

Environmental impact on young children's participation in home-based activities

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ABBREVIATIONS

PEDI-CAT	Pediatric Evaluation of Disability Inventory Computer Adaptive Test
PEM	Participation and Environment Measurement
YC-PEM	Young Children's Participation and Environment Measure

AIM To test the effect of child, family, and environmental factors on young children's participation in home-based activities.

METHOD Caregivers of young children were recruited using convenience and snowball sampling. Participants were 395 caregivers of children (222 males, 173 females) aged from 1 month to 5 years and 11 months. Demographic items and the home section of the Young Children's Participation and Environment Measure were administered online, followed by completion of the daily activities, mobility, and social/cognitive domains of the Pediatric Evaluation of Disability Inventory Computer Adaptive Test by telephone interview.

RESULTS A structural equation model fitted the data well (comparative fit index=0.91) and explained 31.2% of the variance in perceived environmental support and 42.5% of the variance in home involvement. Functional limitations and performance had an indirect effect on young children's participation through their effect on perceived environmental support. Specifically, fewer functional limitations and higher task performance were associated with greater environmental support, which in turn predicted higher levels of home involvement.

INTERPRETATION Results suggest the importance of a young child's functional abilities and task performance on caregiver perceptions of environmental support at home, and the impact of environmental support on a child's participation in home-based activities during the early childhood period. Results warrant replication with more diverse samples to evaluate model generalizability.

Participation in activities is an indicator of children's health and well-being,¹ and is linked to developmental outcomes (e.g. social competence).² Participation is also a key patient-reported outcome for young children with disabilities who are deemed eligible for rehabilitation services.³⁻⁵ Assessment and technology advances allow valid and feasible collection of data to examine disparities and correlates of participation-level outcomes among children with and without disabilities. Patient-reported outcomes of children's participation, particularly for younger children, are designed for completion by caregivers.

Patient-reported outcomes of children's participation often include assessment of the child's attendance and/or involvement in activities.⁶ School-aged children with disabilities reportedly participate less frequently – and are less involved when participating – in activities at home and outside the home.^{7,8} Recent studies demonstrate that young children with developmental needs also experience participation difficulties in and outside the home.⁹⁻¹¹ A higher percentage of caregivers of children with disabilities expressed dissatisfaction with their child's participation.¹⁰

While knowledge about context-specific disparities in children's participation may help to identify clients who could benefit from intervention, there is a need for improved knowledge about correlates of young children's participation to inform clinical decisions about how to focus interventions towards improved participation in a select activity or setting. Previous studies have primarily modeled the impact of child, family, and environmental factors on the participation of school-aged children^{12,13} and young children with physical disabilities.^{14,15} Child factors commonly modeled are disability according to diagnosis or service use, age, and functional abilities according to the severity of a child's impairment(s) (e.g. motor abilities).¹⁴ To our knowledge, studies rarely model the effect of children's task performance,¹⁵ although it has been associated with children's participation^{6,16} and is amenable to intervention. Family factors commonly modeled include socioeconomic status indicated by income and/or education. Anaby et al.¹⁷ reported an indirect effect of income on frequency and involvement in activities.

There is growing evidence of environmental impact on children's participation and evaluation of environment-focused intervention strategies towards participation-level

outcomes among children with physical disabilities.¹⁸ A recent clinical trial involving young children with cerebral palsy showed that both child-focused interventions to remediate impairments (e.g. neurodevelopmental treatment) and environment-focused intervention strategies (e.g. assistive technology) were equally effective in improving functional outcomes.¹⁶ Colver et al.¹³ found that, for children with cerebral palsy, the child's environment accounted for 14% to 52% of the variation in participation. These findings about environmental impact have recently been extended to preschoolers with mild motor disabilities.¹⁴ More recently, Anaby et al.¹⁷ employed the Participation and Environment Measurement (PEM) approach to gather caregiver perspectives of environmental impact on children's participation specific to a setting. They found a significant mediating effect of environment on the relationship between child and family factors and home participation.¹⁷ This model was run on a more diverse sample according to the child's disability status and explained 50% of the variance in frequency and 51% of the variance in home involvement among school-aged children with and without disabilities. However, these findings have not yet been confirmed in a younger population, which is the focus of this study.

