

The Influence of Fathers and Mothers Equally Sharing Childcare Responsibilities on Children's Cognitive Development from Early Childhood to School Age: An Overlooked Mechanism in the Intergenerational Transmission of (Dis)Advantages?

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Abstract

There is increasing awareness that the intergenerational transmission of (dis)advantages is filtered through intra-familial dynamics, in particular, parenting practices. Surprisingly, few studies have investigated what role the extent to which fathers and mothers equally share childcare responsibilities plays in this transmission. Using data from 2,027 families in a Dutch prospective cohort study, our structural equation modelling analyses showed direct effects of equally sharing responsibilities for playful activities on children's cognitive development. Additionally, our study yielded some evidence for the hypothesis that equally sharing responsibilities for playful activities mediates the impact of parents' educational attainment on children's cognitive development. This suggests that the extent to which fathers and mothers equally share childcare responsibilities functions as an underlying mechanism for maintaining social class disparities in children's cognitive development. Our findings also suggest that policies and programmes that encourage fathers and mothers to equally share playful activities may help promote children's cognitive development.

Introduction

There is consensus in the literature that the intergenerational transmission of (dis)advantages is often filtered through intra-familial dynamics, in particular, parenting practices (Lareau, 2000; Conger, Conger and Martin, 2010; Ermisch, Jantti and Smeeding, 2012; Kalil, 2014). Scholars stress that inequality begins at home: parental involvement creates a largely unseen but distinct division line between families, leading to widening gaps in social mobility and inequality that may last for generations (McLanahan, 2004; Kalil, 2014; Putnam, 2016).

Recent studies examining the role of parental involvement in the intergenerational transmission of (dis)advantages have mainly focused on parents' absolute levels of involvement (e.g. McBride, Schoppe-Sullivan and Ho, 2005; Hango, 2007; Byford, Kuh and Richards, 2012; Kalil, Ryan and Corey, 2012; Gracia, 2014; Matsuoka, Nakamuro and Inui, 2015; Milkie, Nomaguchi and Denny, 2015; Altintas, 2016; Dotti Sani and Treas, 2016; Tazouti and Jarlégan, 2019; Gracia and Ghysels, 2017). Most of these studies scrutinized the absolute time spent in active childcare by highly versus less-educated parents, suggesting an 'education gradient' in parents' use of time: highly educated parents generally spend more time than less-educated parents in the broad categories of child time investments that promote child development.

How inequalities in children's cognitive development evolve via the extent to which fathers and mothers equally *share* childcare responsibilities has, to the best of our knowledge, been overlooked. In the present study, we explicitly focus on the role of equally sharing childcare responsibilities in the link between parental educational attainment and child cognitive outcomes. By integrating sociological and developmental perspectives this potential mechanism in the intergenerational transmission of (dis)advantages is studied from a unique cross-disciplinary approach.

In the field of Pedagogical Sciences and Developmental Psychology, parenting research has typically focused on questions regarding what mothers do with, and for, their children, and what influence maternal involvement has on children's development. The importance of father involvement only came into focus in the early 1970s (Lamb and Lewis, 2013). At that time, paternal involvement was operationalized most frequently in terms of co-residence: fathers' presence in the child's household. The next generation of scholars refined the definition of father involvement, defining it in terms of time spent with the child, regardless of the type of activities undertaken. Little evidence was found,

however, for a significant link between fathers' total amount of time spent with children (labelled as absolute involvement) and child development. Subsequently, fathering research gradually shifted towards conceptualizing father involvement as father's direct engagement with the child, through caretaking and other shared activities that might potentially promote child development (Pleck, 2007). Moreover, new norms are emerging, which hold that fathers should contribute equally to parenting with mothers. Although there is consistent evidence that co-parenting has benefits for child development (see for a systematic review, Teubert and Pinquart, 2010), assessing the impact of equally sharing childcare responsibilities for children's (cognitive) development has been overlooked.

In the sociological literature, in contrast, a focus on equity in parenting is not uncommon. Feminist scholars, in particular, have examined men's parental contributions as a component of their contributions to domestic labour in general (Deutsch, Servis and Payne, 2001). As maternal employment increased over the past half-century, these scholars expected that mothers and fathers would come to share childcare responsibilities more equally (Bergmann, 2005). Movement in this direction has been slow (Bianchi, Robinson and Milkie, 2006) which led to research investigating the determinants of the equal division of childcare responsibilities (e.g. Craig and Mullan, 2011; Sayer and Gornick, 2012). Sociologists have argued that equal sharing of childcare responsibilities between father and mother signals not only the stability of commitment from both parents but also relationship satisfaction (Risman and Johnson-Sumerford, 1998; Carlson, Hanson and Fitzroy, 2016): two factors which have been shown to enhance child cognitive development (e.g. Howes and Markman, 1989). Surprisingly, however, parenting in the sociological literature is treated merely as an equity issue between fathers and mothers, without referencing to its consequences for children (but see Deutsch, Servis and Payne, 2001, for a notable exception).

The emergence of equity seems to be particularly salient for middle- and upper-class families (e.g. Townsend, 2002), suggesting that the beneficial impact of sharing childcare responsibilities on children's cognitive development might have increasingly become a privilege for the higher educated (Settersten and Cancel-Tirado, 2010). Therefore, the extent to which fathers share childcare responsibilities with their partner may play a pivotal role in the intergenerational transmission of (dis)advantages. In the present study, we test a mediation model, examining whether the effect of parents' educational attainment on children's cognitive development is (partially) explained by

the extent to which fathers and mothers equally share childcare responsibilities.

