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**SI Table 1: Study components defined** using the PICOT framework

|  |  |
| --- | --- |
| PICOT | Definition |
| Population: | school-age children, aged 4-15years, with a clinical diagnosis of neurodisability and ongoing clinical or participant/caregiver-reported respiratory symptoms. |
| Intervention | 6-week school-based rebound therapy, provided twice weekly in addition to usual care. |
| Comparison | Usual care, inclusive of any activity considered part of their educational curriculum, postural management plan, respiratory care, as detailed within their educational healthcare plan. |
| Outcomes | Subjective and objective chest health measures. Secondary measures will include motor ability, quality of life, adherence and adverse events. |
| Time | T0: Baseline, T6: Pre-intervention, T12: Post-intervention, T18: follow up. |

**SI Table 2a: Absolute contraindications of Rebound Therapy Intervention,** resulting in exclusion of eligibility for study

|  |
| --- |
| Absolute contraindications |
| * Cranio-vertebral Instability (including Atlanto-Axial Instability & Atlanto-Occipital Instability) |
| * Detatching retina (s) or repaired retina (s) |
| * Pregnancy |
| * Brittle bones |
| * Dwarfism |
| * Spinal rodding |

In line with the Chartered Society of Physiotherapy. Quality Assurance Standards for Physiotherapy Service Delivery (2013) and supporting course material from Reboundtherapy.org.

**SI Table 2b: Care Factors of Rebound Therapy Intervention,** resulting in an initial and subsequent weekly risk assessment of intervention whilst enrolled in the study, in line with standard care of rebound therapy.

|  |  |
| --- | --- |
| Care Factors for Rebound therapy Intervention | |
| * Respiratory problems | * Cardiac or circulatory problems |
| * Vertigo, blackouts or nausea | * Spinal cord or neck problems |
| * Epilepsy | * Spinal rodding/spinal fusion |
| * Downs syndrome | * Open wounds |
| * Any recent medical attention | * Complex challenging behaviour |
| * osteoporosis | * Gastrostomy/colostomy |
| * Sensitive or fragile skin | * Gastric reflux |
| * Unstable/hypermobile/painful joints | * Stress incontinence |
| * Hernias | * Joint replacement |
| * Implant surgery (e.g. baclofen pumps) | * Sensory impairment |
| * Prolapse | * Mental health needs |

In line with the Chartered Society of Physiotherapy. Quality Assurance Standards for Physiotherapy Service Delivery (2013) and supporting course material from Reboundtherapy.org.

**SI Table 3: TIDieR Checklist for Rebound Therapy Intervention**

**The TIDieR (Template for Intervention Description and Replication) Checklist\*:**

Information to include when describing an intervention and the location of the information

