Tomás Cano Pompeu Fabra University

Francisco Perales and Janeen Baxter The University of Queensland*

A Matter of Time: Father Involvement and Child Cognitive Outcomes

Objective: *This study provides the first systematic account of how father–child time (in total and across activity types) relates to children's cognitive development as well as examining whether paternal education moderates these associations.*
Background: *Fathers in Western countries allocate progressively more time to child care. However, most research on how parental time inputs affect child development focuses on maternal time. It remains unclear how paternal involvement in the child's upbringing influences child outcomes.*
Method: *The study uses three waves of unique, longitudinal, time-diary data from an Australian national sample of children aged 4 to 8 years (Growing Up in Australia: The Longitudinal Study of Australian Children;* N = *3,273 children, 6,960 observations). Children's cognitive development is measured using the Peabody Picture Vocabulary Test. The data are modeled using a range of estimation strategies for panel data.*
Results: *The total amount of father–child time is associated with, at best, small improvements in children's cognitive functioning. In contrast, the amount of father–child time in educational activities is associated with moderate to large improvements. Such associations are similar for highly and less-highly educated fathers.*
Conclusion: *Our findings are relevant for policy and practice, being indicative that enabling paternal involvement in their children's upbringing should bring moderate to high gains to their children in terms of cognitive functioning, particularly if paternal involvement is directed at educational activities.*

During the past few decades many Western countries have witnessed a rise in fathers' involvement in child care, defined as the time father and child spend together (Gauthier et al., 2004). This shift has been attributed to increasing maternal labor force participation and the spread of gender egalitarian and intensive parenting ideologies (Esping-Andersen, 2009). In this emerging model of involved fatherhood, fathers are not only expected to act as income providers but also to actively engage with the day-to-day caring and upbringing of their children (Barbeta & Cano, 2017).

The importance of fathers' involvement in child care is twofold. First, it can be a precursor to increasing gender equality within families, by "freeing up" time for mothers to develop their skills, (re-)enter the labor market, and realize their economic potential (Hook, 2006). Second, theoretical perspectives in sociology, psychology, and economics suggest that fathers'

DemoSoc Research Unit, Pompeu Fabra University, Carrer de Ramon Trias Fargas, 25, 08005 Barcelona, Spain (tomascl010@gmail.com).

*ARC Centre of Excellence for Children and Families over the Life Course, The University of Queensland, Long Pocket Precinct, 80 Meiers Road, QLD 4068, Brisbane, Australia.

Key Words: children and child development, family, fathers, inequalities, longitudinal research.

DOI:10.1111/jomf.12532

time in child care should be positively associated with child development (Cabrera, Shannon, & Tamis-LeMonda, 2007; Pleck, 2010). For instance, children with involved fathers are exposed to more varied stimuli, resulting from interacting with two parents with different values, behaviors, vocabulary, and parenting styles, and this can lead to better cognitive outcomes for the child (Lamb, 2010).

The increasing availability of quality time-use data on families has spurred a wave of research and academic debate on whether and how parental time investments contribute to child development. Recent studies have focused on the time allotments made by mothers (e.g., Del Bono, Francesconi, Kelly, & Sacker, 2016; Fomby & Musick, 2017; Hsin & Felfe, 2014; Milkie, Nomaguchi, & Denny, 2015) or parents in general (Fiorini & Keane, 2014). The findings are mixed. Although some authors find that maternal time is an important determinant of children's cognitive functioning (Del Bono et al., 2016), others report very small associations (Fomby & Musick, 2017) and no relationship (Milkie et al., 2015). This research has motivated a lively discussion on the topic (see Kalil & Mayer, 2016; Nomaguchi, Milkie, & Denny, 2016; Waldfogel, 2016; Wolfers, 2015). Importantly, some studies suggest that not all types of parental time are beneficial for children (Fiorini & Keane, 2014; Hsin & Felfe, 2014). Activity content matters, and parent–child time spent in educational activities is comparatively more productive than parent–child time spent in other activities (Hsin, 2009). However, this literature has largely neglected how the time children spend with their fathers (as opposed to their mothers or any parent) influences child outcomes. This study fills this gap in knowledge by considering father–child time in its own right.

We contribute to the literature on father's involvement in childrearing and the incipient literature on parental time investments and child outcomes in two main ways. First, we use detailed time-use information on the amount of time fathers spend with their children and the nature of their joint activities. This contrasts with previous research relying on coarse proxy measures for parental time investments, such as employment hours (Bernal, 2008), or considering certain types of time in isolation, such as educational or recreational time (Del Bono et al., 2016). Second, we consider effect heterogeneity by paternal education (Lareau, 2011). Time-use research indicates that more-educated parents spend more time with their children than less-educated parents and also allocate more time to shared activities that enhance child development (Guryan, Hurst, & Kearney, 2008). This time expenditure gap is widening over time (Altintas, 2015; Putnam, 2015). Hence, if fathers' time in child care has positive impacts on children's cognitive capacities, it could be a contributing factor to the intergenerational (re)production of inequalities and the diverging destinies of children from more and less advantaged families (Kalil, Ryan, & Corey, 2012; McLanahan, 2004).

The goal of this article is therefore to provide the first encompassing empirical account of the associations between father–child time and children's cognitive outcomes, focusing on two-parent families. To accomplish this, we use high-quality, time-diary, panel data from The Longitudinal Study of Australian Children (LSAC).

Theoretical Framework

Cognitive skills are core skills that relate to individual learning and problem solving and encompass aspects such as attention, memory, reasoning, and thinking. These crucial skills enable individuals to process sensory information (e.g., evaluate, analyze, remember, make comparisons, etc.) and are important precursors of academic success (Duncan et al., 2007) and labor market outcomes (Heckman, 2006). Cognitive skills develop at a faster rate during childhood, when brain plasticity is greatest, and through children's interactions with their parents, relatives, and peers in their school, neighborhood, and family home (Shonkoff, Phillips, & National Research Council, 2000). Hence, such skills are socially reproduced, transmitted from generation to generation, and highly dependent on the socioeconomic context in which childhood takes place. In the following sections, we draw on principles from developmental psychology, economics, and social stratification research and previous empirical evidence to develop testable hypotheses about how father–child time contributes to shaping children's cognitive outcomes.

Although father and child may undertake activities that also involve the child's mother, here we focus on the time that fathers spend with their children without maternal involvement. During that time, it is safe to assume that the sole (or chief) responsibility for the child rests on the father. We take this course of action because when the child shares time with both mother and father, parents tend to adopt gender-typical roles: mothers can act as gatekeepers to father–child interactions and decision making, whereas fathers often enact a secondary role as helpers, taking direction from mothers (Coltrane, 1996; Pleck, 2010). Importantly, we are interested in the effect of paternal time in its own right, as it remains unclear whether and how this type of time is related to children's cognitive outcomes. This separates our study from previous research focusing on mother–child time (see, e.g., Del Bono et al., 2016; Fomby & Musick, 2017; Hsin & Felfe, 2014; Milkie et al., 2015) or time spent between the child and any parent (see, e.g., Fiorini & Keane, 2014). We consider the following two separate components of father–child time: (a) the quantity of time that fathers spend with their children and (b) the content of the joint activities undertaken during that time.

Father–Child Time Quantity

To our knowledge, no previous study has provided an encompassing empirical account of how the amount of time that fathers spend engaging with their children affects child development. However, this type of time has been previously recognized as an important dimension of father's involvement in the child's upbringing (Russell, 1983; Wilson & Prior, 2011). Different theoretical perspectives suggest plausible mechanisms that link the amount of father–child time with children's cognitive development.

First, spending time with the father may benefit the child by exposing him or her to two involved parental figures instead of just one. A vast majority of mothers are highly involved in the day-to-day care of their children, but this is the case for only a fraction of fathers (Craig, 2006). Hence, to the extent that mother and father are different in their behaviors and personalities, father's involvement may result in greater heterogeneity in the stimuli to which the child is exposed (Amato, 1998; Lamb, 2010). For example, fathers and mothers tend to spend time with their children in different ways: Mothers spend a greater share of time in routine care, whereas fathers spend a greater share in playful and educational activities (Craig & Mullan, 2011; McBride & Mills, 1993). In addition, fathers and mothers talk differently to their children and have different conversation topics (Pancsofar & Vernon-Feagans, 2006). Fathers' language skills are more predictive of children's vocabulary than mothers' and have been argued to afford children extra capabilities in talking to strangers and in public settings (Rowe et al., 2004). During play, fathers are more likely than mothers to encourage their children to take risks, whereas mothers are more likely than fathers to encourage them to take account of others' feelings (Clarke-Stewart, 1978). Diversity in parental inputs should result in enhanced cognitive capacity in the child (Cook, Roggman, & Boyce, 2011). This is because, as argued in social learning theory, skills are acquired by observation (Bandura, 1977). Similarly, as posed by role model theory, "individuals influence role aspirants' achievements, motivation, and goals by acting as behavioral models, representations of the possible, and/or inspirations" (Morgenroth, Ryan, & Peters, 2015, p. 4). Hence, an involved father can act both as a role model for children to reinforce, adopt, and pursue goals, and as an observation point for them to learn problem-solving behaviors. These interactions should promote child development in both cognitive and noncognitive skills, and these are known to be mutually reinforcing—skills beget skills (Heckman, 2006).