Fathers and Mothers Equally Sharing Childcare Responsibilities as an Underlying Mechanism for Maintaining Social Class Disparities in Children's Cognitive Development

To build the argument that the extent to which fathers and mothers equally share childcare responsibilities is an underlying mechanism for the impact of parents' educational attainment on children's cognitive development, we would first have to argue and show that (i) parents' educational attainment is significantly associated with children's cognitive development, (ii) the extent to which fathers and mothers equally share childcare responsibilities is significantly associated with children's cognitive development, and (iii) parents' educational attainment is significantly associated with the extent to which fathers and mothers equally share childcare responsibilities. Consequently, we could examine indirect effects from educational attainment to cognitive development, mediated through the extent to which fathers and mothers equally share childcare responsibilities.

Linkages between Parents' Educational Attainment and Children's Cognitive Development

Numerous studies have revealed that parents' educational attainment influences children's cognitive functioning. Parents with higher educational attainment are able to provide more resources, learning opportunities, and a thriving intellectual environment for their children than parents with lower educational attainment (Yeung, Linver and Brooks-Gunn, 2002; Byford, Kuh and Richards, 2012). In addition, parents with higher levels of education promote their children's cognitive development by holding higher expectations for their children (Davis-Kean, 2005). Furthermore, parents' level of education is positively associated with their use of more advanced expressive language with their children, the number of words used, and the complexity of the words used (Pancsofar and Vernon-Feagans, 2006). Finally, higher educated parents are more likely to be involved in, and supportive of, their children's learning (Lareau, 2000).

Linkages between Equally Sharing Childcare Responsibilities and Children's Cognitive Development

Existing literature does not explicitly focus on linkages between equally sharing childcare responsibilities and children's cognitive outcomes. However, based on the developmental and sociological literature, we can

formulate three pathways through which the extent to which fathers and mothers equally share childcare responsibilities might be linked with children's cognitive development: the first pathway is through the overall family climate, the second through parenting styles, and the third focuses on socialization.

The first pathway is derived from the *shared parenting* literature (e.g. Deutsch, Servis and Payne, 2001; Van Egeren and Hawkins, 2004). Shared parenting is a broad dimension which focuses, among other things, on the responsibility for division of caregiving tasks (Van Egeren and Hawkins, 2004). Shared parenting may be more often present when there is a positive co-parental and partnership relationship (Coiro and Emery, 1998; NICHD Early Child Care Research Network, 2000). The fact that childcare responsibilities are equally shared between the father and the mother may therefore signal that both parents are committed to each other and their child, but also that they are satisfied with their relationship (Carlson, Hanson and Fitzroy, 2016). As such, it can be argued that families in which childcare tasks are shared more equally, the overall family climate in which children are raised is more positive, which is in an important factor contributing to positive child cognitive outcomes (Cabrera *et al.*, 2012; Pendry and Adam, 2013).

A second pathway is focused on parenting styles, in particular, those of fathers. Research has shown that fathers who divide childcare tasks equally with their partner are more likely to be perceived by their children as exhibiting authoritative parenting styles compared with fathers from households with a more traditional task division between parents (Sabattini and Leaper, 2004). Egalitarian childcare arrangements may therefore foster authoritative parenting in fathers, in that the traditional emphasis on parenting control is balanced with responsiveness (e.g. Baumrind, 1989). Authoritative parenting, in turn, has been shown to enhance children's cognitive development (e.g. Dornbusch *et al.*, 1987).

The third pathway, derived from the sociological literature, emphasizes (gender role) socialization. Feminist scholars (e.g. Okin, 1989) have suggested that an equal division of labour between parents provides children with a model of justice that will be beneficial to their (cognitive) development. According to the social cognitive theory of gender development (Bussey and Bandura, 1999), children look to models in their environment for information about gender-appropriate behaviour. Parents who divide childcare responsibilities equally have children with more flexible attitudes about gender (Fulcher, Sutfin and Patterson, 2008), and daughters

who are less vulnerable to gendered achievement patterns (Updegraff, McHale and Couter, 1996). Socialization may therefore underlie linkages between the extent to which fathers and mothers equally share childcare responsibilities and children's cognitive development, in particular for girls.

Linkages between Parents' Educational Attainment and the Extent to Which Fathers and Mothers Share Childcare Responsibilities

A substantial body of research shows that in the last 50 years a meaningful shift has taken place in the division of childcare between mothers and fathers. There is empirical evidence showing that childcare responsibilities are more equally shared when both parents work, when mother's income is higher, and when both parents are highly educated (Sullivan, 2010). Of the main socio-economic factors which have been consistently reported to be associated with differences in the division of family work, one of the strongest effects is that of educational attainment. In the literature, the effects of educational attainment have mainly been interpreted in terms of the differing attitudes, values and ideologies, for example, the greater commitment to egalitarianism associated with higher levels of education (Sullivan, 2010). In their cross-national time-use study, Craig and Mullan (2011) revealed that higher-educated parents are more likely to equally share childcare duties, in particular, duties labelled as routine care (physical care and accompanying a child). A widening gap by education in the case of division of childcare has also been illustrated (Sullivan, 2010).