To our knowledge, this is the first attempt to replicate findings reported by Anaby et al.¹⁷ among caregivers of young children with and without developmental delays who enrolled in an online validation of the Young Children's PEM (YC-PEM).¹⁹ Home is an ideal setting to confirm results pertaining to correlates of young children's participation, because they spend large amounts of time there, and typically receive interventions at home.^{5,7} The purpose of this study is to examine the home environment as a mediator of the link between child and family factors and young children's participation in home-based activities. We hypothesize that caregiver perceptions of home environmental support mediate the relationships between child factors (age, functional limitations, functional performance) and family income on children's home participation. Study results contribute to clinically relevant knowledge about priorities for home-based interventions to improve participation outcomes during early childhood.

METHOD

Setting

This cross-sectional study involved secondary analyses of data obtained during the online validation of a caregiver questionnaire on young children's participation. Institutional ethics approval was obtained before participant recruitment and data collection (June–October 2013). Caregivers of young children were recruited in North America, using convenience and snowball sampling methods, as previously described.¹⁹ All participants met the following inclusion criteria: (1) could read and write in English; (2) resided in the USA or Canada; (3) were 18 years or older; (4) were parents or legal guardians of a child between the ages of 0 and 5 years; and (5) had internet access. Participants were

What this paper adds

- The environment significantly affects home participation during early childhood.
- A child's functional abilities and task performance indirectly affect their home participation.

issued flyers that listed a link for access to a web platform where they confirmed study eligibility to create a user account, provided informed consent, and completed the questionnaires. Questionnaire data were obtained online and by telephone interviews using iPads. Participants were each issued US\$20.00 upon completion.

Participants

Participants were 395 parents of children (222 males, 173 females) between 1 month and 5 years 11 months of age. The mean age was 3 years 1 month (SD 1y 8mo). Most respondents resided in the USA (91.1%), were Caucasian (89.1%), and identified as mothers of young children between 0 and 5 years old (95.9%).

As shown in Table S1 (online supporting information), nearly one-quarter of the children sampled received services (23.5%; $n=93$). More than half of the young children receiving services carried diagnoses, although 34.8% of the children had developmental delays (no diagnosis) or were at risk for developmental delay (6.5%). Parents reported on the type(s) of services utilized, including speech and language therapy (75.3%, $n=70$), occupational therapy (57%, $n=53$), physical therapy (26.9%, $n=25$), private/public preschool programs (19.4%, $n=18$), and other therapies or services (31.2%, $n=29$). Among children receiving services, the most common functional issues were related to communicating with others (74.2%, $n=69$) and controlling behavior (61.3%, $n=57$).¹⁹

Measures

Participants completed three questionnaires (see Appendix S1, online supporting information).

Demographic questionnaire

Caregivers reported on their child (e.g. age, race, functional limitations) and family (e.g. education, income). A child's disability status was based on caregiver report of service utilization to address developmental delays (yes, no). If participants answered 'yes', their child was assigned to the disability subgroup and caregivers reported on type (s) of service used and their child's functional abilities in 12 areas (no problem [0] versus little/big problem [1]). The functional issues of sampled children have been previously reported.¹⁹ For this study, these data were used to capture functional severity by calculating the mean number of functional limitations per case.

Pediatric Evaluation of Disability Inventory Computer Adaptive Test

The Pediatric Evaluation of Disability Inventory Computer Adaptive Test (PEDI-CAT) affords caregiver assessment of functional task performance among children from birth to

20 years. Normative scores are generated for four domains: daily activities (68 items), mobility (97 items), social/cognitive (60 items), and responsibility (51 items).²⁰ PEDI-CAT domains have excellent test–retest reliability, with intraclass correlation coefficients ranging from 0.96 to 0.99.²¹ Khetani et al.¹⁹ found small to moderate associations between three PEDI-CAT normative scores and the YC-PEM home involvement summary score. Thus, normative scores for these three domains (daily activities, mobility, social/cognitive) were used in this study.

Young Children's Participation and Environment Measure

The YC-PEM¹⁹ assesses caregivers' perceptions of their young child's participation and environmental impact on participation in the home, daycare/preschool, and community. Data from the YC-PEM home section were used to address study aims.