Second, regardless of whether fathers exert different parenting to mothers, the time fathers spend with their children may be a substitute for time spent with other guardians. That is, spending more time with a father may mean spending less time with individuals who are less interested in, less committed to, or less able to enhance the child's cognitive upbringing than a father (Cooke & Baxter, 2010). For example, when fathers do not spend time with their children, relatives (e.g., grandparents), neighbors, or external carers (e.g., au pairs or nannies) may take responsibility for the child. The activities and interactions that the child undertakes with these other agents may be less conducive to cognitive development than those initiated by fathers (Belsky et al., 2007). This could occur if the alternative guardians are less educated or less knowledgeable about parenting practices than that child's father (which may be the case for grandparents) or have less knowledge about the child's abilities and dispositions (which may be the case for external carers). It is also possible that paternal time acts as a substitute for time alone. Therefore, paternal time with the child may have a positive effect on child outcomes through substitution by "crowding out" less productive time uses.

Third, fathers' involvement in child care improves certain aspects of family life, which may in turn have downstream positive effects on the child (Lamb, 2010; Pleck, 2010). Increasing father–child time expenditure shifts some of the child-care burden away from mothers. In doing so, it eases maternal time pressure and work–family conflict and frees up time for mothers to increase their social and economic participation or to spend on leisure (Kalil, Ziol-Guest, & Coley, 2005). Critically, paternal involvement in child care is a contributing factor to maternal employment, and this is associated with better child cognitive development (see, e.g., Brooks-Gunn, Han, & Waldfogel, 2002). In contrast, low paternal involvement in child care can exacerbate maternal stress and mental strain and result in suboptimal parenting practices amongst mothers through parenting stress (Kalil et al., 2005; Schober, 2012). Therefore, greater paternal involvement in child care should indirectly enhance the quality of mother–child relationships and, through that channel, the child's cognitive development (Lamb, 2010). In addition, families in which fathers contribute to child care are characterized by a range of positive outcomes (Goeke-Morey & Cummings, 2007), including positive parenting practices (Jia, Kotila, & Schoppe-Sullivan, 2012) and a lower propensity for family breakdown (Kalil & Rege, 2015). In these circumstances, parents may behave in richer ways toward each other and the child, creating a safe and warm environment that is conducive to children's learning and improved cognitive functioning (Lamb, 2010). Based on these postulations, we expect the following: Hypothesis 1—More father–child time should be related to better child cognitive outcomes.

As noted, empirical literature in this area is limited. Most previous studies have lacked time-use data, having to resort to poor proxies of paternal time allocations to the child (for a review, see Sarkadi, Kristiansson, Oberklaid, & Bremberg, 2008). In these studies, the general finding is that fathers' time availability enhances children's cognitive development, particularly among children from disadvantaged backgrounds. Closest to our research are Hofferth (2006) and Milkie et al. (2015), two U.S. studies that leverage time-diary data from the Panel Study of Income Dynamics Child Development Supplement (PSID-CDS). Both of these found no relationships between father–child time (measured as hours per week of time accessible to and engaged with the child) and children's academic and behavioral outcomes. Our study expands their scope by considering the content of the father–child shared activities, effect differences by parental education, and longitudinal estimation.

The Importance of Father–Child Time Content

There is growing recognition that activity content is important when considering the effects of parent–child time on children. As Hsin (2009) puts it, the "simple quantity of time by itself is not sufficient for producing positive achievement outcomes in children [...] the returns to time investments depend on the amount of cognitive stimulation parents provide during that time" (p. 125). Some commentators go as far as arguing that high-quality parent–child time is more important to child development than high-quantity parent–child time (Amato, 1998).

Exposure to different types of activities has different consequences for the child's cognitive development (Hsin, 2009). Activities such as reading, playing games, doing homework, and participating in social events are argued to be associated with positive child outcomes. This is because, in undertaking these activities, children exercise their thinking skills, and this stimulates and contributes to building their brain structure (Diamond & Lee, 2011; Takeuchi et al., 2015). More important, when these activities are undertaken with an engaged adult and more specifically a parent, they provide opportunities for the child to improve his or her reasoning, analysis and problem-solving skills through parental role modeling, direct instruction, and language exchanges (Lareau, 2011; Waldfogel, 2006). That is, these activities are more stimulating for the child if shared with the father (or mother), which should have positive consequences on the child's cognitive development. In contrast, when the child and the father (or mother) spend their joint time in other activities, such as unstructured activities (e.g., watching television) or routine care (e.g., helping the child wash or dress), their interactions may be fewer and less intense and consequently less conducive to children's cognitive development (Hsin & Felfe, 2014). For example, father and child may talk less and in a less engaged way when watching television compared to when playing a board game.

Recent time-use research on how parent–child time in different activity types affects child outcomes has focused on time between the child and the mother (Hsin & Felfe, 2014) or any parent (Fiorini & Keane, 2014), but to date has neglected father–child time. These studies typically split parent–child time into two or three categories according to the type of activity. The most common categories are educational time (i.e., activities that have clear learning components, e.g., reading, playing games), structured time (i.e., scheduled activities, e.g., dance lessons, organized sport); routine care time (i.e., activities aimed at covering basic child needs and that are usually time fixed, e.g., helping the child eat, bathe, or dress); and unstructured time (i.e., activities without a clear structure, e.g., media activities such as watching television, and vague categories, such as other play or doing nothing).

Within this literature, there is consensus that educational time with the mother (Hsin & Felfe, 2014) or any parent (Fiorini & Keane, 2014) is more valuable for children's cognitive outcomes than joint time in other activities. The hierarchy across other activities is less clear. In analyses of PSID-CDS data, Hsin and Felfe (2014) found that the most productive input for children's cognitive development after educational time was structured time, followed by a catch-all reference category capturing all other time uses, and finally unstructured time. In their analyses of verbal ability using LSAC data, Fiorini and Keane (2014) used a more nuanced time categorization. Their value-added model yielded the following hierarchy of time inputs, from most to least productive: educational time spent with parents, educational time with nonparents, media time, social time, general care with parents, general care with nonparents, bed time, and school time.

Although there is no available evidence on how activity type shapes the relationships between father–child time and child outcomes, we expect the associations to be similar to those for mother–child time or parent–child time. We therefore hypothesize the following: Hypothesis 2—Father–child time in educational activities will be more conducive to child cognitive development than father-child time in other activities.

Effect Heterogeneity by Paternal Education

Different bodies of work lead to the prediction that parental education should moderate the effect of father–child time on children's cognitive outcomes. The amount of time parents spend with their children and the content of such time have been shown to differ markedly by social strata (Bonke & Esping-Andersen, 2011; Cha & Song, 2017; Craig & Mullan, 2011; Guryan et al., 2008; Kalil et al., 2012). First, highly educated parents spend more time with their children than less highly educated parents (for a review, see Monna & Gauthier, 2008). For instance, Australian fathers with university degrees spend about 10 more minutes per day with their children than Australian fathers without university degrees (Craig, Powell, & Smyth, 2014). Second, there is evidence of heterogeneity by parental education in the content of the activities that fathers and children share when they spend time together. In particular, highly educated parents engage more in activities that stimulate children's cognitive functioning, such as educational play (Altintas, 2015; Kalil et al., 2012). In addition, highly educated parents are comparatively better in tailoring shared activities to their children's age and developmental stage (Kalil et al., 2012). Collectively, these arguments suggest that father–child time should have a stronger positive effect on child outcomes when fathers have high levels of education.

Furthermore, there are reasons to expect higher returns to father–child time among children of more-educated fathers, net of differences in the amount and content of father–child time. Highly educated fathers dispose of a wider set of skills and sociocultural capital than lowly educated fathers, including problem solving, information seeking, and language abilities (Mirowsky & Ross, 2003) and hold higher expectations for their children (Davis-Kean, 2005). Highly educated fathers can use their sociocultural capital to acquire, develop, and exert cognitively stimulating parenting practices that enhance children's cognitive development. They have both more to transfer to their offspring as well as a greater predisposition to transfer (Bourdieu & Passeron, 1990). For example, children of more educated fathers will be exposed to broader, more complex, and more sophisticated vocabulary and knowledge inputs from their parents during both highly productive shared activities (e.g., educational play) and not so productive shared activities (e.g., unstructured time). Therefore, children of more highly educated parents are likely to attain greater cultural capital, reaping its benefits on cognitive outcomes (Harding, Morris, & Hughes, 2015 for a review; Jæger & Breen, 2016; Lareau, 2011). Altogether, we hypothesize the following: Hypothesis 3—Fathers' total time with children (as well as time on each activity type) will show a stronger positive association with children's cognitive outcomes when parents are highly educated.

Data and Methods

Data Set and Sample Selection

We use data from LSAC. LSAC is a biannual birth-cohort study that since 2004 collects information on Australian children and their families from the study child, his or her parents, and a teacher or carer through a combination of face-to-face and self-complete questionnaires. The LSAC sample was identified using complex probabilistic methods and is largely representative of two cohorts of Australian children: one born between March 1999 and February 2000 ($n = 4{,}983$ children) and one born between March 2003 and February 2004 ($n = 5{,}107$ children). For further details on the study's methodology, see Australian Institute of Family Studies (2002).

LSAC is one of only two longitudinal studies in the world (with the U.S. PSID-CDS) to collect 24-hour time-use diaries for children on multiple occasions. Parents (or the study child, depending on his or her age) provide detailed information about what the child was doing as well as where and with whom the child was, splitting the day into 96 15-minute intervals. This was done for 2 days allocated at random, a weekend day and a weekday (Mullan, 2014). The LSAC time-diary data have some advantages over the analogous PSID-CDS data: It features a much larger analytical sample (approximately 10,000 children in LSAC, compared to approximately 3,500 in the PSID) and closer observation points (2 years in LSAC compared to 5 years in PSID-CDS).