The Extent to Which Fathers and Mothers Equally Share Childcare Responsibilities as a Mediator of the Relationship between Parents' Educational Attainment and Children's Cognitive Development

To our knowledge, no other studies have investigated the role of parents' equally sharing childcare responsibilities as a mediator between educational attainment and child outcomes. Given that there is evidence that parents' educational attainment is related with parents' equally sharing childcare responsibilities, and given that the extent to which parents equally share childcare responsibilities can be argued to be related to children's cognitive outcomes, we expect to find that equally sharing childcare responsibilities mediates the impact of parents' educational attainment on children's cognitive development.

The Present Study

The aim of the present study was to examine the role that equally sharing childcare responsibilities plays in the intergenerational transmission of (dis)advantages in cognitive development. We focus on children's cognitive development from 30 months to 6 years of age, because the transition to, and initial years of, formal schooling constitute an important developmental period in which 'the successful growth of early academic competencies sets children on a path of academic success with long-term repercussions for educational and economic outcomes' (Coley, Lewin-Bizan and Carrano, 2011: p. 1523).

Two primary types of developmentally salient activities with the child can be distinguished in the literature; playful activities and teaching-related activities (e.g. Senechal and LeFevre, 2014). Playful activities provide young children with rich language experiences, as well as contexts for experiencing shared attention, shared meanings, and turn taking. Teaching-related activities are activities in which children are, comparatively more directly, taught skills and knowledge. In the present study, we will examine linkages between the extent to which fathers and mothers equally share childcare responsibilities and children's cognitive development for both types of activities separately.

For an accurate understanding of linkages between parents' educational attainment, the extent to which fathers and mothers equally share childcare responsibilities, and children's cognitive development, it is important to take the following factors into account: parents' absolute level of involvement, child's age, child's sex, child's birth weight, and the presence of siblings. We control for parents' absolute level of involvement, to rule out that any positive effects of fathers and mothers taking relative more equal shares of childcare responsibilities on children's cognitive development, might be explained by the fact that the child merely receives a larger total amount of parental involvement (see also Deutsch, Servis and Payne, 2001). Although ideally we would have liked to control for absolute involvement of parents in specifically playful and teaching-related activities, previous research (Craig, 2006) shows that the ratio of father hours to total hours is similar for both the measure of total numbers of hours spent with the child as well as for the number of hours spent in interactive tasks. These findings reduce concerns that the use of our measures of overall absolute involvement would lead to different conclusions. We include child's age, as the age on which the cognitive abilities of the child were tested varied. We include child's sex, as differences between

boys and girls in cognitive development appear from infancy onwards (Halpern, 2012). We take the presence of siblings into account, as siblings play a major role in each other's cognitive development (e.g. Azmitia and Hesser, 1993). We include child's birth weight to control for early child risks that also are predictive of children's cognitive outcomes (e.g. Jefferis, Power and Hertzman, 2002). Finally, we include a baseline of cognitive abilities of the child at the age of 30 months, enabling us to investigate the impact of fathers and mothers equally sharing childcare responsibilities on changes in children's cognitive development. Incorporating a baseline measure of children's earlier abilities also enables us to control for possible bi-directionality in the relation between parents equally sharing childcare responsibilities and children's cognitive development.

Methods

Setting and Procedure

The present study was embedded within Generation R Study, a prospective cohort investigating growth, development, and health from foetal life onwards in a population-based birth cohort. All pregnant women living in Rotterdam, the Netherlands (Jaddoe *et al.*, 2012) with expected delivery dates of April 2002 to January 2006 were invited to participate by their midwives or obstetricians (baseline participation rate 61 per cent). The research was approved by the medical ethical committee of the Medical Ethics Committee of the Erasmus Medical Center, Rotterdam. All parents signed written consent.

Participants

Cognitive functioning was tested during a lab visit in 5,377 children with a mean age of 6 years and 1 month. For the present study, we selected only families in which mother, father, and child co-resided as our focus were on the influence of parents' equal share of childcare responsibilities. In 637 cases, mother reported to be no longer married to/living together with her partner. In 779 cases, information on partner status was missing. Furthermore, we only included children with a Dutch national origin (child, parents, and grandparents born in the Netherlands) to exclude possible influences of bilingualism, as studies have revealed that processing and acquiring languages works differently for mono- and bilingual children (e.g. Barac and Bialystok, 2011). Of the 3,961 remaining families, 1,839 mothers reported that she and/or her partner were of non-Dutch origin. In 95 cases, information on ethnicity was missing. The focus on two-

parent Dutch families thus resulted in a dataset consisting of 2,027 families. Non-response analyses revealed that the mothers and fathers in the included sample ($n=2,027$) were older, higher educated, and shared childcare responsibilities more equally, than mothers and fathers not in the sample ($n=3,350$). The children of the excluded families had on average lower birth weights and lower verbal and nonverbal cognitive scores in toddlerhood (all P -values < 0.001). Characteristics of the included families are displayed in Table 1.

Measurement

Children's cognitive functioning at 6 years

To measure children's cognitive functioning at age 6 years (mean age = 73 months, $SD = 4.6$ months), children were invited at the Generation R research centre to complete measures of verbal and nonverbal intelligence. Verbal intelligence was measured using the vocabulary comprehension subtest of a Dutch test battery: *Taaltests voor Kinderen* ('Language Test for Children'; Bon, 1982). In the receptive subset of this test battery, each item consisted of two pictures that the child had to match. Due to the length of the original test and the need to minimize the burden on the children, 26 difficult items from the full battery of 40 items were selected, yielding a possible scoring range from 0 to 26 (see for more details, Ghassabian *et al.*, 2014). This scale had questionable reliability, $\alpha = 0.61$, an issue we return to in the Discussion section of our manuscript.

