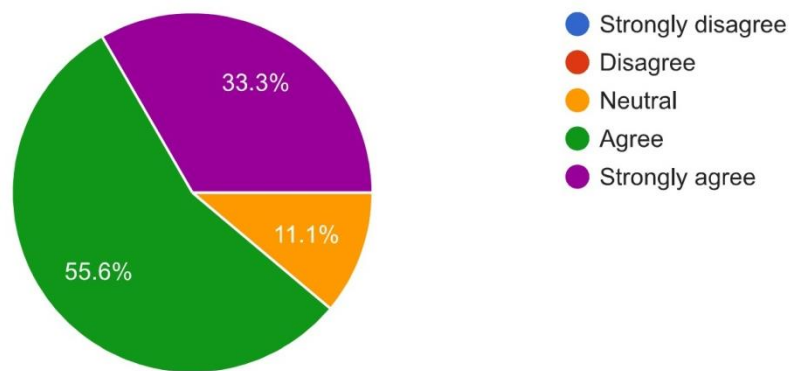


Figure 5 Do you find the A3 disease specific component of 'Involuntary movements' in cerebral palsy and its scoring system mentioned in SPAIC scale appropriate?

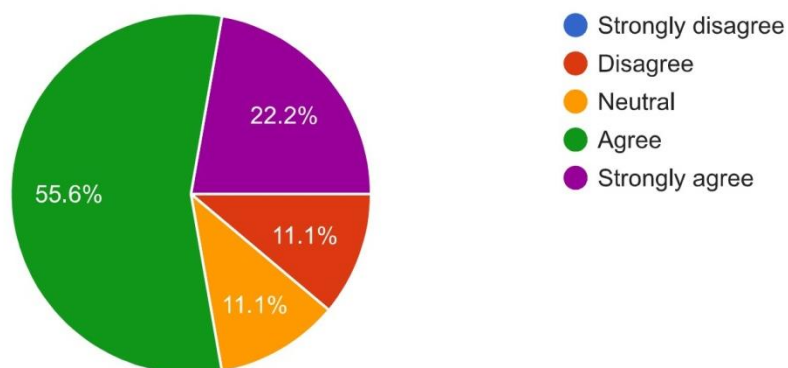


Figure 6 Do you find the A4 disease specific component of 'Vision of child with cerebral palsy' and its scoring system mentioned in SPAIC scale appropriate?

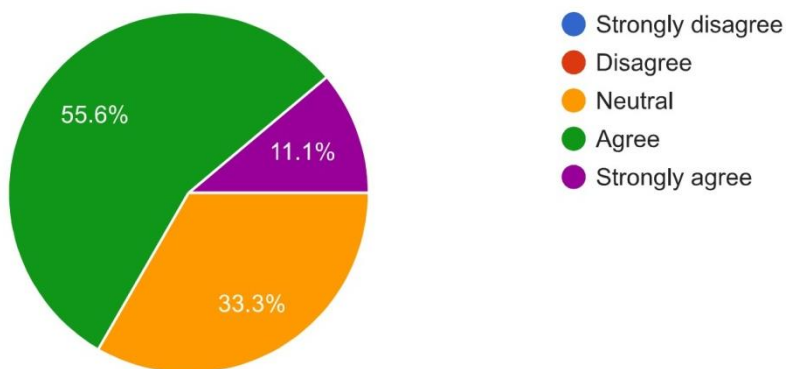


Figure 7 Do you find the A5 disease specific component of Seizure control of cerebral palsy and its scoring system mentioned in SPAIC scale appropriate?

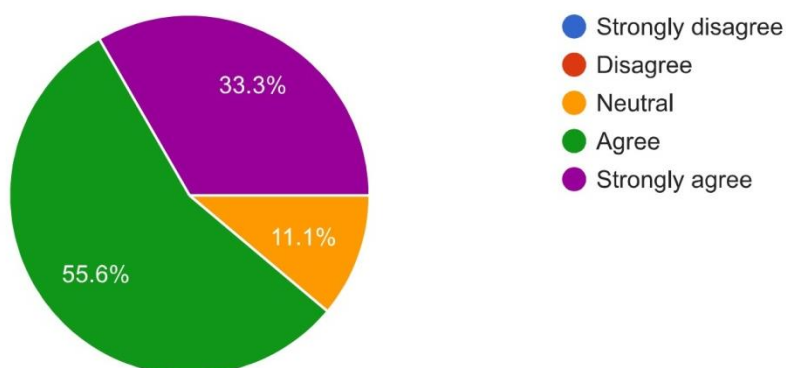


Figure 8 Do you find the B1 component of developmental milestone of neck holding of cerebral palsy (achieved) and its scoring system mentioned in SPAIC scale appropriate?

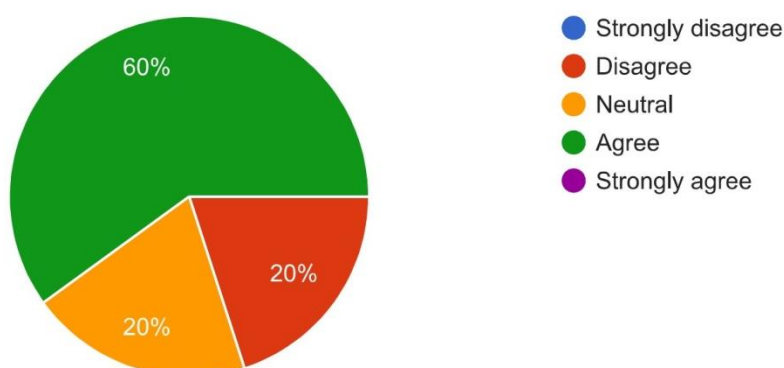


Figure 9 Do you find the B2 component of developmental milestone of neck holding (not achieved) of cerebral palsy and its scoring system mentioned in SPAIC scale appropriate?

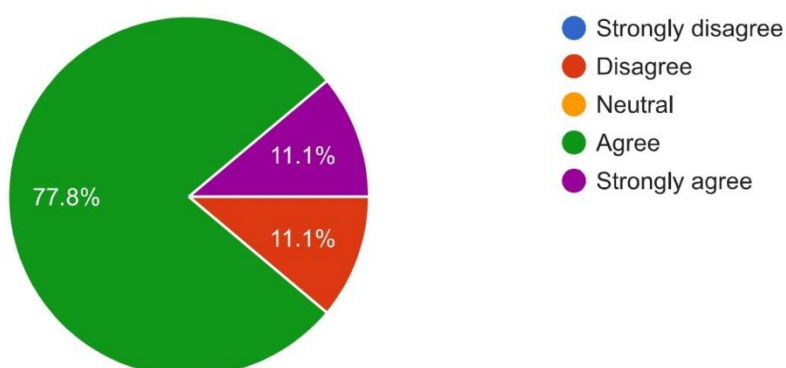


Figure 10 Do you find the B3 component of developmental milestone of 'Prone lifts head and weight bearing on forearm' (achieved) and its scoring system mentioned in SPAIC scale appropriate?