We restrict our analyses to children in the older LSAC cohort and to study Waves 1 (2004), 2 (2006), and 3 (2008), when these children were aged 4, 6, and 8 years, respectively. We focus on this subsample for both theoretical and pragmatic reasons. Theoretically, this age range (particularly 4–6 years) constitutes a sensitive period in children's skill acquisition and a life course stage in which gaps in cognitive skills between advantaged and disadvantaged children begin to widen (Cunha & Heckman, 2007; Ermisch, Jäntti, & Smeeding, 2012). Pragmatically, the collection of the LSAC time-use diaries for the selected cohort changed drastically between study Waves 1 to 3 and study Waves 4 to 6 in ways that hamper comparability. In the latter waves, diaries were no longer filled by parents but by study children themselves, and there were substantial changes in the coding of the activities. In addition, our measure of cognitive ability was only collected in LSAC Waves 1 to 3 for the selected cohort. An example of the LSAC time-use instrument used in the analyses can be found online (http://data.growingupinaustralia.gov.au/studyqns/wave1qns/TUD14.pdf). The vast majority of diaries were collected between mid-March and the end of September, which purposively skips the longer summer school break in Australia (December–January).

We restrict our analyses to children living with both biological parents. This is because the processes linking parent–child shared time-use and children's cognitive development are more complex in other family types, such as single-parent families, step families, and reconstituted families (Furstenberg, 1988; Hofferth, 2006). We excluded observations with missing information on the day in which the time diary was completed ($n = 7$), in which only one of the two time diaries had been completed ($n = 468$), and those that, as an error, had duplicated diaries ($n = 35$). In addition, we excluded observations with missing information on the outcome variable capturing cognitive functioning ($n = 298$), father's or mother's education ($n = 67$), and Indigenous status ($n = 55$). Our final analytical sample comprises 6,960 observations from 3,273 children. In this sample, 91.2% of the weekday time-use diaries were completed by the child's mother, 6.2% by the father, and 2.6% by another person or an unspecified person. Of the weekend time-use diaries, 88.4% were completed by the child's mother, 7.8% by the father, and 3.8% by someone else or an unspecified person.

Key Explanatory Variables: Total Father–Child Time

LSAC includes a variable capturing who was with the child in each of the 96 15-minute blocks that comprise a day. To derive our measure of total father–child time we first sum up each of the blocks in which the child was reportedly spending time with the father, except for those in which the mother was also present. Following previous studies (see, e.g., Bianchi, Robinson & Milkie, 2006; Hofferth, 2006; Milkie et al., 2015), we undertook separate summations for the number of father–child hours in the weekday and weekend day diaries. We then derived an estimate of weekly father–child hours by multiplying the weekday diary amount by 5 and the weekend-day diary amount by 2 and summing the resulting figures. Hence, our measure of total father–child time is an estimate of the total number of hours per week that the father spends as the main carer of the child. Similar measures were created for time with the mother alone, mother and father together, and neither father nor mother. When a 15-minute time block did not contain information on who was with the child, we allocated that time to a residual category (unknown).

Key Explanatory Variables: Activity Categories

In the study waves that we use, the parents could choose one or more activities from a list of 22 to 24 precoded activities for each 15-minute interval when completing the LSAC time-use diaries. Similar to Hsin and Felfe (2014) and Fiorini and Keane (2014), we recoded these activities into the following eight categories: (a) educational, (b) routine, (c) unstructured, (d) social, (e) school or kindergarten, (f) structured, (g) sleep, and (h) unknown. See Table S1 in the Supplementary Online Materials for further details. Then, for each of the three time categories of key analytic interest (educational, structured, and unstructured time), we derived variables capturing the amount of time the child spent on that category with (a) the father alone, (b) the mother alone, (c) the mother and the father together, and (d) neither father nor mother. Again, we allocated missing data to the residual activity category unknown, with some exceptions. Following Fiorini and Keane, we recoded missing data for activities occurring between 10:00 p.m. and 6:00 a.m. as sleep time. In Wave 1, we recoded missing data for activities between 8:00 a.m. and 3:00 p.m. in weekdays as school or kindergarten time. In Waves 2 and 3 (ages 6–8), when school is mandatory, we recoded all time between 8:00 a.m. and 3:00 p.m. in weekdays as school time. This is because most Australian children of those ages attend school or formal child care and missing data were comparatively more prevalent during those times (Baxter, 2007). Where parents reported multiple activities for a single 15-minute time slot and these activities belonged to different activity groups, we allocated a portion of those 15 minutes to each of the groups. For example, if a parent reported that the child was both doing homework and listening to music, we would allocate 7.5 minutes to educational activities and 7.5 minutes to unstructured time. After these adjustments, our time categories add up to 168 hours or the total number of hours in a week.

Outcome Variable: Children's Cognitive Outcomes

Children's cognitive ability is captured by their scores in a short version of the Peabody Picture Vocabulary Test, version three (PPVT-III) administered by a survey interviewer. The PPVT-III is a validated and widely used psychometric test that measures children's knowledge of the meanings of spoken words and their receptive vocabulary (Dunn & Dunn, 1997). Its implementation involves an examiner presenting the child with four images together with a word that describes one of these images. The examiner then asks the child to identify the appropriate image. The complexity of the words and images varies by child's age to match the test's difficulty with developmental stages. PPVT scores range from 0 to 100, where higher scores denote higher cognitive ability. Across all children and study waves in our sample, the PPVT has a mean of 72.75 ($SD = 7.77$; see Table 1).

Control Variables

In our multivariate models we adjust for a set of control variables commonly used in studies of children's cognitive development. These include (a) study child characteristics—sex (male/female), ethnicity (Indigenous/not Indigenous), low birth weight (below 2.5 kg/2.5 kg or more) and age (in months)—and (b) family characteristics—father's and mother's weekly

Table 1. *Descriptive Statistics for Analytic Variables*

Variable	Mean/%	*SD*	Minimum	Maximum
Outcome variable				
Peabody Picture Vocabulary Test	72.75	7.77	34.18	96.98
Weekly time spent…				
Alone with father	6.92	10.39	0	142.5
Alone with mother	26.46	23.25	0	168
With mother and father together	34.80	33.38	0	168
With neither mother nor father	95.40	40.07	0	168
Unknown	4.41	4.43	0	34.25
Weekly time in different activity types				
With father				
Educational activities	0.70	1.62	0	21.12
Structured activities	0.94	2.21	0	38.25
Unstructured activities	1.36	2.79	0	33.62
With mother			0	
Educational activities	2.72	3.71	0	33.56
Structured activities	2.17	3.30	0	37.35
Unstructured activities	4.77	6.13	0	56.25
With mother and father together			0	
Educational activities	2.46	3.34	0	35.12
Structured activities	1.76	2.99	0	30.88
Unstructured activities	4.91	5.44	0	55.46
With neither mother nor father			0	
Educational activities	2.60	3.81	0	42.50
Structured activities	5.22	6.69	0	59.50
Unstructured activities	5.29	7.12	0	42.50
Time in other activities			0	
Attending school/kindergarten	23.84	11.04	0	61.25
Social activities	4.87	6.86	0	99.12
Routine care	18.49	6.18	0	62.00
Sleeping	78.22	6.66	20.75	126.54
Unknown	7.66	7.99	0	45.37
Control variables				
Child's age (in months)	80.67	19.74	51	114
Child is female	49%		0	1
At least one other child in household	43%		0	1
Child speaks English at home	91%		0	1
Child is indigenous	2%		0	1
Child had low birth weight	5%		0	1
Child's father has a university degree	34%		0	1
Child's mother has a university degree	36%		0	1
Family income, in $10,000	10.30	6.54	0	71.28
Child's father weekly work hours, in tens	4.51	1.53	0	10
Child's mother weekly work hours, in tens	1.69	1.62	0	10
Both diaries completed in ordinary day	56%		0	1
Child's mother completed both diaries	85%		0	1

Note. Longitudinal Study of Australian Children. K Cohort, Waves 1 to 3. Observations are pooled across waves. N(observations) = 6,960; N(children) = 3,273.

work hours (expressed in tens), father's and mother's highest educational qualification (university degree/lower than university degree), parental annual income (mothers' plus fathers' weekly income times 52, adjusted for inflation using the Consumer Price Index), presence of a study child's sibling at home (yes or no), and language spoken at home (English or other language). In addition, all models control for a set of dummy variables denoting whether both the weekday and weekend time diaries were completed on ordinary days and whether it was the mother (vs. anyone else) who completed both diaries. Table 1 shows means and standard deviations for all control variables.

Estimation Approach

In our main analyses, we examine the relationships between paternal time investments and children's cognitive functioning using the following two estimation techniques: (a) ordinary least squares (OLS) models similar to those used in previous studies (see, e.g., Fomby & Musick, 2017; Milkie et al., 2015) and (b) longitudinal value-added models that make better use of the panel data at hand (previously used in Fiorini & Keane, 2014). The OLS models used to test the time-quantity hypothesis (Hypothesis 1) take the following form:

$$\mathrm{PPVT}_{\mathrm{ct}} = \beta_0 + \beta_1 \mathrm{T}_{\mathrm{ct}} + \beta_2\, \mathrm{F}_{\mathrm{ct}} + \beta_3\, \mathrm{M}_{\mathrm{ct}} + \beta_4\, \mathrm{X}_{\mathrm{ct}} + e_{\mathrm{ct}} \qquad (1)$$

where subscripts *c* and *t* refer to child and time period, respectively; *T* captures all time inputs; *F* and *M* denote paternal and maternal characteristics, respectively; *X* is a vector of other control variables; β_0 is the model's grand intercept; β_1 to β_4 are coefficients or vectors of coefficients to be estimated; and *e* is the usual random error term. The standard errors are adjusted for the clustering of observations within children. We run OLS models with basic covariates (child's age and gender, diary characteristics) to establish basic associations, and more conservative models with extended covariates (adding also information on birthweight, Indigeneity, siblings, language spoken at home, parental education and work hours, and family income). The value-added model takes into account the correlation between current and previous outcomes and thus considers that children's skills develop cumulatively (for details, see Todd & Wolpin, 2007). This is accomplished by including a lag of the outcome variable ($\mathrm{PPVT}_{\mathrm{ct}-1}$) among the model predictors:

$$\mathrm{PPVT}_{\mathrm{ct}} = \beta_0 + \beta_1 \mathrm{T}_{\mathrm{ct}} + \beta_2\, \mathrm{F}_{\mathrm{ct}} + \beta_3\, \mathrm{M}_{\mathrm{ct}} + \beta_4\, \mathrm{X}_{\mathrm{ct}} + \beta_5\, \mathrm{PPVT}_{\mathrm{ct}-1} + e_{\mathrm{ct}} \qquad (2)$$

These value-added models are better equipped to reduce the possible bias introduced by the fact that parental time investments may be endogenous to children outcomes; that is, that parents may decide how much time they spend with their children based on their cognitive development or other unobserved traits of the parent or the child. Value-added models are estimated using the extended set of covariates.