During the same session, the children's nonverbal intelligence was assessed using two subtests of a Dutch nonverbal intelligence test: *Snijders-Oomen Niet-verbale Intelligentietest-Revisie* ('Snijders-Oomen Nonverbal Intelligence Test-Revision'; SON-R 2 $\frac{1}{2}$ -7; Tellegen *et al.*, 2005): *Mosaics*, which assesses spatial visualization abilities, and *Categories*, which assesses abstract reasoning abilities. The scores of *Mosaics* and *Categories* have a high correlation ($r = 0.86$) with intellectual performance and good internal reliability ($\alpha = 0.85$). The raw test scores were converted into nonverbal intelligence scores using norms tailored to the child's exact age.

Children's cognitive functioning at 30 months

To control for a baseline of children's cognitive functioning, we included assessments of the child's verbal and nonverbal cognitive functioning when they were approximately 30 months old. Verbal cognition was reported by the parents using the Dutch translation of the Language Development Survey (LDS; Rescorla, 1989). Nonverbal cognition was reported by mothers,

Table 1. Observed variable descriptive statistics

	M	SD	Min.	Max.	N
Child cognitive functioning					
Verbal score 6 years	22.63	2.64	7.00	26.00	2,027
Nonverbal score 6 years	105.25	14.28	50.00	150.00	2,027
Verbal score 30 months	247.14	46.39	6.00	310.00	1,558
Nonverbal score 30 months	21.66	2.23	4.73	26.00	1,552
Parent characteristics					
Involvement play ^a	2.61	0.55	1.00	3.00	1,524
Involvement reading ^a	2.41	0.60	1.00	3.00	1,524
Involvement skills ^a	2.81	0.45	1.00	3.00	1,521
Involvement knowledge ^a	2.81	0.45	1.00	3.00	1,520
Education father	0.63	0.48	0.00	1.00	1,541
Education mother	0.64	0.48	0.00	1.00	1,966
Child characteristics					
Sex (boy = 1) ^a	0.49	0.50	0.00	1.00	2,027
Age child at tests	73.17	4.55	60.08	108.97	2,027
Siblings (yes = 1) ^a	0.41	0.49	0.00	1.00	1,957
Birth weight	3514.03	531.56	980.00	5610.00	1,954
Control variables					
Monday father	3.90	2.41	0.00	16.00	1,511
Tuesday father	3.67	2.08	0.00	16.00	1,513
Wednesday father	3.98	2.53	0.00	16.00	1,511
Thursday father	3.72	2.21	0.00	22.00	1,513
Friday father	4.47	2.95	0.00	16.00	1,517
Saturday father	10.24	2.45	0.00	24.00	1,516
Sunday father	10.55	2.25	1.00	24.00	1,515
Monday mother	6.90	3.74	0.00	16.00	1,600
Tuesday mother	6.88	3.71	0.00	16.00	1,605
Wednesday mother	8.23	3.84	0.00	16.00	1,617
Thursday mother	6.78	3.67	0.00	22.00	1,608
Friday mother	8.03	3.77	0.00	16.00	1,606
Saturday mother	11.50	1.97	0.00	24.00	1,619
Sunday mother	11.63	1.79	1.00	24.00	1,617

Note: These are the observed sample descriptive statistics, prior to imputation.

^aCategorical variable.

using the Dutch version of the Parent Report of Children's Ability (PARCA; Saudino *et al.*, 1998). The LDS and the PARCA had excellent internal consistency (in the present study; α s 0.99 and 0.92, respectively), excellent test-retest reliability, and concurrent validity (Rescorla, 1989; Achenbach and Rescorla, 2000; Zink and Lejaegere, 2003).

The extent to which fathers and mothers equally share childcare responsibilities at 36 months

We assessed parents' equally sharing childcare responsibilities in two dimensions, namely playful and teaching-related activities. We used four items from the Child Caregiving Involvement Scale (CCIS; Wood and Repetti,

2004) to measure equal responsibilities in these two dimensions. Respondents were told: 'The following questions are concerned with **activities** (bold is original emphasis) that you undertake with your child'. They were asked to indicate their degree of responsibility. To measure playful activities, we used the items: 'Playing with my child' and 'Reading with my child'. To assess teaching-related activities, we used the items: 'Helping my child to acquire skills' and 'Adding to my child's knowledge'. Each item was rated on a five-point scale: (i) no or very little responsibility (less than 10 per cent); (ii) some responsibility (10–40 per cent); (iii) equal responsibility (40–60 per cent); (iv) much responsibility (60–90 per cent); and (v) almost complete or complete responsibility (90–100 per cent).

We earmarked these four items for inclusion based on theoretical grounds. Exploratory factor analysis (EFA) on the full scale validated this decision, as Horn's (1965) parallel analysis suggested that the full CCIS formed five factors, with the playful items and the teaching-related items each loading highly on their own unique factor, and with negligible cross-loadings. We thus proceeded with only these four items, and conducted a second EFA to see whether the distinction between playful and teaching-related childcare responsibilities was maintained. Horn's (1965) parallel analysis suggested that the CCIS items indeed formed two factors. Factor analyses with oblimin rotation revealed that each item loaded highly on only one factor (loadings between 0.64 and 0.99), and cross-loadings were negligible (between -0.05 and 0.12). The playful factor explained 43 per cent of the variance in the items, and the cognitive factor explained 26 per cent of the variance in items. Reliability estimates for playful and teaching-related childcare responsibilities, respectively, were questionable and excellent; α 0.67 and 0.91. However, as Cronbach's alpha is, in part, a function of the number of items, it is not clear that the usual rules of thumb apply for scales with only two items (Cortina, 1993).