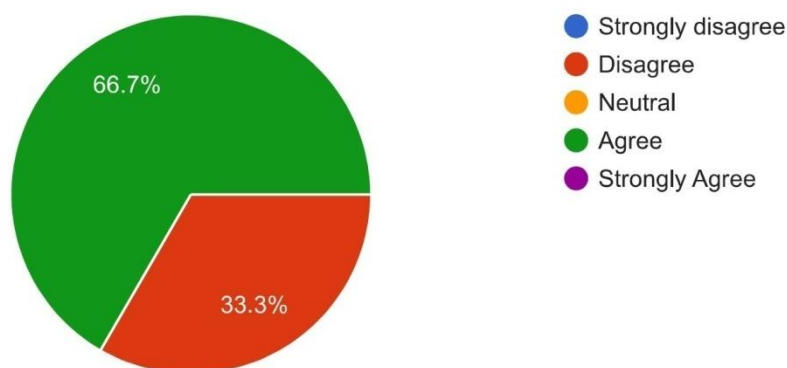


Figure 11 Do you find the B4 component of developmental milestone of 'Prone lifts head and weight bearing on forearm' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?

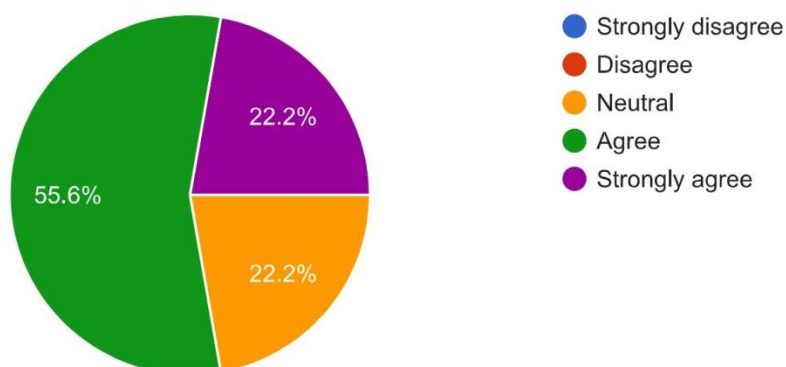


Figure 12 Do you find the B5 component of Developmental milestones 'Creeping Milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?

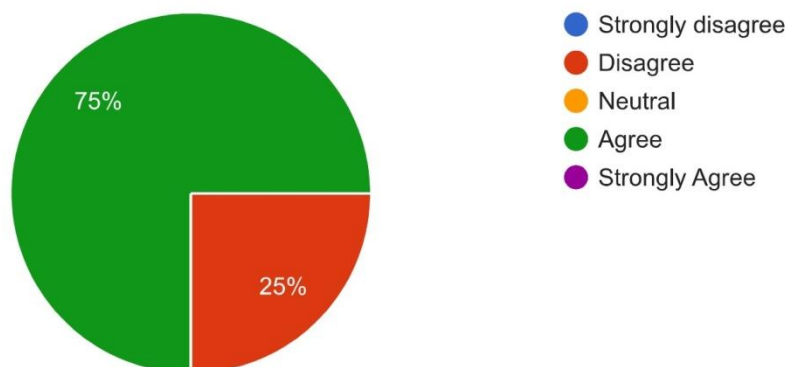


Figure 13 Do you find the B6 component of Developmental milestones 'Creeping Milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?

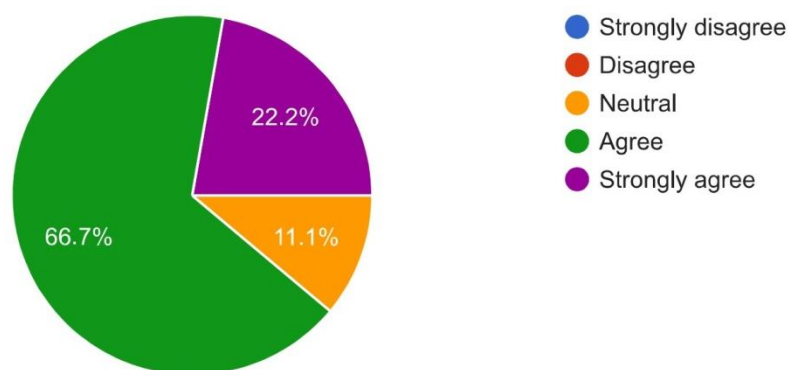


Figure 14 Do you find the B7 component of Developmental milestones 'Rolling milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?

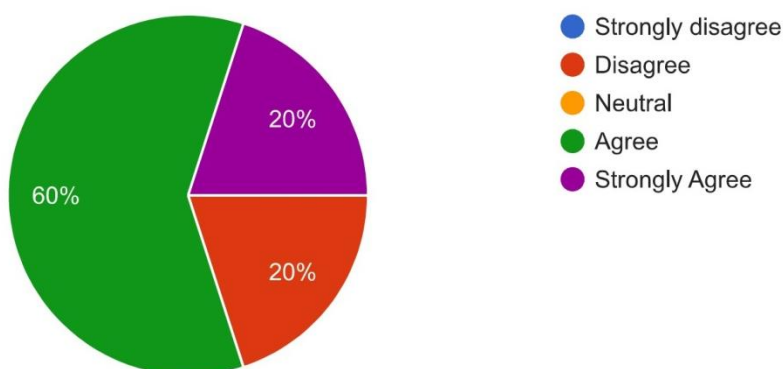


Figure 15 Do you find the B8 component of Developmental milestones 'Rolling milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?

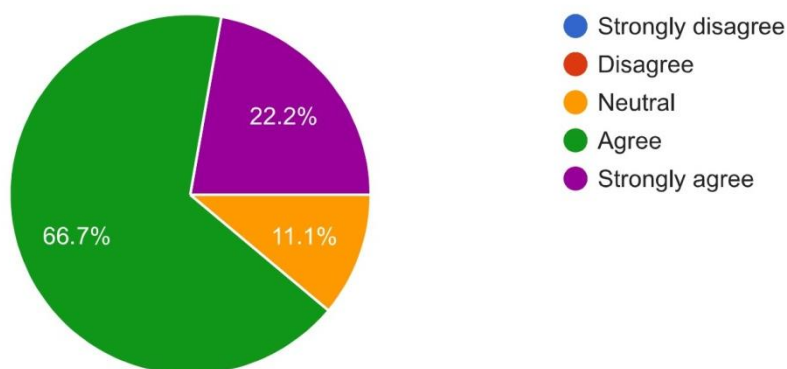


Figure 16 Do you find the B9 component of Developmental milestones 'Sitting with arm support milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?