|  |  |  |  |
| --- | --- | --- | --- |
| **Item number** | **Item** | **Where located \*\*** | |
|  | Primary paper  (page number) | Other † (details) |
| **1.** | **NAME:** Rebound Therapy | 3 | https://reboundtherapy.org/ |
| **2.** | **WHY:** Rebound therapy is a highly accessible form of physical activity, which uses a trampoline to promote individualised therapeutic exercise, positioning, movement, and recreational participation. This intervention supports participation in physical activity for children with complex neurodisability, with the intention to promote chest health, motor ability and quality of life. | 3 | https://reboundtherapy.org/ |
| **3.** | **WHAT** Materials: Trampoline facilities were accessed at each special school research site. Hoist facilities were made available to support safe patient transfer for children equivalent to Gross Motor Function Classification Scale Level V. Use of therapy equipment such as rolls, pillows and gym balls were used to facilitate sitting, supine, four-point and two-point kneeling. | 6 | NA |
| **4.** | **WHAT** Procedure: Rebound therapy was delivered over phase B, for 6 weeks, by a trained physiotherapist (RKL). Risk assessment was completed before, during and after treatments, with additional weekly safety monitoring during the 18-week study period. | 6 | NA |
| **5.** | **WHO PROVIDED:** A trained physiotherapist, trained in Rebound therapy and >10years experience working with children with neurological and respiratory health care problems. An additional therapy or learning assistant familiar with the participant, was present to deliver usual care plans e.g., epilepsy plan, and support communication needs of the participant. | 6 | NA |
| **6.** | **HOW:** Individually, face-to-face | 6 | NA |
| **7.** | **WHERE:** In special school | 6 | NA |
| **8.** | **WHEN and HOW MUCH:** Rebound therapy intervention commenced at week six of the study (Phase B). Sessions were implemented twice weekly for a duration of six consecutive weeks, totaling a maximum of twelve sessions. These were delivered on fixed days and times based on classroom schedule and timetabling of facilities. Each session lasted approximately 20-30 minutes, in line with UK government physical activity guidance. Frequency and duration of intervention was consistent over 6 weeks. | 6 | NA |
| **9.** | **TAILORING:** A range of exercises were selected to increase mobility of the chest wall, spine, and upper limbs, strengthen posture in sitting, rolling and 4-point kneeling, and where possible, increase aerobic activity. Programmes were flexible, individualised, and adapted in response to the participant’s ability and safety parameters, reflecting current practice. | 6 | NA |
| **10.ǂ** | **MODIFICATIONS:** Beyond tailoring of programmes, no modifications were made. | 6,8 | NA |
| **11.** | **HOW WELL** Planned: To ensure intervention was delivered safely within the scope of recognised standard practice, absolute contraindications of rebound therapy informed participant non-eligibility prior to study enrolment. A trained physiotherapist performed a pre-intervention risk assessment of Rebound Therapy care factors, in line with Chartered Society of Physiotherapy Quality Assurance Standards for Physiotherapy Service Delivery (2013) and published material from Reboundtherapy.org. Any recorded ‘precautions’ were subject to risk assessment with relevant healthcare professionals at week 0 and 6, prior to intervention commencement. Any notable changes in chest health symptoms and other co-morbidities such as seizure activity or pain were documented before, during and after each session. Weekly telephone contact sought to identify new or worsening symptoms as part of the safety monitoring protocol and prompted further intervention risk assessment where necessary. Ongoing intervention assent and adequate rest was evaluated by the treating therapist and supporting carer, communicated by participants using Makaton or verbalising ‘more bouncing,’ facial expressions (smiling, laughing, nodding, shaking) and actively moving on/off the trampoline bed where able. Fidelity was reviewed through observation, discussion, and joint sessions with a rebound trainer from the school research site and through sharing of individualised rebound therapy programmes with the named therapist. | 8,9  Supplementary Information Table 2a, b. | Reboundtherapy.org  [Quality Assurance Standards for physiotherapy service delivery | The Chartered Society of Physiotherapy (csp.org.uk)](https://www.csp.org.uk/publications/quality-assurance-standards-physiotherapy-service-delivery) |
| **12.ǂ** | **HOW WELL** Actual: Intervention attendance ranged from 8-12 sessions; four of five cases met the criteria of 75% intervention adherence; one case achieved 100% attendance. Reasons for non-attendance were considered unrelated to the study e.g., the child contracting COVID-19, tonsillitis, chicken pox, diarrhoea, and vomiting. Other reasons included pre-planned consultant appointments and seizure activity on pre-intervention risk assessment. | 11 | NA |

\*\* **Authors** - use N/A if an item is not applicable for the intervention being described. **Reviewers** – use ‘?’ if information about the element is not reported/not sufficiently reported.

† If the information is not provided in the primary paper, give details of where this information is available. This may include locations such as a published protocol or other published papers (provide citation details) or a website (provide the URL).

ǂ If completing the TIDieR checklist for a protocol, these items are not relevant to the protocol and cannot be described until the study is complete.

\* We strongly recommend using this checklist in conjunction with the TIDieR guide (see *BMJ* 2014;348:g1687) which contains an explanation and elaboration for each item.

