

Table 5: Summary of studies reporting Body Structure and Function outcomes

Study	Outcome of interest	Method of measurement	Statistics utilized	Results
Level II				
Jones et al. 2012[43]	Developmental change	BDI PEDI caregiver scale	Wilcoxon signed rank test	Statistically significant difference in receptive language scores between subjects and controls ($p < 0.06$). Increased initiation in self-care tasks – needed less caregiver assistance even though self-care abilities did not increase.
Level IV				
Barfield et al. 2005 [48]	Heart rate (HR)	HR recorded every 5 seconds throughout pre-game and game conditions starting 10 minutes before warm-up. Polar S610 HR monitor used.	Kruskal Wallis test	71% of athletes with CP (adults) or MD (children) were able to achieve and maintain a cardio-respiratory fitness training level for 30 minutes. This level of response was not seen in athletes with SCI (adults) although HR increased across all groups. Exercise above or equal to 55% estimated HR_{max} elicits improvements in cardiovascular fitness in low-fit individuals.
Bottos et al. 2001 [17]	Performance IQ Verbal IQ	Leiter PPVT	Student t test	No statistically significant change observed in performance and verbal IQ between the first and second baseline assessments or the third assessment after the children had used the power wheelchair for 6 months.
	Motor level	GMFM	χ^2 test	No statistically significant change in motor level between first and second baseline assessments, or the third assessment. Motor level and IQ were not statistically related to driving performance.
Deitz et al. 2002 [20]	Affect	Video analysis and coding	Descriptive	Percentages of positive affect were highly variable due to a variety of factors e.g. child's face could not be seen at times.
Guerette et al. 2013 [40]	Ability to remain engaged	Survey of Technology Use (STU)	General Linear Model	Children required more support to remain engaged with a single activity following provision of PWC.
Tefft et al. 2011 [25]	Sleep/wake pattern	MATCH survey	General Linear Model Tukey post hoc analysis	Increased parental satisfaction with sleep/wake pattern ($p < 0.01$).

Bayley III = Bayley Infant & Toddler Scales of Development, Third Edition; BDI = Battelle Developmental Inventory; CP = Cerebral Palsy; GMFM = Gross Motor Function Measure; HR = heart rate; HR_{max} = maximum heart rate; IQ = Intelligence Quotient; Leiter = Leiter International Performance Scale; MATCH = Matching Assistive Technology & Child; MD = Muscular Dystrophy; N/A = Not applicable; p = p value; PPVT = Peabody Picture Vocabulary Test; PEDI = Pediatric Evaluation of Disability Inventory; SCI = Spinal Cord Injury; % = percentage; χ^2 = Chi squared test

Study	Outcome of interest	Method of measurement	Statistics utilized	Results
Level V				
Douglas & Ryan 1987 [21]	Perceptual Developmental change – perceptual development, visual memory and confidence	Description	N/A	Perceptual change: ‘learning about his environment ... realizes he cannot drive through solid objects’ ‘he takes notice of objects and events around him ... rather than just dealing with his own needs’ ‘more adventurous and not so afraid of new places’ ‘He has grown in confidence’.
Everard 1984 [50]	Developmental change	Description	N/A	Increased assertiveness and confidence. Developed concept of danger. Instead of staying at one activity for long periods she started to rush around between activities like other toddlers. Increased positive self-image.
Horne & Ham 2003 [42]	Developmental/ Psychological/ Behavioural change	Survey	N/A	Increased confidence, motivation, happiness and decreased frustration.
Jones et al. 2003 [22]	Developmental change	BDI	N/A	Greater than expected increases in communication, personal-social and cognitive domains.
Lynch et al. 2009 [44]	Developmental change	Bayley III	N/A	Receptive language and cognition exceeded chronological age by 2-4 months. Fine motor and expressive language matched chronological age. Was delayed in all areas of development prior to using PWC.
Nisbet et al. 1996 [52]	Developmental change	Parent/caregiver report	N/A	Increased confidence, mood and motivation. Increased vocalization, curiosity and assertiveness.
Nisbet 2002 [45]	Developmental change	Parent/caregiver report	N/A	Increased sleeping, eating, gaining weight, initiation (less passive), locus of control (able to influence others’ behaviour).
Wiat et al. 2003 [47]	Psychological impact	Survey	N/A	Increased confidence and self-esteem.