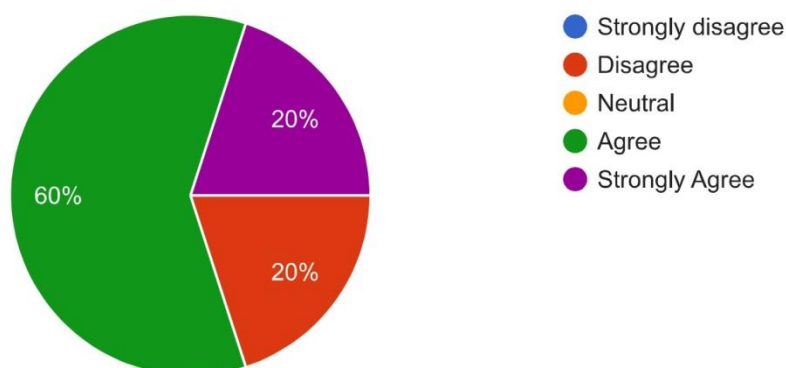


Figure 17 Do you find the B10 component of Developmental milestones 'Sitting with arm support milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?

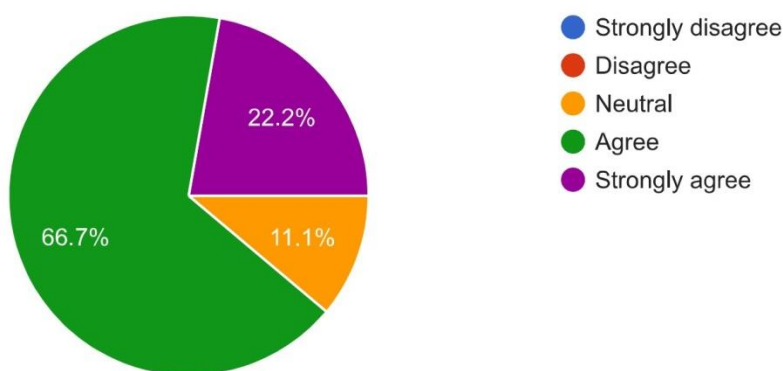


Figure 18 Do you find the B11 component of Developmental milestones 'sitting unsupported milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?

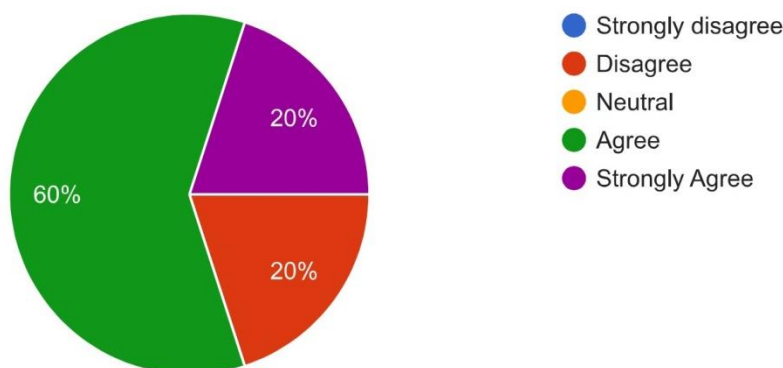


Figure 19 Do you find the B12 component of Developmental milestones 'sitting unsupported milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?

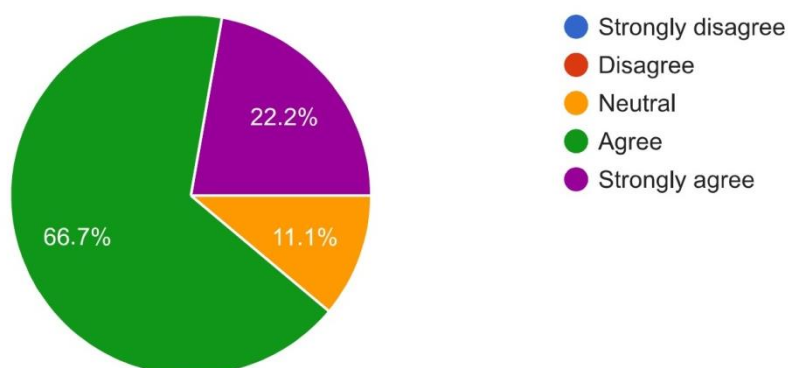


Figure 20 Do you find the B13 component of Developmental milestones 'Crawling milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?

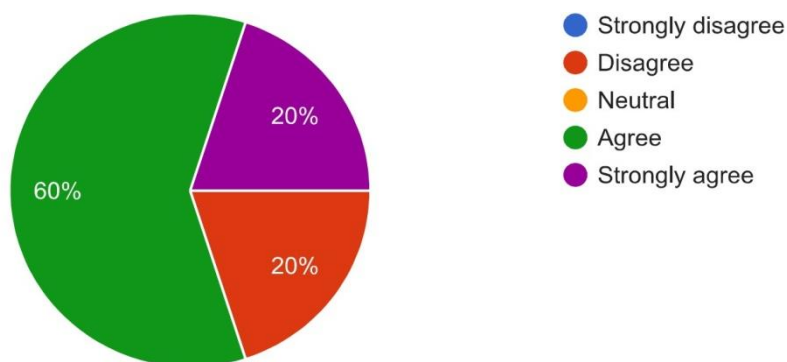


Figure 21 Do you find the B14 component of Developmental milestones 'Crawling milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?

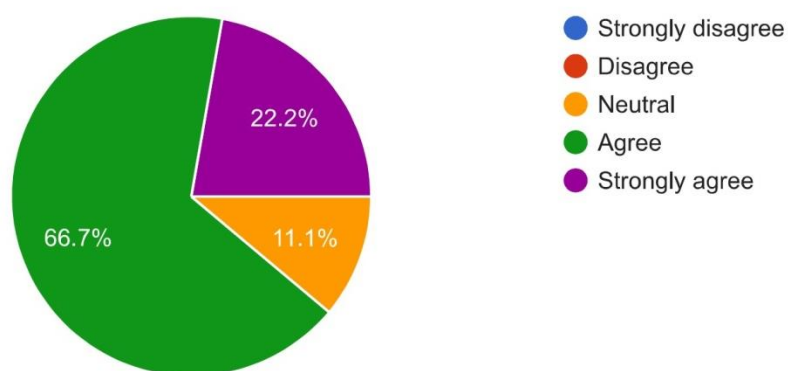


Figure 22 Do you find the B15 component of Developmental milestones 'Pull to stand milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?

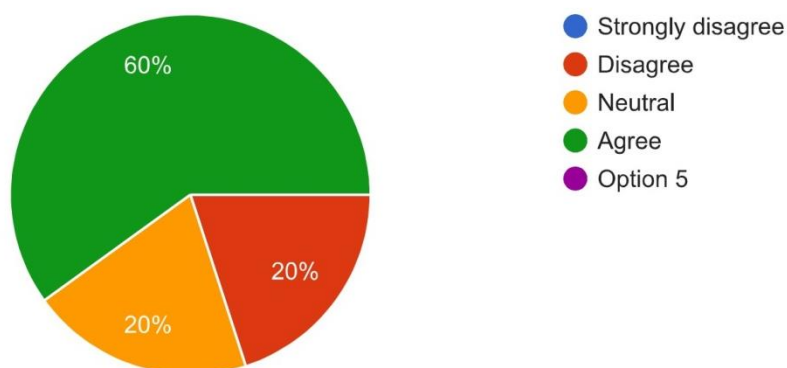


Figure 23 Do you find the B16 component of Developmental milestones 'Pull to stand Milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?