To test the time-content hypothesis (Hypothesis 2), we substitute the time-investment variables in Equations 1 and 2 by more detailed variables that also consider activity type (as described previously). To test the effect heterogeneity hypothesis (Hypothesis 3), we expand all previous models by interacting the time-investment and paternal education variables.

RESULTS

Children's Time Use

The mean amount of weekly father–child time across all child-year observations in our pooled sample was 6.92 hours (*SD* = 10.39), substantially lower than for mother–child time (*M* = 26.46; *SD* = 23.25) or time with mother and father together (*M* = 34.80; *SD* = 33.38; see Table 1). When considering different activity types, weekly father–child time was 0.70 hours (*SD* = 1.62) in educational activities, 0.94 hours (*SD* = 2.21) in structured activities and 1.36 hours (*SD* = 2.79) in unstructured activities. These figures were again much lower than those for mother–child time—2.72 hours (*SD* = 3.71) in educational activities, 2.17 hours (*SD* = 3.30) in structured activities, and 4.77 hours (*SD* = 6.13) in unstructured activities—and time with mother and father together: 2.46 hours (*SD* = 3.34) in educational activities, 1.76 hours (*SD* = 2.99) in structured activities, and 4.91 hours (*SD* = 5.44) in unstructured activities. Altogether, these results are consistent with previous evidence,

Table 2. *Regression Models of Children's Peabody Picture Vocabulary Test Scores, Time Quantity*

	OLS		OLS		VA	
Predictor	β	*SE*	β	*SE*	β	*SE*
Weekly time spent with…(reference category: With neither mother nor father)						
Alone with father	0.027***	0.006	0.020***	0.006	0.018*	0.007
Alone with mother	−0.002	0.003	−0.003	0.003	−0.001	0.003
Together with mother and father	−0.004	0.002	−0.002	0.002	0.001	0.002
Unknown	−0.006	0.016	0.006	0.015	−0.014	0.016
Basic controls						
Child's age (in months)	0.292***	0.003	0.288***	0.003	0.045***	0.008
Child is female	0.085	0.156	−0.006	0.148	−0.453***	0.137
Both diaries completed in ordinary day	−0.193	0.129	−0.088	0.124	−0.142	0.141
Child's mother completed both diaries	0.022	0.198	−0.031	0.187	−0.009	0.188
Extended controls						
At least one other child in household			−0.822***	0.148	−0.420**	0.142
Child speaks English at home			2.583***	0.275	0.554*	0.260
Child is Indigenous			−0.608	0.494	0.241	0.426
Low weight at birth			−1.418***	0.345	−0.395	0.307
Child's father has university degree			1.240***	0.171	0.962***	0.160
Child's mother has university degree			1.122***	0.168	0.469**	0.161
Family income, in $10,000			0.056***	0.012	0.024*	0.011
Father's weekly work hours, in tens			0.038	0.048	−0.018	0.052
Mother's weekly work hours, in tens			−0.094*	0.046	−0.052	0.045
Lag of PPVT score					0.386***	0.015
Intercept	49.290***	0.385	46.212***	0.485	45.124***	0.792
R^2	0.548		0.580		0.391	
AIC/BIC	42,796/42,857		42,291/42,414		20,653/20,771	
N (children)/*N* (observations)	3,273/6,960		3,273/6,960		2,215/3,628	

Note. Longitudinal Study of Australian Children. K Cohort, Waves 1 to 3. AIC = akaike information criteria; BIC = bayesian information criterion; OLS = ordinary least squares; PPVT = Peabody Picture Vocabulary Test; VA = value added. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

pointing to lower paternal than maternal involvement in child care (Craig, 2006) and higher heterogeneity in involvement among mothers than fathers (Craig & Mullan, 2011). When fathers spend time with their children, the mother is typically also present.

Hypothesis 1: Father-Child Time Quantity

Table 2 shows the results from a first set of regression models examining the associations between total father–child time and children's PPTV scores. Because time-use measures add up to 168 hours, due to collinearity, one of them must be left out of the model to serve as reference category (Fiorini & Keane, 2014). Here, we excluded the variable capturing time with neither father nor mother. Relative to 1 hour of time spent with neither father nor mother, 1 hour of father–child time was associated with improved children's PPVT scores in the OLS models with basic ($\beta = 0.027$; $p < .001$) and extended ($\beta = 0.020$; $p < .001$) covariates and in the value-added model ($\beta = 0.018$; $p < .05$). These results are consistent with our first hypothesis. However, the magnitude of the estimated associations was very small: 5 additional weekly hours of father–child time increased PPVT scores by about 1.2% to 1.7% of a standard deviation. This pattern of weak results is nevertheless consistent with recent U.S. findings for mothers (Hsin & Felfe, 2014; Milkie et al., 2015). Mother–child time and time with both father and mother were not statistically related to the child's PPVT scores in any of our models ($p > .05$), and the results on the control variables were generally consistent with expectations and will not be discussed further.

Table 3. *Regression Models of Children's Peabody Picture Vocabulary Test Scores, Time Content*

	OLS		OLS		VA	
Predictor	*β*	*SE*	*β*	*SE*	*β*	*SE*
Weekly time in activity types (reference category: time sleeping)						
With father						
Educational activities	0.263***	0.043	0.199***	0.042	0.138**	0.047
Structured activities	0.133***	0.030	0.104***	0.029	0.026	0.032
Unstructured activities	0.065**	0.025	0.042	0.024	0.045	0.032
With mother						
Educational activities	0.143***	0.022	0.106***	0.021	0.044	0.026
Structured activities	0.101***	0.022	0.077***	0.022	0.030	0.024
Unstructured activities	0.012	0.017	0.006	0.016	−0.013	0.023
With mother and father together						
Educational activities	0.159***	0.023	0.131***	0.022	0.094***	0.026
Structured activities	0.078**	0.026	0.065**	0.025	0.033	0.025
Unstructured activities	−0.019	0.016	−0.010	0.015	0.003	0.019
With neither mother nor father						
Educational activities	0.112***	0.021	0.094***	0.020	0.068**	0.021
Structured activities	0.056***	0.013	0.041**	0.013	0.015	0.015
Unstructured activities	0.000	0.015	0.006	0.014	0.022	0.018
Time in other activities						
Attending school/kindergarten	0.045***	0.012	0.042***	0.012	0.007	0.014
Social activities	0.045***	0.012	0.032**	0.012	−0.009	0.012
Routine care	−0.004	0.014	0.006	0.014	0.006	0.015
Unknown	0.085***	0.013	0.075***	0.013	0.024	0.014
Basic controls	Yes		Yes		Yes	
Extended controls	No		Yes		Yes	
Lag of PPVT score	No		No		Yes	
R^2	0.565		0.590		0.398	
AIC/BIC	42,551/42,695		42,151/42,356		20,635/20,827	
N (children)/*N* (observations)	3,273/6,960		3,273/6,960		2,215/3,628	

Note. Longitudinal Study of Australian Children. K Cohort, Waves 1 to 3. Full set of estimates available from the authors upon request. AIC = akaike information criteria; BIC = bayesian information criterion; OLS = ordinary least squares; PPVT = Peabody Picture Vocabulary Test; VA = value added. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Hypothesis 2: Father–Child Time Content

In a second set of models (Table 3), we examined the associations between children's PPVT scores and time spent between children and parents on different types of activities. Here, following Fiorini and Keane (2014), we left out sleep time as the reference category. Consistent with Hypothesis 2, our results yielded evidence of productivity hierarchies in father–child time by activity type. In the OLS models with base controls, the largest associations with PPVT scores were found for father–child time in educational activities ($\beta = 0.263$; $p < .001$), followed by structured activities ($\beta = 0.133$; $p < .001$), and finally unstructured activities ($\beta = 0.065$; $p < .01$). In the OLS model with extended covariates, a similar hierarchy could be observed—with the coefficient on time spent on unstructured activities no longer being statistically significant ($p > .05$). In the value-added model, only the coefficient on father–child time in educational activities remained statistically significant ($\beta = 0.138$; $p < .01$), with Wald tests (not shown) revealing that this was larger than the coefficients on structured and unstructured time ($p \leq .05$). To get a sense of the magnitude of the association, 5 additional weekly hours of father–child time in educational activities would increase PPVT scores by 9% of a standard deviation. Whereas the same productivity ranking across time-use categories could be observed for mother–child time and time with both parents, none of the coefficients on mother–child time