Bayley III = Bayley Infant & Toddler Scales of Development, Third Edition; BDI = Battelle Developmental Inventory; CP = Cerebral Palsy; GMFM = Gross Motor Function Measure; HR = heart rate; HR_{max} = maximum heart rate; IQ = Intelligence Quotient; Leiter = Leiter International Performance Scale; MATCH = Matching Assistive Technology & Child; MD = Muscular Dystrophy; N/A = Not applicable; p = p value; PPVT = Peabody Picture Vocabulary Test; PEDI = Pediatric Evaluation of Disability Inventory; SCI = Spinal Cord Injury; % = percentage; χ^2 = Chi squared test

Table 6: Summary of studies reporting Activity outcomes

Study	Outcome of interest	Method of measurement	Statistics utilized	Results
Level II				
Jones et al. 2012 [43]	Competent PWC mobility	List of seven driving skills [18][19] PEDI	N/A Wilcoxon signed rank test	Able to use PWC competently within a range of 5–42 weeks. Statistically significant increase in functional mobility skills ($p < 0.02$).
Level III				
Butler et al. 1986 [38]	Self-initiated movement Interaction with toys Interaction with people	Video coding	One tailed dependent t-test	Statistically significant increase ($p < 0.05$) in self-initiated movement. Variable results – some children less able to reach toys from PWC. Variable results – some children became less verbal and demanding but more independent.
Level IV				
Bottos et al. 2001 [17]	PWC mobility	PMP [57]	χ^2 test	21/27 able to use PWC competently including 7/13 with IQ below 55. IQ and motor level were not statistically significant in relation to ability to drive PWC.
	Independence	COPM	Student t test	Statistically significant increase ($p < 0.00001$) in independence in activities of daily living (indoor/outdoor transfers) after introduction of PWC.
Deitz et al. 2002 [20]	Self-initiated mobility	Video coding	N/A	Immediate increase in self-initiated movement during intervention phases with immediate returns to baseline when the PMD was withdrawn.
Guerette et al. 2013 [40]	Impact of early power mobility	Video-coding	N/A	Increase in mobility activities. No increase in interaction with objects. Children did not increase quality of verbal interactions.
Tefft et al. 2011 [25]	Impact of early power mobility	MATCH survey	General Linear Model Tukey post hoc analysis	Statistically significant increase in ability to go where desired ($p < 0.05$).
Level V				
Benedict et al. 1999 [49]	Functional mobility	PEDI	N/A	Functional skills scaled score increased following provision of PWC by 23 points (standard error 4.2).
Butler et al. 1983 [18]	PWC mobility	List of seven driving skills PWC use diary Engine use meter	N/A	8/9 children able to use PWC competently. 7/9 achieved competence in less than 3 weeks.
Butler et al.	PWC mobility	List of seven	N/A	12 children learned to drive competently in an average of 16 days.

ANOVA = analysis of variance; COPM = Canadian Occupational Performance Measure; MATCH = Matching Assistive Technology & Child; MD = Muscular Dystrophy; N/A = not applicable; p = p value; PEDI = Pediatric Evaluation of Disability Inventory; PM = power mobility; PMD = power mobility device; PMP = Power Mobility Program; PWC = power wheelchair; & = and; % = percentage; < = less than; m/day = metres per day; m/sec = metres per second; χ^2 = Chi squared test