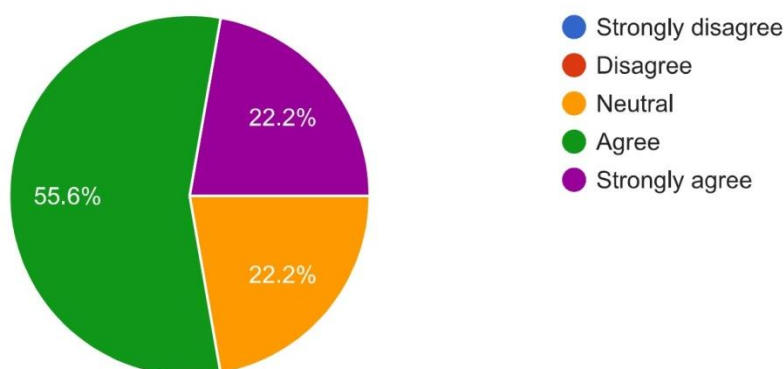


Figure 24 Do you find the B17 component of Developmental milestones 'Standing supported milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?

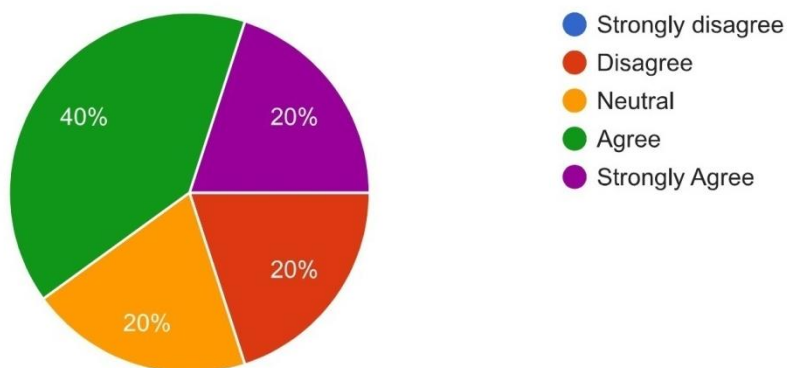


Figure 25 Do you find the B18 component of Developmental milestones 'Standing supported milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?

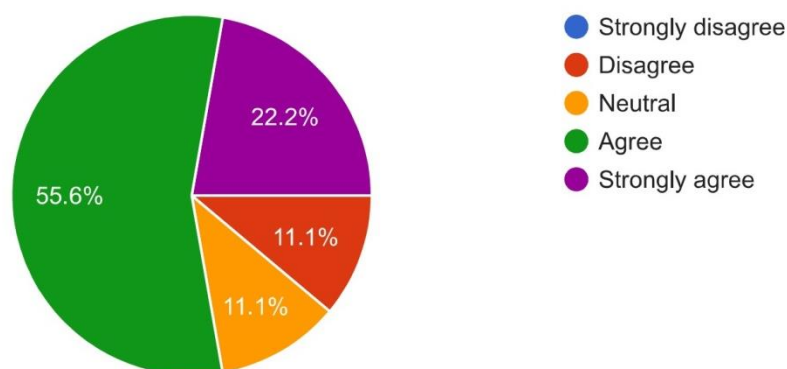


Figure 26 Do you find the B19 component of Developmental milestones 'Standing unsupported milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?

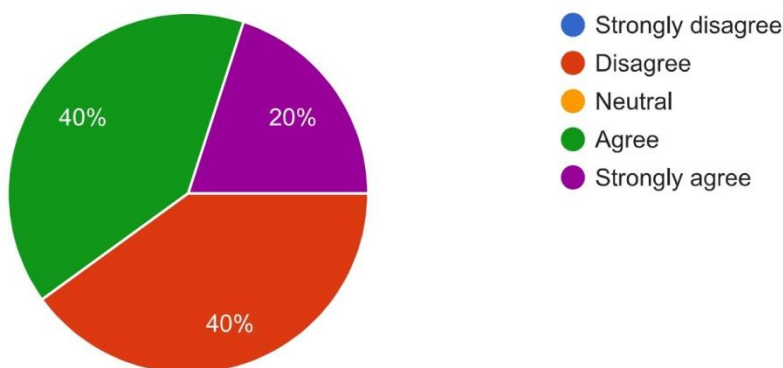


Figure 27 Do you find the B20 component of Developmental milestones 'Standing unsupported milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?

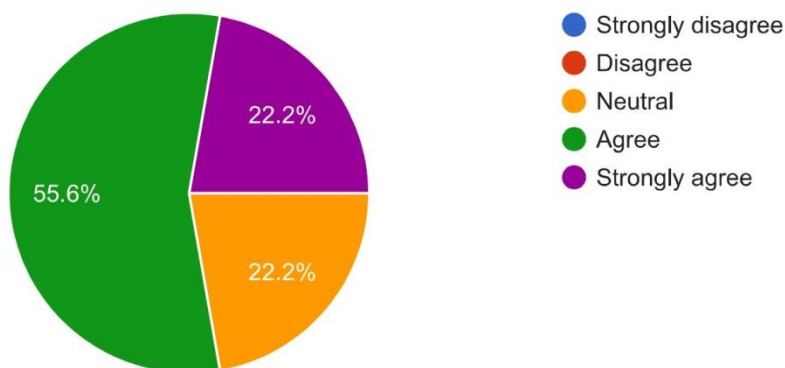


Figure 28 Do you find the C1 component of Infantile reflexes 'Asymmetric tonic neck reflexes' and its scoring system mentioned in SPAIC scale appropriate?

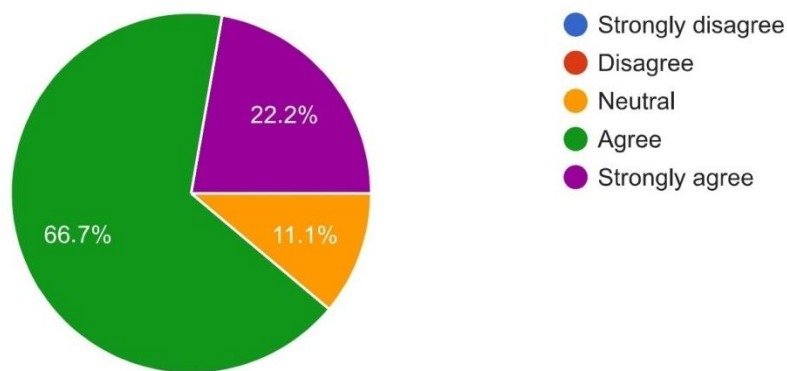


Figure 29 Do you find the C2 component of Infantile reflexes 'symmetric tonic neck reflexes' and its scoring system mentioned in SPAIC scale appropriate?