Table 4. *Alternative Estimation Approaches*

Predictor	Fixed effects β	Fixed effects *SE*	Random effects β	Random effects *SE*	Value Added +Lagged Inputs β	Value Added +Lagged Inputs *SE*
Total time model (reference category: total time with neither father nor mother)						
Total time with father	0.007	0.007	0.014*	0.006	0.016*	0.008
R^2	0.746		0.743		0.388	
AIC/BIC	34,446/34,541		42,293/42,423		20,093/20,235	
N (children)/*N* (observations)	3,273/6,960		3,273/6,960		2,215/3,523	
Time-content model (reference category: sleep time)						
Educational activities with father	0.133**	0.045	0.167***	0.038	0.130**	0.049
Structured activities with father	0.087**	0.032	0.103***	0.027	0.021	0.033
Unstructured activities with father	−0.019	0.028	0.020	0.023	0.032	0.034
R^2	0.755		0.473		0.394	
AIC/BIC	34,220/34,398		42,299/42,402		20,0862/20,372	
N (children)/*N* (observations)	3,273/6,960		3,273/6,960		2,215/3,523	

Note. Longitudinal Study of Australian Children. K Cohort, Waves 1 to 3. All models control for a set of basic and extended controls. The total time model controls for unknown time and the time-content model controls for other time uses (as in Table 3). The Value Added + Lagged Input model is specified as in Fiorini and Keane (2014, p. 805): Predictors include lags of all time-changing time-use and control variables as well as the lag of the outcome variable (i.e., the Peabody Picture Vocabulary Test). Random effects models are estimated using maximum likelihood estimation. The R^2 statistics for the fixed effects models refer to the within R^2. Full set of estimates available from the authors upon request. AIC = akaike information criteria; BIC = bayesian information criterion. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

and only the coefficient on educational time for time with both father and mother ($\beta = 0.094$; $p < .001$) remained statistically significant in the value-added model.

Alternative Specifications

To test the robustness of the associations reported thus far, we replicated the models presented before using alternative estimators (Table 4). First, we reestimated the associations of interest using fixed effects models. These panel regression models account for time-constant unobserved heterogeneity by considering only within-cluster changes in the panel data, that is, by comparing the outcomes of the same children at different time points (Allison, 2009). Second, we used random effect panel regression models, which capture unobserved effects via the inclusion of a child-specific random intercept but require orthogonality between the observed and unobserved variables (Wooldridge, 2010). Third, we reestimated the associations using a "value-added plus lagged inputs" model that includes lags of all time-varying covariates and the outcome variable amongst the controls. By doing this, the model allows the child's achievement at a given age to depend not only on achievement at time $t - 1$ but also on a cumulative history of productive inputs (see Fiorini & Keane, 2014, p. 805; Todd & Wolpin, 2007). The pattern of results in all of these models was similar to that in the models discussed previously. Total time with father was positively and significantly associated with higher PPVT scores (top panel), with father–child time in educational activities being particularly productive (bottom panel). As an exception, the coefficient on total father–child time was not statistically significant in the fixed effects model. This suggests that the small positive associations observed in other models disappear in this more conservative estimation approach, which is sometimes deemed as better able to account for time-constant unobserved heterogeneity (see Discussion).

We also tested the robustness of the results to different methodological choices (see Table S2 in the Supplementary Online Materials). First, we tested the sensitivity of our father–child time estimates to possible downward bias due to noisy time-use measures derived from non-representative days (Wolfers, 2015). To accomplish this, we estimated models using only the subsample of children for whom the weekday and weekend time-diary days were ordinary days

Table 5. *Regression Models of Children's Peabody Picture Vocabulary Test Scores, Interactions With Paternal Education*

	OLS		OLS		VA	
Predictor	*β*	*SE*	*β*	*SE*	*β*	*SE*
Total time						
Child's father has university degree	1.939***	0.186	1.303***	0.196	0.980***	0.188
Total time with father	0.028***	0.007	0.023***	0.007	0.019*	0.008
University Degree × Total Time With Father	−0.014	0.012	−0.009	0.012	−0.003	0.015
R^2	0.560		0.581		0.391	
AIC/BIC	42,606/42,681		42,293/42,423		20,655/20,779	
N (children)/*N* (observations)	3,273/6,960		3,273/6,960		2,215/3,628	
Time content						
Child's father has a university degree	1.611***	0.185	1.164***	0.193	0.890***	0.189
Educational time with father	0.126***	0.021	0.106***	0.021	0.044	0.026
Structured activities with father	0.092***	0.022	0.077***	0.022	0.030	0.024
Unstructured activities with father	0.012	0.017	0.006	0.016	−0.013	0.023
University Degree × Educational Activities With Father	0.014	0.083	0.021	0.079	−0.013	0.090
University Degree × Structured Activities With Father	−0.027	0.055	−0.026	0.054	−0.015	0.061
University Degree × Unstructured Activities With Father	−0.042	0.048	−0.046	0.047	0.029	0.063
Basic controls	Yes		Yes		Yes	
Extended controls	No		Yes		Yes	
Lag of PPVT score	No		No		Yes	
R^2	0.573		0.590		0.398	
AIC/BIC	42,423/42,594		42,155/42,381		20,641/20,852	
N (children)/*N* (observations)	3,273/6,960		3,273/6,960		2,215/3,628	

Note. Longitudinal Study of Australian Children. K Cohort, Waves 1 to 3. Full set of estimates available from the authors upon request. AIC = akaike information criteria; BIC = bayesian information criterion; OLS = ordinary least squares; PPVT = Peabody Picture Vocabulary Test; VA = value added. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

(56% of all observations). The estimates on total father–child time were similar in magnitude to those reported in the main models, but failed to reach statistical significance. The coefficients on father–child time in different types of activities were also similar, with the estimate on educational time being large and statistically significant across specifications. Second, we tested the sensitivity of the results using discrete rather than continuous time-use categorizations, separating fathers who did not spend any time with their child, fathers who spent some time, and more involved fathers (see Fomby & Musick, 2017; Kalil & Mayer, 2016). Results from the value-added model provided evidence of gradual improvements in children's PPVT scores with the degree of paternal involvement for total time, returns to time in educational activities only among highly involved fathers, and no differences by degree of involvement for time in structured or unstructured activities. Third, we considered quadratic specifications of the father–child time variables to capture potential nonlinear associations. The results revealed little evidence of the latter—as denoted by mostly statistically insignificant parameters on the square terms. Fourth, we replicated the analyses excluding a small subset of observations from children who were not yet at school during Wave 1 (92% of all observations), as these children may undertake significantly different daily routines. The results from these models were again consistent with those presented earlier. The results from a fifth sensitivity analysis are discussed below.

Hypothesis 3: Effect Heterogeneity by Paternal Education

In a final set of models, we examined whether the estimated associations between children's PPVT scores and father–child time (in general and across activity types) differed by paternal education (Table 5). This was accomplished by adding to the models variables interacting paternal highest educational qualification (degree or lower than degree) and father–child time-use.

Against the predictions of Hypothesis 3, all of the interaction terms were statistically insignificant ($p > .05$), indicating that the degree to which children's cognitive functioning benefits from paternal involvement did not differ in families with highly and less highly educated fathers.

In alternative specifications, we replicated these analyses using a more disaggregated categorization of paternal education (see Cha & Song, 2017). This differentiated between degree or higher qualifications (33.8% of observations), professional qualifications (43.1%), Year 12 education (11.3%), and below Year 12 education (11.8%). The results, shown in Table S3 in the Online Appendix, were similar to those presented here. We also reestimated the models splitting the sample by the dichotomous indicator of paternal degree education, which is statistically equivalent to interacting paternal degree education with all predictors. The coefficients on father–child time were comparable in the models for degree-educated and non-degree-educated fathers. Altogether, results from these robustness checks were consistent with those in the main models, providing no evidence that paternal education moderates the relationships between father–child time (overall or educational) and children's PPVT scores in our Australian sample.

DISCUSSION

In this article, we have provided what, to our knowledge, constitutes the first systematic account of how father–child time is associated with children's cognitive functioning (operationalized using the PPVT) using longitudinal time-diary data. In doing so, we contributed to both the literature on the role of fathers in child development (Cabrera et al., 2007; Lamb, 2010; Pleck, 2010) and emerging empirical evidence documenting how parental time inputs and involvement in child care are associated with child development—a body of work that has focused almost exclusively on maternal rather than paternal time with children (Fomby & Musick, 2017; Milkie et al., 2015). We accomplished this by leveraging high-quality panel survey data from LSAC spanning from 2004 to 2008 on a subsample of children aged 4 to 8 years. Our results lead to three conclusions regarding the associations between father–child time and children's cognitive functioning, which we discuss in turn.

First, our analyses provided some evidence that higher amounts of father–child time overall are associated with higher levels of cognitive development in their children, consistent with Hypothesis 1. However, the magnitude of association was rather small. For example, in the value-added model, 5 additional hours of father–child time in a given week were associated with an increase of about 0.1 in the PPVT, which ranges from 0 to 100, or about 2% of its standard deviation. In fixed effects models, the coefficient on total father–child time was not statistically significant. Because these models are arguably more useful in accounting for time-constant unobserved heterogeneity, this pattern of results suggests that unobserved effects may be responsible for the small associations observed in the other specifications. Yet fixed effects models have some limitations in our context. First, they are highly susceptible to data with high levels of measurement error, such as time-use diary data, as this may distort within-individual trends (Griliches & Hausman, 1986). Second, they are not as helpful in accounting for reverse causation as some of the other specifications considered here, such as the value-added models (Gunasekara, Richardson, Carter, & Blakely, 2013). Jointly, these issues may have led to downward-biased estimates in the fixed effects models. In any case, the small or inexistent associations between total father–child time and child outcomes reported here are consistent with earlier U.S. literature focusing on motherhood. For example, Fomby and Musick (2017) found very small associations between mother–child time and children's reading scores. Similarly, Milkie et al. (2015) found no evidence of statistically significant associations between mother–child time and several measures of children's academic and behavioral outcomes.