As mentioned earlier, we were interested to examine whether children's cognitive development benefits most from having a father and a mother who had an equal share of responsibility for these activities. We conducted exploratory analyses to test this assumption. The results (see Supplementary Appendix 1) showed that, when the involvement scale was used in its original configuration, a significant negative curvilinear association emerged between fathers' relative involvement and children's cognitive development, such that optimal cognitive functioning was reached at the midpoint of the involvement scale. We recoded the items in such a way that higher scores indicate a more equal share of childcare responsibilities between fathers and mothers (by recoding the items of the involvement scale into 1 = unequal task division between mother and father, score 1 or score 5; 2 = some equal task division between mother and father, score 2 or score 4; and 3 = completely equal division in childcare tasks between mother and father, score 3). After rescaling, the relationship between the extent to which fathers and mothers equally share childcare responsibilities and child cognitive functioning was linear. These findings suggest that children's cognitive functioning benefits most from having fathers and mothers having an equal share of responsibility for these activities. For this reason, we used the recoded items for fathers' relative involvement in parenting as indicators in our structural equation models.

Educational Attainment

The theoretical framework in which parenting practices are conceptualized as class-specific cultural practices, is most strongly linked with educational attainment. In addition, in the Netherlands, educational attainment rather than income or occupational status is considered the most important marker of social inequality (Bovens, 2012). Both mother and father reported the highest level of education completed at the intake of the study. Answers were coded as following: 1 = *up to primary education*, 2 = *up to 3 years of secondary school*, 3 = *medium education* (more than 3 years of secondary school or intermediate vocational training), 4 = *higher vocational training*, and 5 = *university degree*.

In preliminary analyses, we checked the distribution of the educational attainment variable for fathers and mothers and found out that the distribution resembles a non-normal mixture of two distributions, particularly for fathers, which suggests that it might be better to create dummies for educational attainment. We used latent class analysis to examine what number of dummies would best fit the data. We extracted one to six class solutions, and found that the two-class solution fit the data significantly better than a one-class (normal distribution) solution, based on (i) a lower AIC, (ii) acceptable entropy, (iii) significant Lo-Mendell-Rubin test, and (iv) high posterior classification probabilities. These two classes corresponded perfectly to a split between cases scoring a 3 or lower, versus 4 or 5. Moreover, correlations (Spearman and Pearson's were identical within rounding error) between the dichotomized education variables and the original education variable were 0.88 for fathers and 0.87 for mothers, implying an explained variance of approximately 76 per cent, indicating most of the information was retained despite dichotomizing the variable. Thus, our dichotomous variable for education attainment is as follows: *low education* = up to medium education (more than 3 years of secondary school or intermediate vocational training) and *high education* = at least higher vocational training or university degree.

Control Variables

To control for parents' absolute level of involvement in parenting, we asked fathers and mothers to report on the average number of hours they spend with the child at age 36 months each day of the week. Birth weight and infant sex were obtained from midwives and hospital registers at birth. Birth weight was measured in grams. Information about the presence of siblings in the family was obtained using questionnaires administered at the time of the first prenatal interview at the gestational age

of 18–25 weeks. Finally, child's age is measured in months.

Missing Data Imputations

The percentage of missingness by variable ranged from 0 per cent to 25.8 per cent, with an average of 18.0 per cent. Participants were enrolled in this prospective cohort study prenatally, and followed until the age of 6 years. Missing data due to attrition are common in such longitudinal data sets (Jeličić, Phelps and Lerner, 2009), and must be accounted for in order to draw valid conclusions. It is important to test whether missingness is related to any measured variable. According to Jamshidian and Jalal's (2010) non-parametric MCAR test, missingness was not related to any measured variables ($P = 0.10$). We imputed missing data in R 3.3.0 using missForest (Stekhoven and Bühlmann, 2012), an innovative approach which uses random forests to predict missing values and tends to outperform multiple imputation. The advantages of this method are that (i) it includes continuous and categorical variables simultaneously, (ii) it does not make any distributional assumptions, which means it easily handles (multivariate) non-normal data and complex interactions and non-linear relations amongst the data, and (iii) the accuracy of the imputation can be estimated based on the algorithm's ability to correctly predict the values of data not part of the bootstrap sample each iteration. Classification error was 12.2 per cent for the continuous variables and 13.3 per cent for the categorical variables. The bivariate correlations among the study variables were explored with Pearson's correlations and Phi correlations (Supplementary Appendix 2).

Preliminary Analyses

From a theoretical point of view, the distinction between the number of hours a parent spends with his/her child, and the extent to which these parents equally share childcare responsibilities is justified (e.g. Craig 2006; Phares, Fields and Kamboukos, 2009; Craig and Mullan, 2011; Doucet, 2015). Furthermore, a distinction has been made between different dimensions of childcare responsibility. However, these indicators of parental involvement might be closely related, and including closely related predictor variables in a model incurs a risk of multicollinearity. To investigate whether these variables could be modelled individually, or should be represented by a single construct, we conducted exploratory factor analyses on all variables related to parents' involvement: hours of involvement on each day of the week, and the four items of the scale on parents'

equally sharing childcare responsibilities (CCIS). Horn's (1965) parallel analysis indicated that four factors best explained the data. Factor analyses with oblimin rotation revealed that these factors represented parents' equally sharing responsibilities for playful activities, parents equally sharing responsibilities for teaching-related activities, hours of involvement during weekdays, and hours of involvement during the weekend. These results indicate that the relative and absolute measures of parents' involvement can be modelled separately.