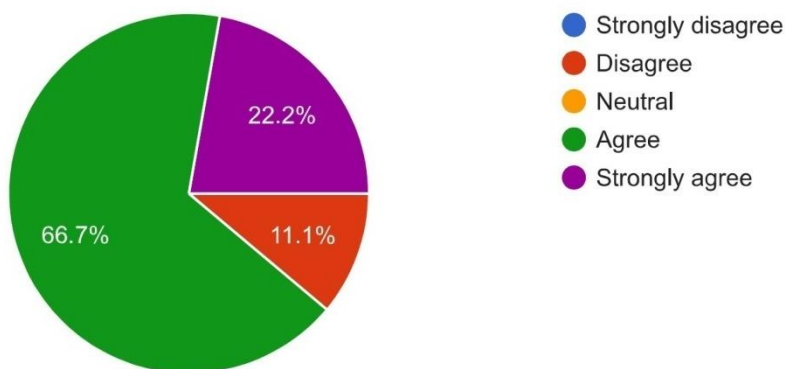


Figure 30 Do you find the C3 component of Infantile reflexes 'Stepping reflex' and its scoring system mentioned in SPAIC scale appropriate?

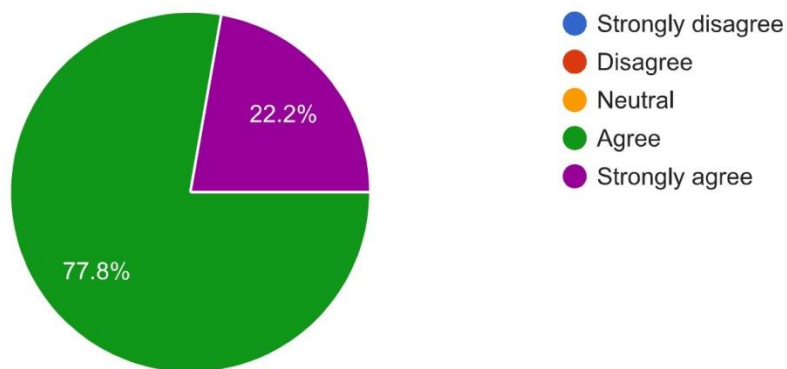


Figure 31 Do you find the C4 component of Infantile reflexes 'Moro reflex' and its scoring system mentioned in SPAIC scale appropriate?

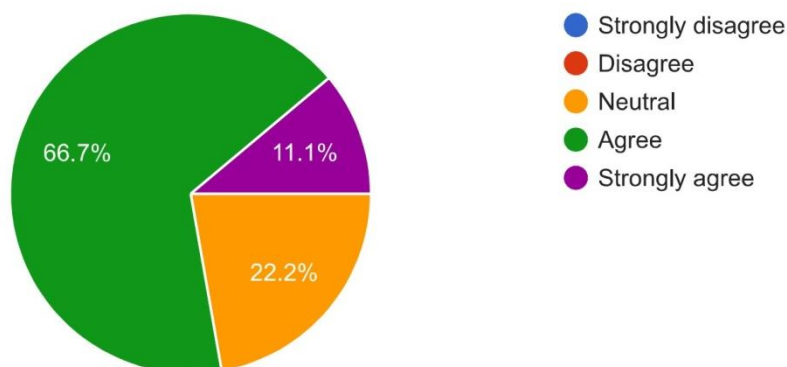


Figure 32 Do you find the C5 component of Infantile reflexes 'Tonic labyrinthine reflexes' and its scoring system mentioned in SPAIC scale appropriate?

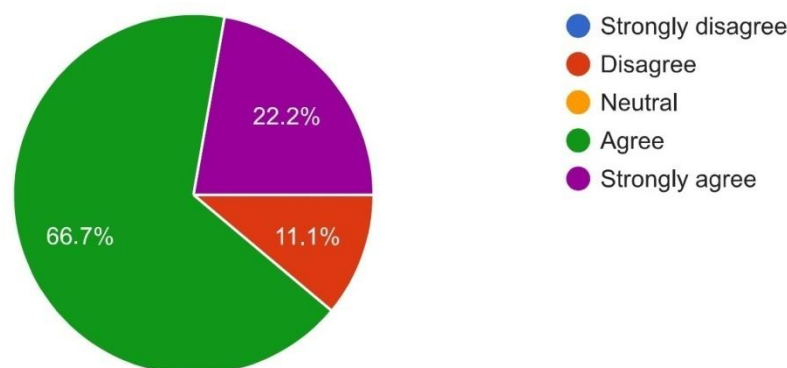


Figure 33 Do you find the C6 component of Infantile reflexes 'Postural reactions in sitting 90-90°' and its scoring system mentioned in SPAIC scale appropriate?

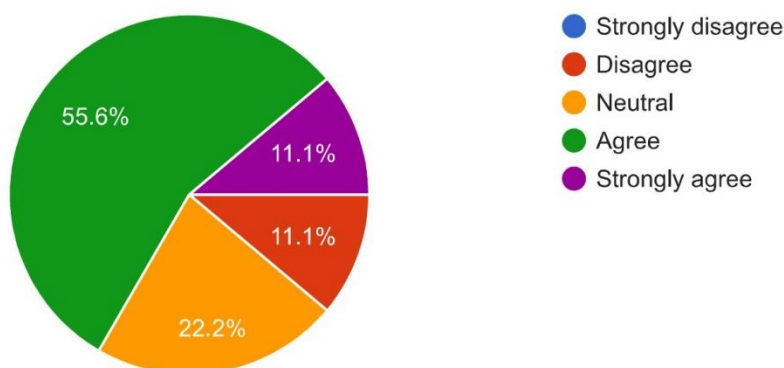


Figure 34 Do you find the D1-Patient specific component of Indirect factors 'Hearing' and its scoring system mentioned in SPAIC scale appropriate?

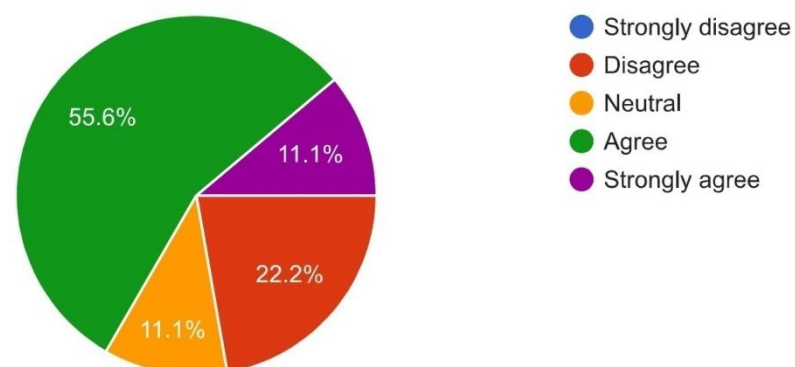


Figure 35 Do you find the D3 Patient specific component of Indirect factors- ‘Musculoskeletal impairments’ and its scoring system mentioned in SPAIC scale appropriate?