\* The focus of TIDieR is on reporting details of the intervention elements (and where relevant, comparison elements) of a study. Other elements and methodological features of studies are covered by other reporting statements and checklists and have not been duplicated as part of the TIDieR checklist. When a **randomised trial** is being reported, the TIDieR checklist should be used in conjunction with the CONSORT statement (see [www.consort-statement.org](http://www.consort-statement.org)) as an extension of **Item 5 of the CONSORT 2010 Statement.** When a **clinical trial** **protocol** is being reported, the TIDieR checklist should be used in conjunction with the SPIRIT statement as an extension of **Item 11 of the SPIRIT 2013 Statement** (see [www.spirit-statement.org](http://www.spirit-statement.org)). For alternate study designs, TIDieR can be used in conjunction with the appropriate checklist for that study design (see [www.equator-network.org](http://www.equator-network.org)).

**SI Table 4: Summary of measures and timepoints**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Measure Name | Measure variable | Procedure | Setting | Time | Endpoint |
| To examine the impact of a 6-week customised rebound therapy programme on caregiver-reported chest health outcomes in CYP with neurodisability | | | | | |
| Liverpool Symptom Respiratory Questionnaire  (LSRQ-Neuro) | Proxy-reported chest health symptoms in the last month | Issued to participants/caregivers 1 week prior to planned assessment point via post, at week 0, 6, 12 and 18. Answers were reviewed with the researcher during each appointment. | At home or during the planned assessment point | 10 minutes to complete | Week 0, 6, 12, 18 |
| Chest health observations | Proxy-reported chest health observations in predetermined period of time | Participants/caregivers were trained to observe and report their child’s respiratory rate/min, cough frequency/min and time spent completing respiratory care. Oxygen saturation was considered if a pulse oximetry formed part of a participant’s usual care. | At home, via encrypted Text or telephone | 1 minute of observations | Weekly from week 0-18 |
| To examine the impact of a 6-week customised rebound therapy programme on caregiver-reported quality of life in CYP with neurodisability | | | | | |
| Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD) | Caregiver reported Quality of life (37 item questionnaire) | Issued to participants/caregivers 1 week prior to planned assessment point via post, at week 0, 6, 12 and 18. Answers were reviewed with the researcher during each appointment. | At home or during the planned assessment point | 10 minutes to complete | Week 0, 6, 12, 18 |
| Qualitative semi-structured exit Interview (Optional) | Caregiver and/or participant reported quality of life Indicators | Participants/caregivers were invited to a semi-structured interview at the end of study, to share their experiences and views of quality of life during this study. The topic guide was based on findings from Morris et al. (2014) | At home or during the planned assessment point | Estimated 30-45 minutes | Week 18 |
| To examine the impact of a 6-week customised rebound therapy programme on observed motor ability in CYP with neurodisability | | | | | |
| Chailey Levels of Ability | Clinician-observed motor ability and posture in lying and sitting | An observation assessment of the Chailey Levels of Ability was carried out by a trained physiotherapist in line with local infection control and manual handling guidelines.. Each participant was observed in supine, prone and sitting, with or without support. Fidelity was assessed by a second researcher (RR). | In the school therapy room or in clinic | Estimated 45 minutes | Week 0, 6, 12, 18 |
| To monitor adherence to 6-week rebound programme, with recorded reasons for non-adherence | | | | | |
| Intervention adherence | Adherence to 12 rebound therapy sessions | Treating therapist recorded number (%) of rebound sessions attended and reason for non-attendance established via discussion with participant/caregiver during weekly telephone contact | In school | 1 minute | Week 6-12 |
| To monitor (Serious) adverse events across all phases of the study | | | | | |
| Change in general health | Proxy-reported general health | Participant/caregivers were asked to report any changes in general health that may be related / unrelated to the study variables. | At home, via encrypted Text or telephone | 1 minute | Weekly from week 0-18 |
| New symptoms | Proxy-reported new symptoms | Participant/caregivers were asked to report any “new symptoms” that may be related / unrelated to the study and any actions taken in response. | At home, via encrypted Text or telephone | 1 minute | Weekly from week 0-18 |
| Worsening symptoms | Proxy-reported worsening symptoms | Participant/caregivers were asked to report any “worsening symptoms” that may be related / unrelated to the study and any actions taken in response. | At home, via encrypted Text or telephone | 1 minute | Weekly from week 0-18 |
| To monitor changes in usual care across all phases of the study | | | | | |
| Change in postural management care | Proxy-reported Postural care plan | Participant/caregivers were asked to report any changes in ‘usual’ postural management care plan that may be related / unrelated to the study variables. | At home, via encrypted Text or telephone | 1 minute | Weekly from week 0-18 |
| Change in chest health management care | proxy-reported change in chest health care plan | Participant/caregivers were asked to report any pharmaceutical and/or non-pharmaceutical changes in the chest health care that may be related / unrelated to the study variables. | At home, via encrypted Text or telephone | 1 minute | Weekly from week 0-18 |
| To explore parent/caregiver perceptions of the study design components, outcome measures and contact methods | | | | | |
| Qualitative semi-structured exit Interview (Optional) | Caregiver and/or participant reported study feasibility | Participant/caregivers were invited to take part in an optional semi-structured exit interview, obtaining feedback on design components, outcome measures and contact methods of the study | At home or during the planned assessment point | Estimated 30-45 minutes | Week 18 |