Finally, we explored whether sex of the child moderated the influence of the extent to which fathers and mothers equally shared responsibilities for playful and teaching-related childcare activities on children's cognitive development. However, these interaction terms were non-significant ($P = 0.21$ and $P = 0.87$, respectively). Therefore, in our main statistical analyses, the sex of the child was mainly included as a control variable.

Main Statistical Analyses

We used structural equation modelling with weighted least squares estimation (WLSMV) in MPLus 7.4 (Muthén and Muthén, 1998–2012). Latent variables were constructed to represent children's cognitive functioning at age 6 years and at 30 months; for parents' equal share of responsibilities for playful and teaching-related activities, and for parents' quantity of involvement (in hours). Parents' level of education was defined as a formative latent variable, to reflect the fact that parents' levels of education are not caused by a common factor, but do jointly constitute a meaningful construct, akin to socio-economic status. All (other) control variables were treated as observed variables.

To answer our research question 'What role does the extent to which fathers and mothers equally share childcare responsibilities play in the intergenerational transmission of (dis)advantages in cognitive development', we tested whether the extent to which fathers and mothers equally shared childcare responsibilities is an underlying mechanism for the impact of parents' educational attainment on children's cognitive development. To do so, we investigated the association between parents' educational attainment and children's cognitive development, and tested whether this association is mediated by our two measures of parents' equally sharing responsibilities for playful and teaching-related activities. Because the sampling distribution of indirect effects is non-normal, we tested their significance by means of bias-corrected bootstrapped 95 per cent confidence intervals (1,000 bootstrap samples). If the confidence

interval did not include zero, the parameter was considered to be significant.

Children's cognitive functioning at age 6 years was controlled for cognitive functioning at 30 months, so the results should be interpreted as predicting relative *change* in cognitive functioning over time. Children's cognitive functioning at age 6 years was further controlled for effects of parents' absolute involvement (in hours), child's sex and birth weight, presence of siblings in the family, and age of the child at the time of testing. The indicators of parents' equally sharing childcare responsibilities were treated as categorical.

Results

Figure 1 shows the graphical representation of the structural equation model run to test our hypotheses, and includes all parameters discussed in this results section. This model had acceptable fit according to three different fit indices; RMSEA = 0.06, CFI = 0.94, TLI = 0.93 (Little, 2013). For a full overview of model parameters, see [Supplementary Appendix 3](#). We report standardized regression coefficients throughout the results section. This is an effect size measure, interpreted as follows: for a 1 SD increase on the independent variable, the dependent variable is predicted to increase a number of standard deviations equal to the standardized regression coefficient.

Our results show that parents' educational attainment positively predicts children's cognitive development. This means that children from higher educated parents showed greater relative increases in cognitive functioning from 30 months to 6 years. Furthermore, parents' educational attainment significantly predicted the extent to which parents equally shared responsibilities for playful activities. Thirdly, the extent to which parents equally shared responsibilities for playful activities significantly predicted children's cognitive development. There was a significant indirect effect from educational attainment to cognitive functioning, mediated by the extent to which parents equally shared responsibilities for playful activities. This indicates that the association between parents' education and their children's cognitive development is partly explained by the fact that higher educated parents more often equally share the responsibilities for playful activities. Of the total effect of education on children's cognitive outcomes, 13 per cent ($=0.04/(0.27 + 0.04)$) is mediated by parents' equally shared responsibilities for playful activities. Parents' educational attainment did not significantly predict the extent to which parents' equally shared responsibilities for teaching-related activities, and the

extent to which parents equally shared responsibilities for teaching-related activities did not significantly predict children's cognitive functioning. There was no indirect effect from educational attainment to cognitive functioning, mediated through parents' equal share of responsibilities for teaching-related activities. These results indicate that one of the reasons children of higher educated parents show stronger relative increases in cognitive functioning from 30 months to age 6 years is because their parents more equally share childcare responsibilities, albeit only in terms of playful activities. Our hypothesis, namely that parents' equal share of childcare responsibilities is an underlying mechanism for the impact of parents' educational attainment on children's cognitive development, is thus partly supported by the analyses, and only with respect to parents' equal sharing of responsibilities for playful activities.

In addition to the finding that parents' equally sharing childcare responsibilities is an underlying mechanism for the impact of parents' educational attainment on children's cognitive development, we found evidence for a direct positive predictive effect of the extent to which parents equally shared childcare responsibilities on children's cognitive development. This means that, the more parents equally shared parenting responsibilities, the greater increases in cognitive functioning their children showed from 30 months to 6 years of age. Readers should note, however, that this effect only pertains to parents' equal share of responsibilities for playful activities. The extent to which parents equally shared responsibilities for teaching-related activities did not significantly predict children's cognitive functioning.

Control Variables

Several control variables significantly predicted cognitive functioning at 6 years. The significant effect of cognitive functioning at 30 months indicated that there was substantial rank-order stability in cognitive functioning. Childs' age and birth weight both significantly positively predicted cognitive functioning, but child sex did not. Finally, the presence of older siblings in the home negatively predicted cognitive functioning.