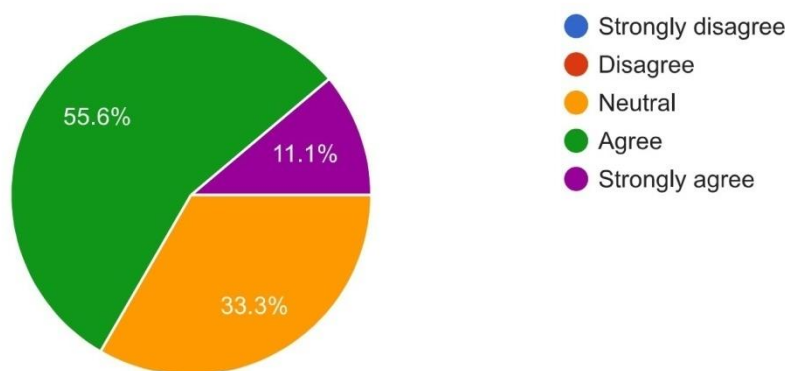


Figure 36 Do you find the D4 Patient specific component of Indirect factors – ‘Surgical Interventions’ and its scoring system mentioned in SPAIC scale appropriate?

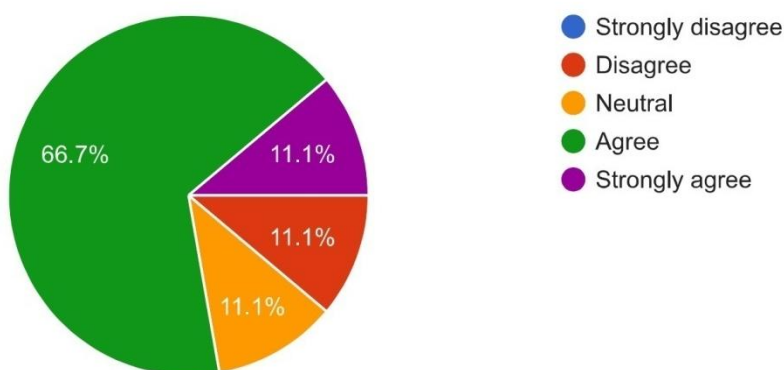


Figure 37 Do you find the E1 component of Environment specific Indirect factors – ‘Walking aids’ and its scoring system mentioned in SPAIC scale appropriate?

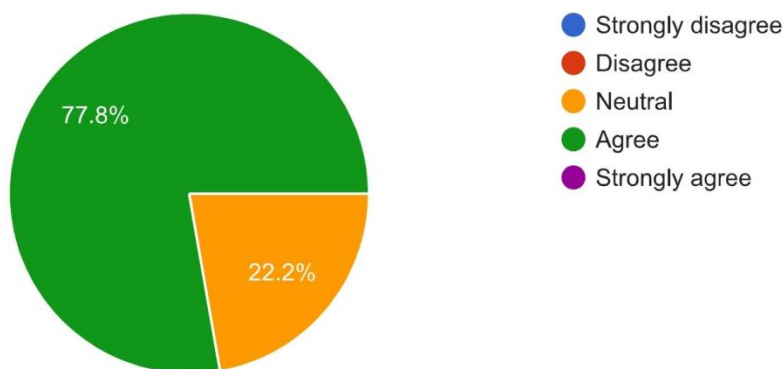


Figure 38 Do you find the E2 component of Environment specific Indirect factors ‘Orthosis prescription’ and its scoring system mentioned in SPAIC scale appropriate?

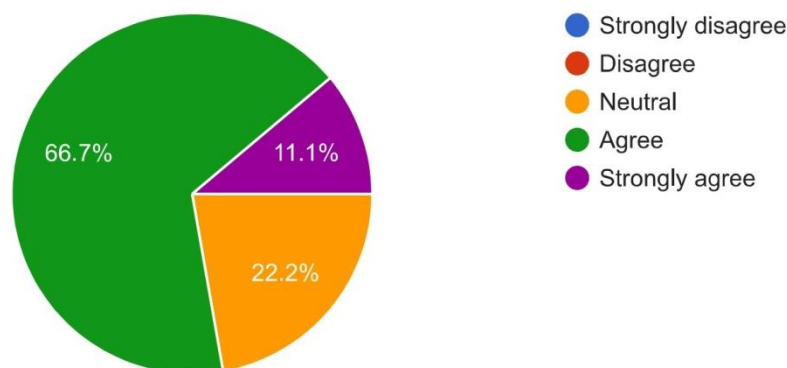


Figure 39 Do you find the E3 component of Environment specific Indirect factors 'Socioeconomic status of family' and its scoring system mentioned in SPAIC scale appropriate?

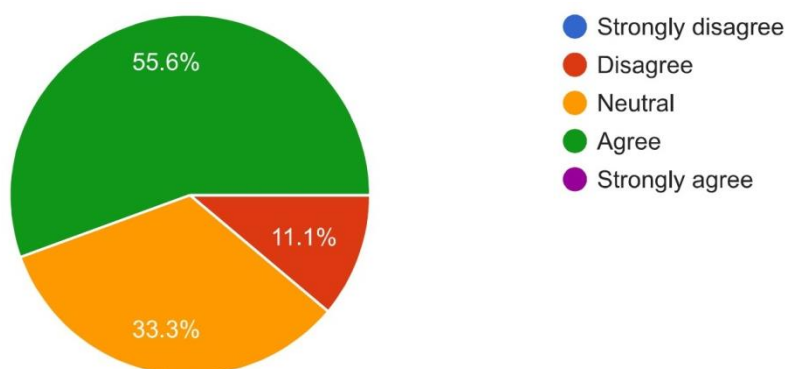


Figure 40 Do you find the E4 component of Environment specific Indirect factors 'Adherence to physiotherapy intervention' and its scoring system mentioned in SPAIC scale appropriate?

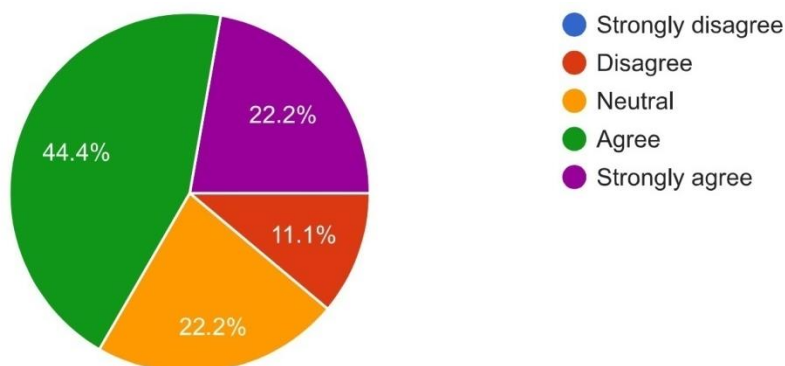


Figure 41 Do you find the E5 component of Environment specific Indirect factors 'Parent's educational qualification' and its scoring system mentioned in SPAIC scale appropriate?