Study	Outcome of interest	Method of measurement	Statistics utilized	Results
1984 [19]		driving skills PWC use diary Engine use meter		
Cooper et al. 2008 [37]	Mobility related wheelchair activity – driving time and distance	Data logger	Mann Whitney U test	Children using PWC drove 1752.42 m/day at a speed of 0.75 m/sec. Boys travelled statistically significantly further than girls (p=0.008). No statistically significant differences between manual and PWC users in terms of distance travelled or speed.
Douglas & Ryan 1987 [21]	Driving PWC Expressive language Independence and exploration	Description	N/A	Mastered control of PWC within 5 months of intermittent use. 'talks in more active terms – I'm going, coming, getting, finding...His vocabulary is being extended and consolidated'. 'can take some responsibility, like taking a message to someone, or even carry objects...he has more immediate opportunity to explore his own interests'.
Dunaway et al. 2012 [36]	Driving PWC	Modified PMP [57]	N/A	4 children achieved independence on all items on PMP in an average of 238 days (median 210.5 days, range 73-458 days).
Everard 1984 [50]	Competent PWC mobility	Parent observation	N/A	Able to use PWC competently within 6 weeks.
Galloway et al. 2008 [39]	Infants ability to use a mobile robot for self-initiated mobility	Data from robot	N/A	Path length increased 141%. Joystick activations increased 73%. Time spent driving increased 30%. Child appeared to associate joystick with movement in the robot.
Horne & Ham 2003 [42]	Outcomes of PWC provision	Survey	N/A	Increased independence.
Huhn et al. 2007 [41]	PWC mobility	Observation Counting collisions Driving tasks	N/A	Able to drive through doorway, down 100 foot hallway and through three cones after several years of training. Mid-wheel drive chair may be more intuitive for head array users or users with cognitive limitations.
Jones et al. 2003 [22]	Competent PWC mobility	PEDI List of seven driving skills[18][19]	N/A	Positive trend in self-care, mobility and social function mobility domains. Able to use PWC competently within 6 weeks.
LePage et al. 1998 [24]	Association between characteristics of locomotion and	Life Habits Assessment	ANOVA Tukey post hoc analysis	Statistically significant increase in level of mobility (p<0.01) and communication (p<0.05) in PWC users versus children using manual wheelchairs.

ANOVA = analysis of variance; COPM = Canadian Occupational Performance Measure; MATCH = Matching Assistive Technology & Child; MD = Muscular Dystrophy; N/A = not applicable; p = p value; PEDI = Pediatric Evaluation of Disability Inventory; PM = power mobility; PMD = power mobility device; PMP = Power Mobility Program; PWC = power wheelchair; & = and; % = percentage; < = less than; m/day = metres per day; m/sec = metres per second; χ^2 = Chi squared test

Study	Outcome of interest	Method of measurement	Statistics utilized	Results
	life habits			
Lynch et al. 2009 [44]	Self-initiated mobility	Data from PMD	N/A	Path length increased steadily and total path length more than doubled by month 4. Number of joystick activations almost doubled from baseline to month 4. Able to drive straight in most trials by month 4. Began using standard PWC in month 5 to alleviate frustration. More success driving straight in PWC. Directional control not yet achieved.
McGarry et al. 2012 [51]	Driving skills in Smart wheelchair	PMP [57]	Visual presentation of data	2 children increased time contacting switch and ability to look in direction of travel. 1 child could maintain contact for a longer time (10 seconds) and was beginning to stop. 4 th child was able to stop spontaneously to avoid objects and could turn in two directions.
Nisbet et al. 1996 [52]	Augmentative mobility	Observation	N/A	Increased mobility skill in Smart wheelchair over 3-15 months. 2/3 children were able to transition to using a conventional PWC, one was able to drive purposefully with use of line follower to assist with driving through doorways.
Nisbet 2002 [45]	Augmentative mobility	Observation	N/A	Increased driving skill in Smart wheelchair over 6 month period. One child able to transition to standard PWC with switch interface. One achieved independence in Smart wheelchair using switch interface and bumpers for doorways. Third child learned to use one switch successfully with emergent use of second switch. Increased cause-effect and hand use described.
Østensjø et al. 2005 [28]	Impact of assistive devices on care and daily activity	PEDI	χ^2 test	PM was reported to facilitate independence as well as reducing care needs ($r=0.78$, $p<0.001$)
Pope et al. 1994 [53]	PWC mobility	Observation	N/A	4/8 children were competent drivers. Two could maneuver in all directions with difficulty. One had limited directional control. One did not develop directional control but enjoyed self-initiated movement.
Ragonesi et al. 2010 [9]	Mobility and socialization	Video coding	Visual presentation of data	Increased mobility during intervention phase but significantly less than peers. Only drove 5-10% of most active 30 minutes - between 1 and 2 minutes. Drove 25% of most active 30 minutes (2-10 minutes) in post-training phase.
Ragonesi et al. 2011 [46]	Mobility and socialization	Video coding	Visual presentation of data	Mobility increased in intervention phase but did not increase from previous study. Drove PMD 10% of most active 30 minutes - between 1 and 4 minutes.
Ragonesi & Galloway 2012 [10]	PWC mobility	Video coding	Visual Presentation of data	Increased visual and physical contact with the joystick from first to second half of training period. Increased time spent in independent mobility in contrast to caregiver and assisted mobility.
Wiat et al. 2003 [47]	Impact of PWC use	Survey	N/A	Increased freedom and independence