Additional Analyses

We tested the alternative explanation that linkages between equally sharing childcare responsibilities and children's cognitive outcomes are driven by selection. The theoretical arguments, operationalization of the variables that may capture these selection mechanisms (household income and father's and mother's work hours) and the results can be found in [Supplementary](#)

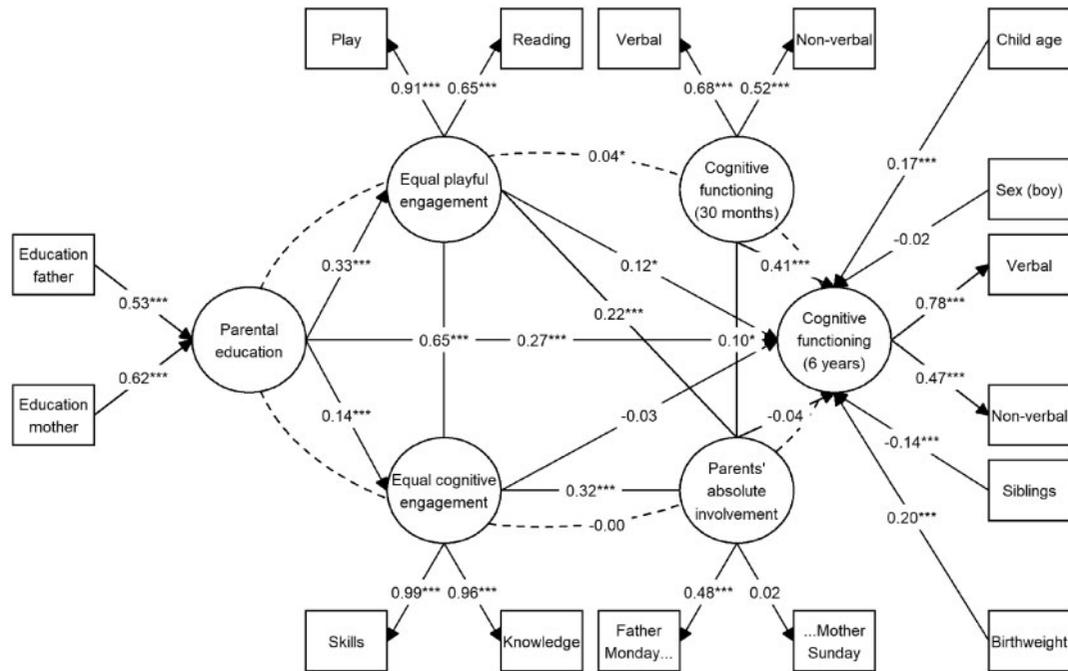


Figure 1. Structural equation model of parents' equal share of childcare responsibilities predicting child cognitive functioning

Notes: Standardized model coefficients are displayed. Model simplified for the sake of presentation; all coefficients are displayed in [Supplementary Appendix 3](#). Dashed lines represent indirect effects. RMSEA = 0.06, CFI = 0.94, TLI = 0.93. * $P < 0.05$, *** $P < 0.001$.

Appendix 4. These results suggest that linkages between equally sharing childcare responsibilities and children's cognitive outcomes are not driven by selection in parents' socio-economic characteristics.

Discussion

In this article, we examined the link between parents equally sharing of childcare responsibilities and children's cognitive development and we asked the question: what role does the extent to which parents equally share childcare responsibilities play in the intergenerational transmission of (dis)advantages in cognitive development? Our models controlled for important child characteristics and earlier levels of children's cognitive functioning, adjusting for early child risks and abilities that also are predictive of cognitive outcomes at 6 years of age. We also incorporated absolute measures of parents' involvement, in an effort to estimate unique links between parents' equally sharing childcare responsibilities and children's cognitive outcomes at age 6 years.

Our results provided evidence for our hypothesis that parents' equally sharing childcare responsibilities

functions as an underlying mechanism in the impact of parents' educational attainment on children's cognitive development. Parents' greater educational attainment predicts more equal responsibility for playful activities, which, in turn, predicts greater increases in children's cognitive functioning from 30 months to 6 years of age. This means that, controlling for absolute involvement, the more fathers and mothers had equal responsibility for playful activities with their child, the greater increases in cognitive functioning their child showed from 30 months to 6 years of age. Our study was one of the first to examine the role of *parents' equal share of involvement* in the intergenerational transmission of (dis)advantages and adds to the ongoing discussion regarding the notion that the intergenerational transmission of (dis)advantages is often filtered through intra-familial dynamics, in particular, parenting practices (e.g. [Daneri, Blair and Kuhn, 2018](#)).

Important to note is that the indirect effect of parents' educational attainment on children's cognitive development via parents' equally sharing childcare responsibilities explained 13 per cent of the total effect of parents' educational attainment on children's cognitive development. This means that additional

mechanisms might explain the impact of parents' educational attainment on their children's cognitive development. For example, the home environment literature suggests that the link between parents' educational attainment and children's cognitive development could be partly mediated by the number of books in the household, or by parental attitudes (e.g. concerning the importance of reading prior to the start of school; [Senechal and LeFevre, 2014](#)).