In the YC-PEM home section, caregivers first evaluated their child's participation in 13 types of activity (e.g. mealtime). For each activity type, caregivers assessed their child's participation along three dimensions: (1) frequency (8-point scale, from never [0] to once or more each day [7]); (2) involvement (5-point scale, from not very involved [1] to very involved [5]); and (3) desire for change (yes [1] or no [0]). If caregivers answered 'yes', they specified type (s) of change desired (do more or less often, be more interactive, be more helpful, and/or participate in a broader variety of activities).

After completing the home participation section, caregivers evaluated the impact of 13 home environmental features (e.g. cognitive activity demands) and resources (e.g. time) on their child's participation at home. Perceived impact of environmental features and resources was assessed on a 3-point scale (no impact/not needed/usually helps/usually yes [3] to usually makes harder/usually no [1]). Multiple response options for environmental support are provided to ensure that items are understood by caregivers of children with and without disabilities (see Appendix S1).²² A perceived environmental support summary score was calculated by summing responses across all home environmental items and dividing the sum by the maximum possible score, and multiplying by 100 (range=0–100).

The three YC-PEM home participation scales (frequency, involvement, desire change) and home environmental support scale have acceptable internal consistency reliability ($\alpha=0.82$ – 0.96) and test–retest reliability (intraclass correlation coefficient= 0.69 – 0.91 for home frequency and involvement scales and home environmental support scale; $\kappa=0.57$ for home desire change scale).¹⁹ The YC-PEM home involvement and environmental support scales can also distinguish between young children with and without disabilities ($d=0.74$ – 1.85).

Analysis

Structural equation models were computed in *Mplus* version 5 (<https://www.statmodel.com/>; Muthén & Muthén 2007, Los Angeles, CA, USA) using full information

maximum likelihood estimation, a method that handles missing data by estimating each parameter on the basis of all available data. Model fit was evaluated using several fit indices, including χ^2 , the comparative fit index, and the root mean square error of approximation. Comparative fit index values between 0.90 and 0.99 and root mean square error of approximation values between 0.05 and 0.08 are considered acceptable.²³

Structural equation modeling was used to extend the model of Anaby et al.¹⁷ to test home environmental support as a mediator of the link between child age, functional limitations, functional performance, family income, and young children's frequency and involvement in home participation. We also pursued evaluation of group differences in the model according to the child's disability status. Congruent with previous empirical and theoretical work,^{6,13,17,22} multiple dimensions of home participation concept (i.e. frequency and involvement) were considered as latent variables in the model. We also extended the model of Anaby et al.¹⁷ by including a latent construct of young children's functional performance across daily activities, social, and mobility PEDI-CAT domains.

RESULTS

Confirmatory factor analysis using *Mplus* was pursued to replicate previous work suggesting that the frequency and involvement PEM subscales represent two related yet distinct dimensions of home participation^{6,17,22} and to evaluate PEDI-CAT scores as indices of functional performance. The factor structure was confirmed for functional performance (standardized factor loadings range 0.80–0.93; see Fig. S1, online supporting information), and one of two relevant dimensions of participation, home involvement (standardized loadings range 0.38–0.69, see Fig. 1). Because previous studies of young children's participation have often included models of more than one participation dimension (e.g. frequency and enjoyment),^{14,15} we proceeded to test a model specific to the home involvement dimension.

Following confirmatory factor analysis, caregiver perceptions of environmental support was evaluated as a mediator of the link between child age, functional limitations, functional performance, family income, and the child's involvement in home-based activities. Indices of model fit demonstrated acceptable fit to the data (comparative fit index= 0.91 ; root mean square error of approximation= 0.06 ; 95% confidence interval 0.047–0.063). This model explained 31.2% of the variance in perceived environmental support and 42.5% of the variance in home involvement. Figure 2 demonstrates that child functional limitations and functional performance had an indirect effect on home involvement by way of perceived environmental support (functional limitations indirect effect $b=-0.26$, $p=0.001$; bias-corrected bootstrapped 95% confidence interval lower limit= -0.38 , upper limit= -0.14 , functional performance indirect effect $b=0.14$, $p=0.002$, bias-corrected bootstrapped 95% confidence interval lower