A second conclusion drawn from our analyses is that father–child time is more strongly associated with children's cognitive outcomes when that time is spent in educational activities (such as reading or educational play), which is consistent with Hypothesis 2. Irrespective of the modeling approach used, father–child time spent in educational activities displayed larger positive associations with children's cognitive functioning than father–child time spent in structured activities (such as extracurricular activities or sports) or unstructured activities (such as watching TV or using a computer). The magnitude of these associations appeared to be moderate to large. For instance, in the value-added model the increase in PPVT scores associated with 5 extra weekly hours of father–child time in educational activities was equivalent to about 9% of the standard deviation in the PPVT and comparable to the estimated effect of having a parent with university-level qualifications. The hierarchy of productivity across activity types is highly consistent with findings on maternal involvement in the United States by Hsin and Felfe (2014) as well as findings for time spent with either parent in Australia by Fiorini and Keane (2014). This result is generally robust to different model specifications and estimation approaches. Our findings therefore add to theoretical perspectives arguing, and a growing body of evidence demonstrating, that it is not the amount of parent–child time that matters, but the content of the activities undertaken between the parent and the child during their interaction (Amato, 1998; Hsin, 2009; Lamb, 2010; Pleck, 2010). Sharing cognitively stimulating activities such as reading, playing games, doing homework, or participating in social events with their father leads to more positive outcomes among children than father–child time that is spent somehow else. Whether it is father–child time expenditure in specific educational activities or a healthy packaging of different father–child educational activities that makes a difference remains an open question to be addressed in further research.

Interestingly, the estimated associations between mother–child time and children's cognitive outcomes were smaller than those observed for father–child time and occasionally statistically insignificant. This pattern of results is consistent with that reported in studies of parental involvement that did not use time-use data. For example, Harris, Furstenberg, and Marmer (1998) documented statistically significant associations between adolescent-reported measures of paternal behavioral and emotional involvement and adolescent outcomes in the United States, but no evidence of associations for equivalent measures of maternal involvement. These results are perhaps surprising and might have emerged for different reasons. First, children coming from families with an involved father might be exposed to other unobserved factors that enhance their development (e.g., higher levels of social capital or less parental conflict) and may also display a predisposition toward certain time uses (e.g., due to the child's temperament or parental preferences; Cabrera et al., 2007; Lamb, 2010). Some of these may remain unaccounted in our models. Consistent with this notion, differences between the coefficients on maternal and paternal overall time with the child in fixed effects models were not statistically significant ($p > .05$), which, despite the aforementioned caveats, are often deemed as better able to account for unobserved effects. Second, mothers may be more likely than fathers to make sure that the child is undertaking appropriate developmental activities, even when they are unable to be present themselves. This is consistent with the notion of extensive mothering, whereby mothers who delegate substantial amounts of day-to-day child care to others define "good mothering" as ensuring their children's well-being through controlling their daily routines (Christopher, 2012). Hence, mothers may be more likely than fathers to positively affect their children's well-being while being away, and so the correlation between "being there" and "positive child outcomes" should be weaker among mothers than fathers. Finally, judging by the average amount of time spent with the child by mothers and fathers in our sample, paternal participation in child care may be characterized as 'discretionary', whereas maternal participation may be seen as 'obligatory' (see also Craig, 2006; Kühhirt, 2011). Thus, mothers may be more prone than fathers to increase their time allocations to aid struggling children, which may produce stronger feedback effects (reverse causality) in the observed relationships between mother–child time and child outcomes when compared with those for father–child time.

A third conclusion drawn from our analyses is that father–child time is not more strongly associated with children's cognitive functioning when fathers are highly educated. Against the predictions contained in Hypothesis 3, we found no evidence that 1 hour of father–child time yields more benefit to the child when fathers have tertiary education qualifications. Instead, our results indicated that 1 hour of father–child time (overall, as well as across activity types) yielded the same returns to the children of highly and less highly educated fathers. This finding can be taken in a positive light: It suggests that paternal involvement matters for disadvantaged children as much as it does for advantaged children. That is, paternal involvement in child care need not be a mechanism driving social inequalities and diverging destinies among children.

Fathers with low educational credentials can compensate for their children's developmental deficits (see Ermisch et al., 2012) by spending more time with them, provided that, as previously discussed, they engage in educational activities.

Nevertheless, this is not to say that paternal education does not matter. Paternal education remains important in two ways. First, even after controlling for multiple observable and unobservable sources of confounding and several intervening mechanisms (e.g., parental income and father–child time), paternal education significantly and substantially improved children's cognitive functioning in our Australian sample. For example, in the value-added model in Table 2, having a parent with university qualifications was associated with an increase of nearly one-unit (or 12% of a standard deviation) in PPVT scores, *ceteris paribus*. This pattern of results is consistent with findings from other studies examining the effect of paternal education on child outcomes (see, e.g., Chevalier, 2004; Dickson, Gregg, & Robinson, 2016). Second, consistent with recent scholarship (see, e.g., Altintas, 2015; Cha & Song, 2017; Craig & Mullan, 2011), we found that fathers who held university degrees spent more time with their children than parents who did not have university degrees. Specifically, degree-educated fathers spent an average of 7.75 hours per week with their children, of which 0.84 hours were in educational activities. In contrast, fathers with lower educational credentials spent an average of 6.79 hours per week overall, 0.55 hours in educational activities. The existence of these differences, which were statistically significant ($p < .05$), stresses the importance of differential time investments in children between highly and lowly educated fathers as a driver of differences in their children's cognitive functioning. Altogether, our findings about the relationships between paternal education, time use and child outcomes suggest that the main mechanism whereby highly educated parents transfer their advantage onto their children is via an investment surplus in educational activities, consistent with the theory of concerted cultivation (Lareau, 2011).

Although the impact of father–child time overall and in educational activities on children's cognitive functioning was not found to vary by paternal education, such impact may vary by other paternal characteristics that may be associated with cognitively stimulating father–child exchanges. Putative candidates include paternal work in a cognitively demanding job (a proxy for paternal day-to-day engagement in complex thinking), paternal parenting style (e.g., autonomy-encouraging, warm, or consistent parenting), paternal self-efficacy, and paternal aspirations for the child. Future research should examine whether these and other father characteristics moderate the relationships between different sorts of father–child time and the cognitive functioning of their offspring.

Study Limitations and Avenues for Further Research

Despite the uniqueness of our study, the data at hand, and our methodological approach, some caveats to our findings need to be acknowledged. These point toward potential avenues for methodological refinement and further scholarly inquiry. First, an inherent problem with time-diary data, such as the LSAC data, is the relatively large incidence of missingness. For example, even after making assumptions about missing data during some parts of the day as sleep or school time, we are still unable to determine which type of activity the child was doing for about 8 hours per week. This issue may have led to attenuation of our estimates on the effects of father–child time on children's PPVT scores.

Second, the majority of the time-use data on father–child time in LSAC was reported by mothers. When mothers are not present, they may be unaware of whether the child was indeed with the father or the content of father–child activities. This may introduce measurement error to measures of father–child time, which may in turn dilute their associations with children's cognitive outcomes. Social desirability biases may also result in downward bias in the mother-reported amount of father–child time, as mothers may follow normative scripts of "women as main carers" and overreport their own involvement. A few studies have examined the validity of maternal reports of father involvement in child care. Their findings indicate that mothers report less paternal involvement than do fathers, although the correlations between maternal and paternal reports are high (Charles et al., 2018; Coley & Morris, 2002; Hernandez & Coley, 2007; Mikelson, 2008). A common conclusion is that "the use of maternal survey reports of father involvement appears to be a defensible practice" (Hernandez & Coley, 2007, p. 8). Two factors add confidence to our results. First, LSAC requests that data be collected from the parent who knows more about the child and his or her routines (the Parent 1 or P1; Mullan, 2014). Second, our sample comprises only coresident biological parents—for which studies find disagreement to be smaller (Charles et al., 2018; Coley & Morris, 2002), with some exceptions (Mikelson, 2008). Coresident parents should be more knowledgeable about the activities undertaken between the child and the other parent than non-co-resident parents. They may also be able to consult each other when completing the time-use diaries or complete them in tandem. Although the number of children whose diaries were exclusively completed by fathers is too small for separate analysis, in sensitivity analyses we reestimated the models excluding these cases. The results were highly consistent with those reported here (see Table S2 in the Online Appendix), which adds further confidence to our findings.

Third, despite the wide array of panel estimation approaches deployed in this study, we do not claim that the results reported here represent causal effects. Not only unobserved heterogeneity—as previously discussed—but also reverse causality remains a looming cause of bias to estimates of how parental involvement in child care relates to child well-being: Parents may spend more time (particularly educational time) with their children if they perceive that their children's cognitive development is slowed or impaired. This would result in downward-biased estimates on the effects of parent–child time on child outcomes in this and other studies. Unfortunately, traditional solutions to correct for reverse causation—including pseudo-experimental approaches—are difficult, if at all possible, to implement in this context; see Fiorini and Keane (2014, p. 792) or Todd and Wolpin (2007) for further discussion. For instrumental-variable regression specifically, finding appropriate instruments for multiple endogenous time-investment variables remains an insurmountable obstacle. Methodological developments aimed at minimizing these possible sources of bias using survey data are required to respond to this concern. More radical innovation could be attained by implementing experimental designs that manipulate the amount and content of father–child time, which would require careful thinking about ethical challenges.