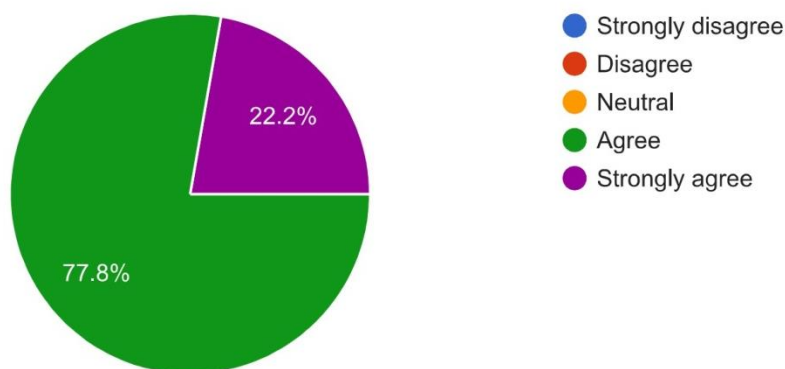


Figure 42 Do you find the E6 component of Environment specific Indirect factors 'Environmental support' and its scoring system mentioned in SPAIC scale appropriate?

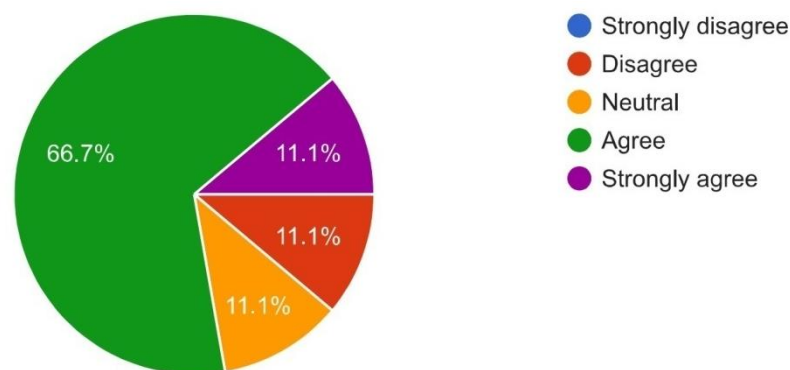


Figure 43 Do you find the overall final scoring system mentioned in SPAIC scale appropriate and feasible?

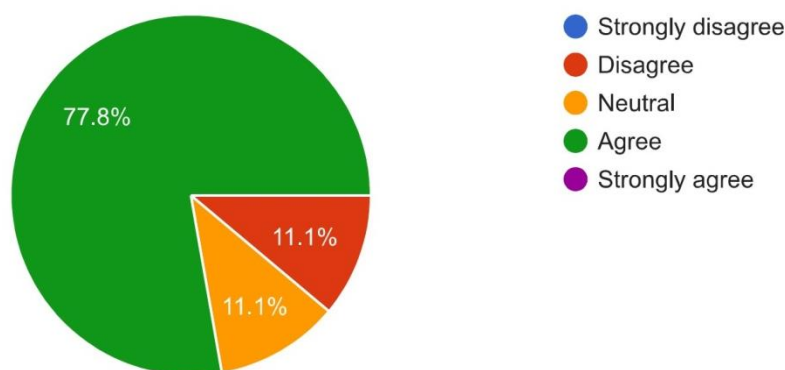


Figure 44 Do you find the classification of prediction of ambulation based on the final score of SPAIC scale appropriate and feasible?

All items showed moderate to strong correlation values exceeding the standard of 0.30 for validation. This analysis confirmed the content validity and reliability of the SPAIC scale and suggested that it can be used for further data collection as in (Table 1). However, longitudinal studies are needed to investigate the causal relationship between the scale's items and actual ambulation achieved by the child. Test-retest reliability and concurrent validity of the scale should also be assessed for further validation.

Table 1 Cronbach's Alpha for Overall Questionnaire

Q. No.	Cronbach's Alpha for Overall Questionnaire = 0.958	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	Do you think that the division of SPAIC Scale for prediction of ambulation in Indian Children with Cerebral Palsy in Direct and Indirect factors is appropriate?	0.326	0.958
Q2	Do you find 80 % weightage given to direct factors and 20 % weightage given to indirect factors in beta version of SPAIC Scale appropriate?	0.675	0.956
Q3	Do you find the A1 disease specific component of 'Type of cerebral palsy' and its scoring system mentioned in SPAIC scale appropriate?	0.687	0.956
Q4	Do you find the A2 disease specific component of 'Tone' and its scoring system mentioned in SPAIC scale appropriate?	0.539	0.957
Q5	Do you find the A3 disease specific component of 'Involuntary movements' in cerebral palsy and its scoring system mentioned in SPAIC scale appropriate?	0.718	0.956
Q6	Do you find the A4 disease specific component of 'Vision of child with cerebral palsy' and its scoring system mentioned in SPAIC scale appropriate?	0.641	0.957
Q7	Do you find the A5 disease specific component of Seizure control of cerebral palsy and its scoring system mentioned in SPAIC scale appropriate?	0.495	0.957
Q8	Do you find the B1 component of developmental milestone of neck holding of cerebral palsy (achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.738	0.956
Q9	Do you find the B2 component of developmental milestone of neck holding (not achieved) of cerebral palsy and its scoring system mentioned in SPAIC scale appropriate?	0.421	0.958
Q10	Do you find the B3 component of developmental milestone of 'Prone lifts head and weight bearing on forearm' (achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.488	0.957
Q11	Do you find the B4 component of developmental milestone of 'Prone lifts head and weight bearing on forearm' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.550	0.957
Q12	Do you find the B5 component of Developmental milestones 'Creeping milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.633	0.957
Q13	Do you find the B6 component of Developmental milestones 'Creeping milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.523	0.960
Q14	Do you find the B7 component of Developmental milestones 'Rolling milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.725	0.956
Q15	Do you find the B8 component of Developmental milestones 'Rolling milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.360	0.958
Q16	Do you find the B9 component of Developmental milestones 'Sitting with arm support milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.725	0.956