Alternatively, possible explanations for the relatively small effect size concern the suitability of the used measures and the omission of potentially important measures in the present study. With respect to the issue of omitted measures, we were not able to control for circumstances or events that happened between the child's third and sixth birthday that may be related to both parents' equal share of childcare responsibilities as well as children's cognitive development (e.g. parents' mental health). Furthermore, we measure the extent to which parents equally share childcare responsibilities 3 years before the observation of cognitive outcomes. An assumption of our work is that a snapshot of parenting when the child is 3 years old is somewhat representative for parenting in the period from 30 months to 6 years of age. If parenting is variable in this period, this would introduce noise that might lead to an underestimation of the effect size.

The small effect size seems to imply that little can be gained from prevention or intervention strategies directed at increasing equal sharing of responsibilities for playful childcare activities. Nevertheless, interventions based on small effect sizes can yield substantial benefits (as [Rose \(1981\)](#) described in his discussion of the 'prevention paradox'). Thus, although the size of the indirect effect was small, it has clear clinical and societal relevance, as it is valuable to know that there are familial or parental factors explaining variance in children's cognitive development. As our model shows, most factors that predict children's cognitive development are beyond parental control. Cognitive development is predicted by parents' educational attainment, child age, birthweight, and siblings. Against this background, it is important to know that there are also factors making a difference which can be influenced by parents and which can be impacted upon in prevention or intervention programmes.

We found no associations between the extent to which parents equally share responsibilities for teaching-related activities and children's cognitive development, nor did we find that parents' equal share of responsibilities for teaching-related activities functions as an underlying mechanism between parents' educational attainment and children's cognitive development.

Several factors might help explain these non-significant findings. First, in early childhood children might benefit more from playful dyadic interaction between parent and child than from teaching-related activities initiated by the parent. Second, the items that assessed teaching-related activities might not have been able to capture the essence of [Lareau's \(2000\)](#) concept of concerted cultivation. Scholars have argued that stage-setting—cultivating or enriching the child—is more important than teaching children a particular task ([Harris and Robinson, 2016](#)).

Our study is situated in the Netherlands, a country with some distinct characteristics that may structure the extent to which parents equally share childcare responsibilities. Dutch society was long characterized by a male bread-winner model and until the 1960s working (married) women were the exception rather than the rule ([Plantenga, Schippers and Siegers, 1999](#)). Although the Netherlands now has one of the highest female labour force participation rates among OECD countries ([OECD, 2012](#)), relatively few women work full-time. Furthermore, women take on the majority of the childcare duties at home ([Portegijs and Merens, 2010](#)), although this is a pattern found in most Western countries ([Craig and Mullan, 2011](#)). Our results showed that when Dutch fathers and mothers are sharing the responsibility for reading and playing with their child more equally, the greater the increases in their children's cognitive development.

Some limitations of our study should be mentioned here. For one, as mentioned above, our sample consists of native Dutch, co-residing parents, which might limit generalizability to families with different family constellations or ethnic backgrounds. Also, fathers who agreed to participate in the present study may be more involved than those who declined. Their willingness to participate may signal a greater commitment to, or confidence in, their role as a father ([Martin, Ryan and Brooks-Gunn, 2007](#)), which is likely to influence the extent to which they equally share childcare responsibilities.

A second limitation pertains to our measure of children's verbal cognition. Verbal cognition was measured with the *Taaltests voor Kinderen* ([Bon, 1982](#)) which originally consists of 40 items. As the lab visit in which the language test was measured had to be shortened after a pilot test to decrease the burden on the 6-year-old, the test was shortened to 26 items. This procedure was not preceded by a validity check, which implies that we should interpret the results regarding the verbal cognitive outcomes with some caution. Also, although the developer of the *Taaltests voor Kinderen* reports validation of the instrument ([Bon, 1982](#)), no additional studies have been conducted to test the instrument validity, which can

be considered a limitation as well. However, although the estimate of reliability for the measure of verbal intelligence at 6-year-old was questionable, low reliability is problematic primarily because this could lead to an under-estimation of relationships. As this scale had an acceptable loading on the latent variable of cognitive functioning at 6 years of age, and effects of other variables on this variable were sizeable and in the expected direction, it appears that the scale performed as expected. Similarly, the reliability of playful involvement was low. However, it is unclear whether the customary rules of thumb for Cronbach's alpha apply when a scale consists of only two items. Despite the low reliability, factor loadings for the two items were good (0.91 and 0.63), and the scale related to other constructs as predicted.

Third, in the present study, we focused on the extent to which parents equally shared responsibility for playful and teaching-related activities with their children. Although we elaborated on three pathways that could possibly explain linkages between the extent to which fathers and mothers shared childcare responsibilities and children's cognitive development, we were not able to put these pathways to the test. Given that our study found evidence for linkages between parents' equal share of childcare responsibilities and children's cognitive development, and given that our additional analyses suggest that these linkages are not driven by selection in parents' socio-economic characteristics, putting (some of) the three causal pathways to the test might be an important step for future research.

In conclusion, our study provided a novel investigation of the influence parents have on their children's cognitive development, in specific, the role that parents' equally sharing childcare responsibilities plays in the intergenerational transmission of (dis)advantages. Our results revealed some evidence for the idea that the effect of parents' educational attainment on children's cognitive development is partially explained by the extent to which parents equally share childcare responsibilities. Our findings also suggest that policies and programmes that encourage fathers and mothers to equally share responsibility for playful activities may help promote children's cognitive development.

Supplementary Data

[Supplementary data](#) are available at ESR online.

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