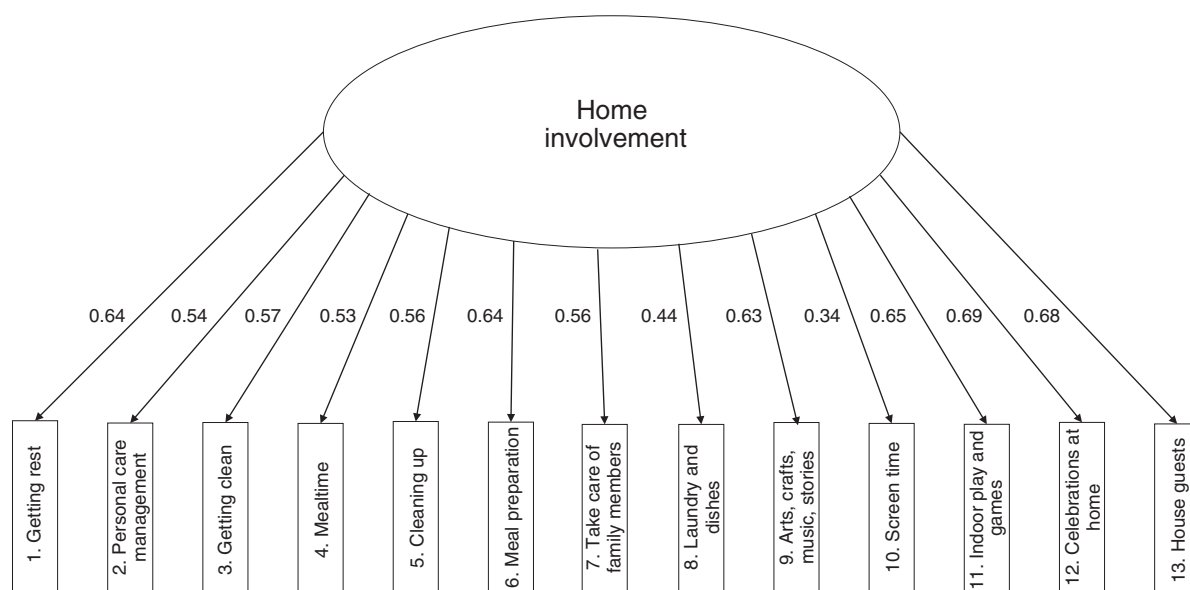


Figure 1: Factor structure of home involvement. Standardized factor loadings are shown (all $p < 0.010$).

limit=0.02, upper limit=0.28). As shown in Figure 2, child functional limitations and functional performance did not have a direct effect on caregiver perceptions of the child's home involvement, but the indirect effect (also known as the AB path)^{24,25} was significant, and the confidence interval did not contain zero. Therefore, perceived environmental support mediated the relationship between functional limitations and functional performance and home involvement.^{25,26} Fewer functional limitations were associated with higher levels of perceived environmental support, which in turn was related to greater involvement in home-based activities. Similarly, higher levels of functional performance in everyday tasks were associated with higher levels of perceived environmental support, which in turn was associated with greater involvement in home-based activities. Child age and family income were not significant predictors of perceived environmental support or involvement, but were included in the final models on the basis of previous work suggesting their importance in predicting children's participation.¹⁷ These variables emerged as significant covariates of functional performance and functional limitations (see Fig. 2). We could not generate a reliable model to examine the relative effect of disability status on home involvement because of the small sample size for the disability subgroup ($n=93$).

DISCUSSION

The impact of children's environments on their health and well-being, including their participation in everyday activities, is well documented.¹⁶⁻¹⁸ Although recent studies suggest disparities in caregiver perceptions of environmental support,¹⁰ this study contributes new knowledge about the impact of perceived environmental support on the participation of young children across a broader age range (0-5y)

and abilities.^{12-15,17} Main study findings confirm the hypothesis that caregiver perceptions of home environmental support mediate the relationship between child and/or family factors and home involvement. This model accounts for 42.5% of the variance in home involvement, which is less than the variance explained by Anaby et al.¹⁷ However, it is considerably larger compared with a study involving preschool children with mild motor disabilities whereby 26% to 34% of the variance in participation was explained.¹⁴