Q17	Do you find the B10 component of Developmental milestones 'Sitting with arm support milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.360	0.958
Q18	Do you find the B11 component of Developmental milestones 'sitting unsupported milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.725	0.956
Q19	Do you find the B12 component of Developmental milestones 'sitting unsupported milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.360	0.958
Q20	Do you find the B13 component of Developmental milestones 'Crawling milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.725	0.956
Q21	Do you find the B14 component of Developmental milestones 'Crawling milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.360	0.958
Q22	Do you find the B15 component of Developmental milestones 'Pull to stand milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.725	0.956
Q23	Do you find the B16 component of Developmental milestones 'Pull to stand milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.421	0.958
Q24	Do you find the B17 component of Developmental milestones 'Standing supported milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.879	0.955
Q25	Do you find the B18 component of Developmental milestones 'Standing supported milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.589	0.957
Q26	Do you find the B19 component of Developmental milestones 'Standing unsupported milestone' (achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.861	0.955
Q27	Do you find the B20 component of Developmental milestones 'Standing unsupported milestone' (not achieved) and its scoring system mentioned in SPAIC scale appropriate?	0.714	0.956
Q28	Do you find the C1 component of Infantile reflexes 'Asymmetric tonic neck reflexes' and its scoring system mentioned in SPAIC scale appropriate?	0.558	0.957
Q29	Do you find the C2 component of Infantile reflexes 'symmetric tonic neck reflexes' and its scoring system mentioned in SPAIC scale appropriate?	0.747	0.956
Q30	Do you find the C3 component of Infantile reflexes 'Stepping reflex' and its scoring system mentioned in SPAIC scale appropriate?	0.718	0.956
Q31	Do you find the C4 component of Infantile reflexes 'Moro reflex' and its scoring system mentioned in SPAIC scale appropriate?	0.607	0.957
Q32	Do you find the C5 component of Infantile reflexes 'Tonic labyrinthine reflexes' and its scoring system mentioned in SPAIC scale appropriate?	0.634	0.957
Q33	Do you find the C6 component of Infantile reflexes 'Postural reactions in sitting 90-90' and its scoring system mentioned in SPAIC scale appropriate?	0.718	0.956

Q34	Do you find the D1 - Patient specific component of Indirect factors 'Hearing' and its scoring system mentioned in SPAIC scale appropriate?	0.583	0.957
Q35	Do you find the D3 Patient specific component of Indirect factors - 'Musculoskeletal impairments' and its scoring system mentioned in SPAIC scale appropriate?	0.656	0.957
Q36	Do you find the D4 Patient specific component of Indirect factors - 'Surgical Interventions' and its scoring system mentioned in SPAIC scale appropriate?	0.813	0.956
Q37	Do you find the E1 component of Environment specific Indirect factors - 'Walking aids' and its scoring system mentioned in SPAIC scale appropriate?	0.619	0.957
Q38	Do you find the E2 component of Environment specific Indirect factors 'Orthosis prescription' and its scoring system mentioned in SPAIC scale appropriate?	0.278	0.958
Q39	Do you find the E3 component of Environment specific Indirect factors 'Socioeconomic status of family' and its scoring system mentioned in SPAIC scale appropriate?	0.266	0.958
Q40	Do you find the E4 component of Environment specific Indirect factors 'Adherence to physiotherapy intervention' and its scoring system mentioned in SPAIC scale appropriate?	0.328	0.958
Q41	Do you find the E5 component of Environment specific Indirect factors 'Parent's educational qualification' and its scoring system mentioned in SPAIC scale appropriate?	0.600	0.957
Q42	Do you find the E6 component of Environment specific Indirect factors 'Environmental support' and its scoring system mentioned in SPAIC scale appropriate?	0.607	0.957
Q43	Do you find the overall final scoring system mentioned in SPAIC scale appropriate and feasible?	0.919	0.955
Q44	Do you find the classification of prediction of ambulation based on the final score of SPAIC scale appropriate and feasible?	0.743	0.956

SPAIC = Scale for prediction of ambulation in Indian Children with Cerebral Palsy

4. DISCUSSION

In this study, a new instrument was developed to predict ambulation in Indian children with CP. All 41 items in SPAIC scale were reliable and the factors identified were consistent with the items reported to predict ambulation in these children. SPAIC scale has 41 items and Delphi round II has 44 items out of which 41 questions were based on items included in SPAIC Scale and 3 questions were on factors other than SPAIC scale items. Several direct and indirect factors were found to be responsible for the prediction of ambulation. Direct factors are disease-specific and include gross motor performance, vision, infantile reflexes and postural responses, which directly affect the prediction of ambulation (World Health Organization, 2007; Beckung et al., 2008; Wely et al., 2012).

Indirect factors do not directly affect ambulation but can significantly influence its prediction. Indirect factors can be considered patient-specific or environment-specific. Patient-specific factors include impairments in cognition, the Musculoskeletal system, hearing and surgical procedures. In contrast, environment-specific factors include the availability of walking aids, orthotics, socioeconomic status, adherence to physiotherapy treatment, parental educational qualifications and environmental support in urban, rural and home modification.

Although there are research articles on the correlation between ambulation and factors that influence it, no instrument has considered all these factors for an objective prediction of ambulation. This scale considers all these factors to make it a comprehensive instrument for predicting ambulation. A qualitative and quantitative analysis was conducted to develop the SPAIC scale. An open-ended Delphi round 1 with experts confirmed the need for an objective instrument to predict walking ability in

children with CP. Seizure control and postural responses were the factors suggested by the experts for inclusion. All experts suggested weighting the direct and indirect factors separately to avoid the floor and ceiling effects of the scale.

The experts suggested that the direct factors in the evaluation system should be weighted at 80% and the indirect factors at about 20%. This weighting system was suggested to avoid deviation from the scale's floor and ceiling effects. Delphi Round 2 was a closed-response questionnaire and experts' opinions were sought on 41 items where achieved and unachieved milestones were assessed separately. One expert questioned the need for separate assessments of achieved and unachieved milestones, which was explained with an example. The expert agreed with 5 out of 7 explanations and reported their reproduction (Boateng et al., 2018).

The positive results related to the development and validation of the SPAIC scale can be justified by the selection of items included in the scale. All scale items were based on factors affecting locomotion in children with CP. All items, such as gross motor performance, infantile reflexes, postural responses, patient-specific factors, disease-specific factors and environment-specific factors and their scoring criteria were determined based on the extensive literature on these individual factors. Therefore, the scale was discussed and validated appropriately based on expert opinions in Delphi rounds and focused discussions. Based on the statistical analysis, the scale was found to be optimal for further data collection, as it demonstrated the required content validity and reliability according to the standard statistical procedure.

5. CONCLUSION

The SPAIC scale, comprising 41 items, is a valuable tool for predicting ambulation in Indian children with CP. Notably, this is the first objective instrument available for this purpose. It considers 31 direct and 10 indirect factors that affect ambulation and provides a reliable and objective scoring system that parents can use to assess their child's future ambulation. Furthermore, this scale can serve as an outcome measure for assessments and research. The percentage scores obtained from the objective assessment can be explained to parents simply by rehabilitation professionals. The scale has undergone standard statistical procedures to confirm content validity and reliability and it can be used for future data collection.

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Author's contribution

Pallavi Palaskar conceptualized and prepared the original draft. Sanjeev Attray, Rinkle Malani, Anjali Kale and Namrata Sant reviewed the data along with the draft. The final manuscript was reviewed and approved by both the authors.

Ethical approval

The study was approved by the Institutional Ethics Committee of National Institute of Medical Sciences and Research Centre, NIMS University, Rajasthan, Jaipur, India. Ethical Approval Code: NIMSUR/IEC/2022/249

Informed consent

Written and Oral informed consent was obtained from all individual participants included in the study.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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