Fourth, a strength of the present study is that we were able to approximate, with some degree of confidence, the child's complete time expenditure. As highlighted by Fiorini and Keane (2014), this approach constitutes an important step forward relative to studies focusing on a single type of time input or a subset of these. This is because the estimated effect of a given time input depends on what other time inputs are considered in estimation (Fiorini & Keane, 2014, p. 788). Time is a zero-sum game, and increasing allocations to one activity or with a certain guardian necessarily involves reducing allocations to others (Fiorini & Keane, 2014, p. 789). This line of reasoning opens up complex and unresolved questions about time substitution and the myriad of ways in which this could operate. Even with their advantageous properties, the analyses deployed here constitute just a first step in understanding how children's time use relates to their outcomes. Subsequent studies should pay further attention to the nuanced ways in which children's time is packaged, how such packaging differs by family socioeconomic background, and how it ultimately influences child development—potentially in ways that contribute to the intergenerational transmission of advantage.

CONCLUSION

Our findings are not only novel but also relevant for policy and practice: They are indicative that enabling paternal involvement in their children's upbringing (e.g., by promoting work–family balance among fathers) should bring moderate-to-high gains to their children in terms of cognitive functioning. The case for investing in paternal involvement in child care becomes even more compelling when these results are considered vis-à-vis evidence suggesting that such involvement is also a factor contributing to improved maternal mental health, maternal labor force participation, and enhanced family functioning. Future studies should also address important questions that we have not covered in this study, such as how father–child time affects other child outcomes (e.g., children's socio-emotional functioning). In addition, our results relate to a single country, Australia, which features a highly idiosyncratic constellation of institutional features concerning parental involvement in child care. For example, Australia is characterized by high levels of intensive parenting and policies that encourage mothers dropping out of the labor market or moving into part-time work to undertake the lion's share of the child care. Identifying whether and how these and other features of the institutional environment contribute to the mix of parental time inputs on their children, and their outcomes, constitutes an important avenue for further research.

Note

This research was supported by projects CSO2016-80484-R and CSO2014-58754-P and the FPI Program (BES-2013-066777) funded by the Spanish Ministry of Economy and Competitiveness. The research was also supported by the Australian Research Council Centre of Excellence for Children and Families over the Life Course. This paper uses data from the Longitudinal Study of Australian Children, a survey conducted in partnership between the Department of Social Services, the Australian Institute of Family Studies and the Australian Bureau of Statistics. The authors would like to thank María José González, Sergi Vidal, Martin O'Flaherty, David Ribar, and Walter Forrest for their feedback as well as participants in the 2017 European Consortium for Sociological Research Spring School on the Intergenerational Transmission of Inequality, the 2017 European Consortium for Sociological Research General Conference and the 2017 RC28 Spring Meeting at the University of Cologne for comments and suggestions.

Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1. Correspondence between activities and time categories

Table S2. Alternative specifications

Table S3. Regression models of children's Peabody Picture Vocabulary Test scores, interactions with paternal education (disaggregated)

References

Allison, P. D. (2009). *Fixed effects regression models*. London: Sage.

Altintas, E. (2015). The widening gap in developmental childcare activities in the United States, 1963 – 2015. *Journal of Marriage and Family*, *78*, 26–42. https://doi.org/10.1111/jomf.12254

Amato, P. (1998). More than money? Men's contributions to their children lives. In A. Booth & A. C. Crouter (Eds.), *Men in families: When do they get involved? What difference does it make?* (pp. 241–278). Mahwah, NJ: Lawrence Erlbaum.

Australian Institute of Family Studies. (2002). *Introducing the Longitudinal Study of Australian Children* (LSAC Discussion Paper No. 01). Growing up in Australia: The Longitudinal Study of Australian Children.

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice-Hall.

Barbeta, M., & Cano, T. (2017). Toward a new model of fatherhood? Discourses on paternal involvement in urban Spain. *Revista Española de Investigaciones Sociológicas*, *159*, 13–30. https://doi.org/10.5477/cis/reis.159.13

Baxter, J. (2007). *Children's time use in the Longitudinal Study of Australian Children: Data quality and analytical issues in the 4-year cohort* (Technical Paper No. 4). Growing up in Australia: The Longitudinal Study of Australian Children.

Belsky, J., Vandell, D. L., Burchinal, M., & Owen, M. T. (2007). Are there long-term effects of early child care? *Child Development*, *78*, 681–701.

Bernal, R. (2008). The effect of maternal employment and childcare on children's cognitive development. *International Economic Review*, *49*, 1173–1209. https://doi.org/10.1111/j.1468-2354.2008.00510.x

Bianchi, S. M., Robinson, J. P., & Milkie, M. (2006). *Changing rhythms of American family life*. New York: Russell Sage.

Bonke, J., & Esping-Andersen, G. (2011). Family investments in children: Productivities, preferences, and parental child care. *European Sociological Review*, *27*, 43–55. https://doi.org/10.1093/esr/jcp054

Bourdieu, P., & Passeron, J. C. (1990). *Reproduction in education, society and culture*. London: Sage.

Brooks-Gunn, J., Han, W.-J., & Waldfogel, J. (2002). Maternal employment and child cognitive outcomes in the first three years of life: The NICHD study of early child care. *Child Development*, *73*, 1052–1072.

Cabrera, N., Shannon, J. D., & Tamis-LeMonda, C. (2007). Fathers' influence on their children's cognitive and emotional development: From toddler to pre-K. *Applied Developmental Science*, *11*, 208–213.

Cha, S. E., & Song, Y. J. (2017). Time or money: The relationship between educational attainment, income contribution, and time with children among Korean fathers. *Social Indicators Research*, *134*, 195–218.

Charles, P., Spielfogel, J., Gorman-Smith, D., Schoeny, M., Henry, D., & Tolan, P. (2018). Disagreement in parental reports of father involvement. *Journal of Family Issues*, *39*, 328–351.

Chevalier, A. (2004). *Parental education and child's education: A natural experiment* (Institute for the Study of Labor Discussion Paper No. 1153). Bonn, Germany: Institute for the Study of Labor.

Christopher, K. (2012). Extensive mothering. Employed mothers' constructions of the Good Mother. *Gender & Society*, *26*, 73–96.

Clarke-Stewart, K. (1978). And daddy makes three: The father's impact on mother and young child. *Child Development*, *49*, 466–478. https://doi.org/10.2307/112871

Coley, R. L., & Morris, J. E. (2002). Comparing father and mother reports of father involvement among low-income minority families. *Journal of Marriage and Family*, *64*, 982–997. https://doi.org/10.1111/j.1741-3737.2002.00982.x

Coltrane, J. (1996). *Family man: Fatherhood, housework, and gender equity*. New York: Oxford University Press.

Cook, G., Roggman, L., & Boyce, K. (2011). Fathers' and mothers' cognitive stimulation in early play with toddlers: Predictors of 5th grade reading and math. *Family Science*, *2*, 131–145. https://doi.org/10.1080/19424620.2011.640559

Cooke, L. P., & Baxter, J. (2010). Families' in international context: Comparing institutional effects across Western societies. *Journal of Marriage and Family*, *72*, 516–536. https://doi.org/10.1111/j.1741-3737.2010.00716.x

Craig, L. (2006). Do fathers care mean father's share? *Gender & Society*, *20*, 259–281. https://doi.org/10.1177/0891243205285212

Craig, L., & Mullan, K. (2011). How mothers and fathers share childcare. A cross-national time use comparison. *American Sociological Review*, *76*, 834–861. https://doi.org/10.1177/0003122411427673

Craig, L., Powell, A., & Smyth, C. (2014). Toward intensive parenting? Changes in the composition and determinants of mothers' and fathers' time with children 1992-2006. *British Journal of Sociology*, *65*, 555–579. https://doi.org/10.1111/1468-4446.12035

Cunha, F., & Heckman, J. (2007). The technology of skills formation. *American Economic Review*, *97*, 31–47. https://doi.org/10.1257/aer.97.2.31

Davis-Kean, P. E. (2005). The influence of parent education and family income on child achievement: The indirect role of parental expectations and the home environment. *Journal of Family Psychology*, *19*, 294–304. http://doi.org/10.1037/0893-3200.19.2.294

Del Bono, E., Francesconi, M., Kelly, Y., & Sacker, A. (2016). Early maternal investment and early child outcomes. *The Economic Journal*, *126*, F96–F135. https://doi.org/10.1111/ecoj.12342

Diamond, A., & Lee, K. (2011). Interventions shown to aid executive function development in children 4 to 12 years old. *Science*, *333*, 959–964. https://doi.org/10.1126/science.1204529

Dickson, M., Gregg, P., & Robinson, H. (2016). Early, late or never? When does parental education impact child outcomes? *The Economic Journal*, *126*, F158–F231.

Duncan, G., Dowsett, C., Claessens, A., Magnuson, K., Huston, A., Klebanov, P., … Japel, C. (2007). School readiness and later achievement. *Developmental Psychology*, *43*, 1428–1446. https://doi.org/10.1037/0012-1649.43.6.1428

Dunn, L. M., & Dunn, L. M. (1997). *Peabody Picture Vocabulary Test* (3rd ed.). Circle Pines, MN: American Guidance Service.

Ermisch, J., Jäntti, M., & Smeeding, T. (Eds.). (2012). *From parents to children: The intergenerational transmission of advantage*. New York: Russell Sage.

Esping-Andersen, G. (2009). *The unfinished revolution. Adapting welfare states to women's new roles*. Bristol, England: Polity.