These results partly replicate the model of Anaby et al.¹⁷ because results are specific to one of three relevant settings that comprise a young child's everyday life and provide an estimate for one relevant dimension of children's participation.^{6,22} The home environment was selected because young children spend most of their time and receive interventions there.⁵ Nearly half of the caregivers sampled were not employed outside the home, and in nearly 82% of the cases they reported being a source of child care. Given their time use and involvement in providing care, participants may have been more attentive to how various facets of their home environment affect their young child's participation. Future studies are needed to examine the generalizability of this model to daycare/preschool and community settings. Variability in child care enrollment practices in early childhood presented unique challenges to obtaining adequate sample sizes for testing models specific to the daycare/preschool setting. However, studies involving children enrolled in child care may result in more diverse samples according to parental employment, because children enrolled in these programs tend to have parents employed outside the home.¹⁰ In addition, future studies should attempt to replicate this model when applied to other dimensions of

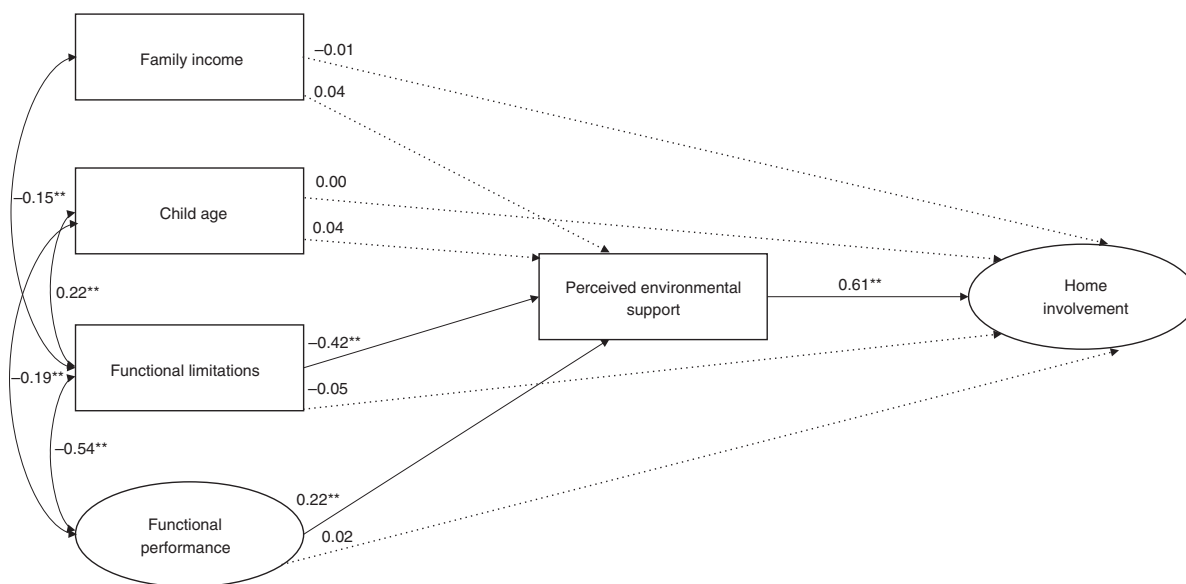


Figure 2: Structural model demonstrating indirect effects of function limitations and functional performance on home involvement by way of perceived environmental support. To enhance readability, the indicators for the latent variables of functional performance and home involvement have been removed (see Fig. 2 and Fig. S1). Dotted lines indicate non-significant pathways. Standardized parameter estimates are shown (** $p < 0.010$).

the participation construct such as frequency. Both attendance and engagement are key dimensions of children's participation warranting investigation.⁶ Anaby et al.¹⁷ were able to model on both dimensions with a school-aged sample. However, it is not clear whether both dimensions can be modeled in younger children with diverse abilities given the challenges we found in establishing a reliable model specific to frequency.