**SI Table 5: thresholds for data analysis**

|  |  |  |
| --- | --- | --- |
| Analysis method | Threshold | Implication |
| Extended celeration line (ECL) | a chance-level score was considered 50%, or three out of six intervention data points above / below the trend line | **Linear trend of data** |
| percentage of overlapping data (PND) | a threshold of >70% suggested intervention was effective | **Robust treatment effect** |
| Two Standard Deviation Band Method (2SD) | at least two consecutive data points fall outside the 2SD range within the intervention phase. | **Clinically significant change** |

**SI Table 6: Illustrative quotes from qualitative exit interview with parent/carer and/or child**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Theme: child and family perceived impact | | | | | | |  | | | |
| Sub theme 1: chest health | | | | | | | |  | | |
| Her cough appears easier and better, it’s stronger, lounder and clears secretions in her throat quicker | | | Nora’s Parent | | | | |
| This coincided with her return to school; she is tired on Fridays and exposed to lots of coughs and colds following shielding, so much more bugs than usual. However, [Isla] has coped with them better than expected. | | | Isla’s parent | | | | |
| Her chest is generally very good | | | Evie’s Parent | | | | |
| I was anxious about stopping antibiotics but surprised that she has had no infections; normally she would have 7 infections over 6 months this time last year | | | Sarah’s Parent | | | | |
| His chest has been the most stable it’s been for a long time, and he recovered very well from COVID. I’ve not had to use his inhaler at all. | | | Ryan’ Parent | | | | |
| Sub theme 2: postural ability | | | | | | | | |  |
| She is easier to dress as she is less stiff in her arms, although I do appreciate it is summer clothing and much easier in the summer. | | | Nora’s parent | | | | |
| Her arms seem much more relaxed…making it easier to dress her | | | Isla’s parent | | | | |
| She is more fidgety, no longer happy sitting on the sofa and wants to move and explore more | | | Evie’s Parent | | | | |
| I have noticed since finishing rebound, [Sarah] is able to climb more confidently and pull to stand against the sofa, with wide legs. Movement has been the biggest change for us | | | Sarah’s Parent | | | | |
| Sleep is slightly more problematic as he can now shuffle in and out of bed by himself | | | Ryan’s Parent | | | | |
| Sub theme 3: quality of life | | | | | | | | |  |
| 3a. Sleep | | Sleep has much improved; there is less waking during the night and she only needs turning on occasion | Nora’s parent | | | | |
| 3b. Digestion | | I noticed less burping at night and that wind can usually make her more uncomfortable | Nora’s parent | | | | |
|  | | Pain and constipation is the same and remains unpredictable | Isla’s parent | | | | |
| 3c. Communication | | Her voice is louder and sharper | Nora’s parent | | | | |
|  | | She is increasingly chatty and responsive since starting rebound again | Isla’s parent | | | | |
|  | | She talks more, and is more vocal and chatty | Evie’s Parent | | | | |
| 3d. Mood/Happiness | | She is much more happier in herself in general, more noted over last 6 months but particularly these 6 weeks as well, she is more affectionate, particularly with daddy | Evie’s Parent | | | | |
|  | | More sociable when people are talking to him | Ryan’s Parent | | | | |
| 3e. Carer burden | | It has made me realise how well her chest can be and how much it has improved over the past 6 months; most improved is her physical activity and in turn the amount of care I have to give her has reduced | Sarah’s Parent | | | | |
|  | | Her arms seem much more relaxed with better movement, making it easier to dress her (Isla) | Isla’s parent | | | | |
|  | | Easier to put his t-shirt on as his arms are more active in helping with the task (Ryan) | Ryan’s Parent | | | | |
| Theme: Study Feasibility and Acceptance | | | | | |  | | | | |