Fiorini, M., & Keane, M. (2014). How the allocation of children's time affects cognitive and noncognitive development. *Journal of Labor Economics*, *32*, 787–834. https://doi.org/10.1086/677232

Fomby, P., & Musick, K. (2017). Mothers' time, the parenting package and links to healthy child development. *Journal of Marriage and Family*, *80*, 166–181. https://doi.org/10.1111/jomf.12432

Furstenberg, F. F., Jr. (1988). Good dads—bad dads: Two faces of fatherhood. In J. Palmer & I. Sawhill (Eds.), *The changing american family and public policy* (pp. 193–218). Washington, DC: The Urban Institute Press.

Gauthiery, A., Smeeding, T. & Furstenberg, F. F. (2004). Are parents investing less time in children? Trends in selected industrialized countries. *Population and Development Review*, *30*, 647–672.

Goeke-Morey, M. C., & Cummings, E. M. (2007). Impact of father involvement: A closer look at indirect effects models involving marriage and child adjustment. *Applied Developmental Science*, *11*, 1–5.

Griliches, Z., & Hausman, J. A. (1986). Errors in variables in panel data. *Journal of Econometrics*, *31*, 93–118.

Gunasekara, F. I., Richardson, K., Carter, K., & Blakely, T. (2013). Fixed effects analysis of repeated measures data. *International Journal of Epidemiology*, *43*, 264–269.

Guryan, J., Hurst, F., & Kearney, M. (2008). Parental education and parental time with children. *Journal of Economic Perspectives*, *22*, 23–46. https://doi.org/10.1257/jep.22.3.23

Harding, J., Morris, P., & Hughes, D. (2015). The relationship between maternal education and children's academic outcomes: A theoretical framework. *Journal of Marriage and Family*, *77*, 60–76. https://doi.org/10.1111/jomf.12156

Harris, K. M., Furstenberg, F. F., & Marmer, J. K. (1998). Paternal involvement with adolescents in intact families: The influence of fathers over the life course. *Demography*, *35*, 201–216.

Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science*, *312*, 1900–1902. https://doi.org/10.1126/science.1128898

Hernandez, D. C., & Coley, R. L. (2007). Measuring father involvement within low-income families: Who is a reliable and valid reporter? *Parenting Science and Practice*, *7*, 69–97.

Hofferth, S. L. (2006). Residential father family type and child well-being: Investment versus selection. *Demography*, *43*, 53–77. https://doi.org/10.1353/dem.2006.0006

Hook, J. L. (2006). Care in context: Men's unpaid work in 20 countries, 1965-2003. *American Sociological Review*, *71*, 639–660. https://doi.org/10.1177/000312240607100406

Hsin, A. (2009). Parent's time with children: Does time matter for children's cognitive achievement? *Social Indicators Research*, *93*, 123–126. https://doi.org/10.1007/s11205-008-9413-6

Hsin, A., & Felfe, C. (2014). When does time matter? Maternal employment, children's time with parents, and child development. *Demography*, *51*, 1867–1894. https://doi.org/10.1007/s13524-014-0334-5

Jæger, M. M., & Breen, R. (2016). A dynamic model of cultural reproduction. *American Journal of Sociology*, *121*, 1079–1115. https://doi.org/10.1086/684012

Jia, R., Kotila, L., & Schoppe-Sullivan, S. J. (2012). Transactional relations between father involvement and preschoolers' socioemotional adjustment. *Journal of Family Psychology*, *26*, 848–857. https://doi.org/10.1037/a0030245

Kalil, A., & Mayer, S. E. (2016). Understanding the importance of parental time with children: Comment on Milkie, Nomaguchi, and Denny (2015). *Journal of Marriage and Family*, *78*, 262–265. https://doi.org/10.1111/jomf.12261

Kalil, A., & Rege, M. (2015). We are family: Fathers' time with children and the risk of parental relationship dissolution. *Social Forces*, *94*, 833–862. https://doi.org/10.1093/sf/sov076

Kalil, A., Ryan, R., & Corey, M. (2012). Diverging destinies: Maternal education and the educational gradient in time with children. *Demography*, *49*, 1361–1383. https://doi.org/10.1007/s13524-012-0129-5

Kalil, A., Ziol-Guest, K., & Coley, R. (2005). Perceptions of father involvement patterns in teenage-mother families: Predictors and links to mothers' psychological adjustment. *Family Relations*, *54*, 197–211. https://doi.org/10.1111/j.0197-6664.2005.00016.x

Kühhirt, M. (2011). Childbirth and the long-term division of labour within couples: How do substitution, bargain power, and norms affect parents' time allocation in West Germany? *European Sociological Review*, *28*, 565–582.

Lamb, M. E. (Ed.). (2010). *The role of father in child development* (5th ed.). New York: Wiley.

Lareau, A. (2011). *Unequal childhoods: Class, race and family life* (2nd ed.). Berkeley: University of California Press.

McBride, B. A., & Mills, G. (1993). A comparison of mother and father involvement with their preschool age children. *Early Childhood Research Quarterly*, *8*, 457–477. https://doi.org/10.1016/S0885-2006(05)80080-8

McLanahan, S. (2004). Diverging destinies: How children are faring under the second demographic transition. *Demography*, *41*, 607–627. https://doi.org/10.1353/dem.2004.0033

Mikelson, K. S. (2008). He said, she said: Comparing mother and father reports of father involvement. *Journal of Marriage and Family*, *70*, 613–624. https://doi.org/10.1111/j.1741-3737.2008.00509.x

Milkie, M., Nomaguchi, K., & Denny, K. (2015). Does the amount of time mothers spend with children or adolescents matter? *Journal of Marriage and Family*, *77*, 355–372. https://doi.org/10.1111/jomf.12170

Mirowsky, J., & Ross, C. (2003). *Education, social status and health*. New York: de Gruyter.

Monna, B., & Gauthier, A. H. (2008). A review of the literature on the social and economic determinants of parental time. *Journal of Economic Issues*, *29*, 634–653. https://doi.org/10.1007/s10834-008-9121-z

Morgenroth, T., Ryan, M. K., & Peters, K. (2015). The motivational theory of role modeling: How role models influence role aspirants' goals. *Review of General Psychology*, *19*, 465–483. https://doi.org/10.1037/gpr0000059

Mullan, K. (2014). *Longitudinal analysis of LSAC time diary data. Considerations for data users* (Longitudinal Study of Australian Children Technical Paper No. 11). Growing up in Australia: The Longitudinal Study of Australian Children.

Nomaguchi, K., Milkie, M., & Denny, K. (2016). Quantity of maternal time and child and adolescent development: Response to Kalil and Mayer (2016) and to Waldfogel (2016). *Journal of Marriage and Family*, *78*, 270–275. http://doi.org/10.1111/jomf.12258

Pancsofar, N., & Vernon-Feagans, L. (2006). Mother and father language input to young children: Contributions to later language development. *Journal of Applied Developmental Psychology*, *27*, 571–587. https://doi.org/10.1016/j.appdev.2006.08.003

Pleck, J. H. (2010). Paternal involvement: Revised conceptualization and theoretical linkages with child outcomes. In M. E. Lamb (Ed.), *The role of the father in child development* (5th ed., pp. 58–93). Hoboken, NJ: Wiley.

Putnam, R. D. (2015). *Our kids: The American dream in crisis?* New York: Simon & Schuster.
Rowe, M. L., Coker, D. & Pan, B. A. (2004). A comparison of fathers' and mothers' talk to toddlers in low-income families. *Social Development*, *13*, 278–291. https://doi.org/10.1111/j.1467-9507.2004.000267.x
Russell, G. (1983). *The changing role of fathers?* St. Lucia, Australia: University of Queensland Press.
Sarkadi, A., Kristiansson, R., Oberklaid, F., & Bremberg, S. (2008). Fathers' involvement and children's developmental outcomes: A systematic review of longitudinal studies. *Acta Pædiatrica*, *97*, 153–158. https://doi.org/10.1111/j.1651-2227.2007.00572.x
Schober, P. S. (2012). Paternal child care and relationship quality: A longitudinal analysis of reciprocal associations. *Journal of Marriage and Family*, *74*, 281–296. https://doi.org/10.1111/j.1741-3737.2011.00955.x
Shonkoff, J., Phillips, D., & National Research Council. (2000). *From neurons to neighborhoods: The science of early child development*. Washington, DC: National Academy Press.
Takeuchi, H., Taki, Y., Hashizume, H., Asano, K., Asano, M., Sassa, Y., … Kawashima, R. (2015). The impact of parent–child interaction on brain structures: Cross-sectional and longitudinal analyses. *Journal of Neuroscience*, *35*, 2233–2245.
Todd, P., & Wolpin, K. (2007). On the specification and estimation of the production function for cognitive achievement. *The Economic Journal*, *113*, F3–F33.
Waldfogel, J. (2006). *What children need*. Cambridge, MA: Harvard University Press.
Waldfogel, J. (2016). How important is parental time? It depends: Comment on Milkie, Nomaguchi, and Denny (2015). *Journal of Marriage and Family*, *78*, 266–269. https://doi.org/10.1111/jomf.12259
Wilson, K., & Prior, M. (2011). Father involvement and child well-being. *Journal of Paediatrics and Child Health*, *47*, 405–407. https://doi.org/10.1111/j.1440-1754.2010.01770.x
Wolfers, J. (2015, April 2). Why a claim about the irrelevance of parenting time doesn't add up. *The New York Times*. Retrieved from https://www.nytimes.com/2015/04/03/upshot/why-a-claim-about-the-irrelevance-of-parenting-time-doesnt-add-up.html?_r=0
Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data*. Cambridge, MA: MIT Press.