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Table 7: Summary of studies reporting Participation outcomes

Study	Outcome of interest	Method of measurement	Statistics utilized	Results
Level IV				
Deitz et al. 2002 [20]	Initiation of interaction with others	Video coding	N/A	One child increased interaction with other children. Other child did not initiate interaction with others. However, other children interacted more with him and he had increased adult negative interactions when in PMD – he was moving around and getting into trouble.
Guerette et al. 2013 [40]	Play and social skills	ASBI PKBS Survey of Technology Use (STU)	General Linear Model	Statistically significant increase in ‘prosocial’ component of ASBI. PKBS – statistically significant increase in all positive social skills and no statistically significant increase in negative behaviours. STU – statistically significant decrease in ability to remain engaged, increased frequency of family interactions and improved self-esteem, self-confidence and composure. Statistically significant difference in quality of interactive play and level of symbolic play.
Tefft et al. 2011 [25]	Parent perceptions of child’s participation	MATCH STU	General Linear Model Tukey post hoc analysis	Statistically significant increase in child’s interactions with family ($p < 0.05$).
Level V				
Everard, 1984 [50]	Impact of independent mobility	Parent observation	N/A	Increased interaction and participation with peers and more ‘normal’ friendships.
Horne & Ham 2003 [42]	Outcomes of PWC provision	Survey	N/A	Increased integration and participation with other children and in family life. Increased participation in games and activities and increased communication.
Le Page et al. 1998 [24]	Association between locomotion and life habits	Life Habits Assessment	ANOVA Tukey post hoc analysis	Statistically significant increase in ability to participate in social roles, interpersonal relationships ($p < 0.01$), responsibility ($p < 0.01$) and education ($p < 0.05$) in comparison with children using a manual wheelchair.
Nisbet et al. 1996 [52]	Augmentative mobility	Observation	N/A	Participation in play and games, class visits, increased social interaction with other children and increased home responsibilities.
Nisbet 2002 [45]	Augmentative mobility	Observation	N/A	Participating in gym class, let’s go day and shopping.
Ragonesi et al. 2010 [9]	Socialization	Video coding	Visual presentation of data	More time interacting with peers and teachers and reduced time in solitary or parallel play in comparison with baseline. However, still spent most time in solitary or parallel play. In comparison with peers, he spent less time interacting with peers and teachers.

Study	Outcome of interest	Method of measurement	Statistics utilized	Results
Ragonesi et al. 2011 [46]	Socialization	Video coding	Visual presentation of data	Less time spent in solitary and parallel play and more time in teacher-peer and peer-peer interactions during intervention phase.
Wiat et al. 2003 [47]	PM use	Survey	N/A	PWC enhanced participation with peers.