Although qualities of home, school, and community environments differ, their direct effect on school-aged children's participation across settings has been shown when using the PEM¹⁷ compared with other environmental assessment approaches.¹² Because children's participation and environment are assessed together within the same PEM instrument, these results may be partly attributed to shared method variance. Alternatively, these results may reflect the fact that the PEM questionnaires capture environmental impact beyond the physical dimension and with respect to a specific setting.¹⁹ Current findings do not specify which environmental features or resources are more or less predictive of home participation outcomes. However, subsequent analyses of these data could include item-level analyses of home environmental responses in order to examine the relative impact of physical, social, attitudinal, and institutional supports on a young child's home involvement. Alternatively, future studies could examine the effect of parental self-efficacy in moderating the environmental support/home involvement relationship.¹⁴ A sum score based on PEM responses to items on caregiver strategy use at home could be explored as a proxy for parental self-efficacy in these models. These future studies could inform context-specific interventions towards participation-level outcomes.

On the basis of a convenience sample, young children's functional limitations and functional performance had a significant indirect effect on home involvement through perceived environmental support. These findings reinforce the importance of capturing the functional consequences of a child's diagnosis, particularly during early childhood when most children receive services without diagnoses.⁵ Previous studies have typically included proxy estimates or standardized assessment of the child's functional capacities to perform tasks in an ideal environment,^{14,17} but not their capabilities when performing tasks in natural environments as captured by PEDI-CAT data.²⁰ Study results suggest a larger direct effect of functional limitations relative to functional performance on perceived environmental support within the home. This finding may be explained by increased variability in caregiver report of young children's discrete task performance patterns. Task performance variability is expected because children's capabilities of performing tasks are, by definition, more closely tied to environmental opportunities and resources such as the cognitive, motor, and communication demands of those tasks.^{27,28} Despite these differences in effect size, both factors significantly contributed to this model predicting home involvement. Future studies using a restricted sample of young children who are eligible for services are needed to replicate findings on the relative contribution of functional limitations to home participation. This information can be used to substantiate early childhood interventions that are expected to address functional goals in the child's natural environment.⁴

In contrast to previous studies, income and child age covaried with functional limitations and performance but

did not have a direct effect on home involvement. Income findings may be explained by the focus on the dimension of child involvement in home-based activities, as Soref et al.¹⁴ reported an effect of socioeconomic status on preschooler participation diversity, but not intensity. Age is associated with functional limitations and performance,^{17,28} so its effect may have been masked by these variables. Alternatively, child age may influence participation outcomes in settings like daycare/preschool as there are more consistent age-based norms for a young child's involvement in that setting.

Limitations

Convenience and snowball sampling resulted in a sample of predominantly Caucasian-identified families with higher income. Hence, we could not fully examine how family income and race/ethnicity relates to variability in perceived environmental support and children's home participation. Secondly, sample size restricted our ability to yield a reliable picture of young children's home participation by disability status. Work is underway to examine the feasibility of gathering large sums of PEDI-CAT and YC-PEM data in early intervention. This approach may yield larger and more diverse samples to examine the effect of the child's disability status on home participation. This approach affords linking of functional outcomes with billing data, including standardized data on the nature and severity of developmental delay, to strengthen model testing of the child's functional capacities on participation.

We could not fully replicate the model of Anaby et al.¹⁷ because the confirmatory factor analysis of home frequency demonstrated poor model fit. This may have been due to timing data collection during summer months, when time use at home may fluctuate owing to improved weather conditions and/or variable family schedules. Alternatively, children's participation frequency may vary during early childhood and/or according to the child's functional severity, as has been shown recently in a similar study involving young children with cerebral palsy.¹⁵ Finally, the cross-sectional design precludes conclusions about cause-effect relationships between concurrent child and family factors, environmental support, and home participation. Future studies should include two or more time points to allow longitudinal replication of results.

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CONCLUSION

This study extends previous knowledge about the role of supportive home environments in explaining the relationship between a young child's functional abilities and their involvement in home-based activities. Further studies are needed to evaluate model generalizability with more socio-demographically diverse samples as well as in out-of-home contexts, because these are more salient as children age and are where young children with disabilities are known to experience difficulty in participation.^{9–11} Additionally, longitudinal studies of younger children with functional difficulties are needed to test causal models predicting changes in participation across settings.²⁸

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SUPPORTING INFORMATION

The following additional material may be found online:

Table S1: Sample characteristics.

Appendix S1: Variable map.

Figure S1: Factor structure of functional performance.

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