| Sub theme 1: Overall study acceptance | | | | | | |  | | |
| We loved being part of the study | | | | Sarah’s Parent | | | | |
| No negatives, all positive | | | | Nora’s Parent | | | | |
| It was a very positive experience. It would have been lovely to see him on the trampoline but also nice to keep him in school as part of his day | | | | Ryan’s parent | | | | |
| Sub theme 2: Study learning and leadership | | | | | | |  | | |
| monitoring has been really valuable, and it has been a good experience to lead the readings for breathing rate and I will continue to do this in the future to monitor her breaths | | | | Nora’s Parent | | | | |
| …What with COVID and return to school; the trial helped me to assess how stable she was and what 'normal' looked like for her. She really enjoyed all the extra rebound on all accounts, which was amazing and helped me learn about monitoring her observations. | | | | Isla’s Parent | | | | |
| It was good to monitor breathing for my own learning (Evie) | | | | Evie’s Parent | | | | |
| The weekly monitoring helped me think about her chest and increased awareness of how much her chest has improved, particularly monitoring her breathing rate and pattern. I feel more confident to know her baseline and understand when her breathing rate worsens | | | | Sarah’s Parent | | | | |
| Nice for me as a parent to take the lead and learn something new | | | | Sarah’s Parent | | | | |
| Me and his dad sat down together to do the questionnaires, which we really enjoyed and I learnt to count his chest breaths, which I enjoyed learning a new skill | | | | Ryan’s parent | | | | |
| Sub theme 3: Study burden | | | | | | |  | | |
| 3a. Study contact | | It was easiest when texting results; face to face and phone calls were good for communicating any changes such as the starting of baclofen | Nora’s Parent | | | | |
|  | | Text and telephone was not time consuming but easy to forget to respond to text towards the last 6 weeks of the trial | Isla’s parent | | | | |
|  | | It was useful to have phone call contact, especially when events such as seizures had occurred, which were difficult to communicate over text | Evie’s Parent | | | | |
|  | | text was very convenient; face to face every week would have been too hard | Sarah’s Parent | | | | |
| 3b. study environment | | clinical appointments felt very natural in her own school environment, [JPU] would have been ok but school is much more familiar and less clinical; she also has had a bad experience in [JPU] | Sarah’s Parent | | | | |
|  | | School environment was very familiar and comfortable for both me and Ryan; It was good to see familiar faces such as the teacher; JPU would have been difficult to travel to without a car | Ryan’s parent | | | | |
| 3c. study travel | | Travel burden was fine and very convenient for clinic appointments at school, especially being flexible around pick up and drop off | Evie’s Parent | | | | |
|  | | There were no problems with travel to school as [its] very close by and I can walk; | Nora’s Parent | | | | |
| Sub theme 4: Questionnaire response | | | | | | |  | | |
| The time between questionnaires was also too long for me to remember what I last put. | | | Isla’s parent | | | | |
| Once the first one was completed, the next ones became easier to complete. Only took 5minutes | | | Evie’s parent | | | | |
| We completed in about 10 minutes, I did it together with Ryans dad, the questions felt appropriate and easy to understand | | | Ryan’s parent | | | | |
| Some of the questions about understanding was not appropriate when child is non verbal | | | Evie’s parent | | | | |
| Not all questions were relevant for example, personal care questions can make you realise what she can’t do; same for communication; can make you feel a bit rubbish, especially when having to repeatedly do it and the reality on paper can hit you | | | Sarah’s parent | | | | |
| The questions in the CP child were very subjective; it was difficult to attach meaning to ‘mild’ and ‘moderate’ | | | Isla’s parent | | | | |