

Cover Page



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Chapter

2

Causal Impact of the Low-Dosage Intervention BookStart on Language Development

Abstract

In this study we tested the causal impact of BookStart, a nationwide project in the Netherlands, low in dosage and budget, on language development. BookStart provides parents of newborn babies with a sample baby book, and an information flyer about an early start with book sharing as well as free access to age-appropriate reading materials at the library. We examined whether compliance with the BookStart suggestion to read books to a child as early as the first year increases infants' early language development. We obtained an unobtrusive indicator of book sharing around 8 months by asking parents to tick the baby books among images of book covers of 40 real books and 23 'foils' (fake book covers). In a sample of 640 parents and children we found that if parents comply with the BookStart suggestion to expose their young child to books from an early age, their children's language scores, assessed with the MacArthur-Bates CDI at 15 and 22 months, were higher than those of a similar group of children who had not been exposed to BookStart. We took care to estimate effects of book sharing on language development only if parents had changed their behavior due to BookStart. This study is one of the first to provide evidence for a causal relationship between an exogenous stimulus for an early start with book sharing, and children's language scores at 15 and 22 months. From 15 to 22 months effect sizes increased, which may indicate that a reading routine becomes more influential over time.

Based on:

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Sharing books with your baby may be one of the most promising ways to realize verbal interaction that may create life-long advantages for cognitive development. In several studies the prospective connections between the onset of book reading in infancy and early development of language skills have been assessed: If parents regularly shared books with their child, 2- to 4-years old children have better receptive and expressive language skills than less well-read-to children (DeBaryshe, 1993; Fletcher & Reese, 2005; High, Lagasse, Becker, Ahlgren, & Gardner, 2000; Payne, Whitehurst, & Angell, 1994; Raikes et al., 2006). In this study we tested the impact of BookStart on an early start with book sharing and, through book sharing, on early language development. BookStart is a nationwide project in the Netherlands that provides parents of newborn babies with access to age-appropriate reading materials.

BookStart started in 1990 in Britain and has since been adopted in other European countries, among which the Netherlands, as well as Australia, Canada, Colombia, Jamaica, Japan, Korea, New Zealand, and Thailand. In the Netherlands, parents of newborn babies living in areas where BookStart is adopted receive a BookStart case that includes a flyer explaining the importance of an early start with shared reading, and a sample baby book. Parents also receive free access to the local library so that they can make use of a large collection of baby books. The librarians are trained to advise parents about age-appropriate books and how to engage babies in shared reading.

There is some evidence in the literature that the ingredients of the BookStart program - access to a variety of books at the library - stimulate parents to make an early start with book reading which, in turn, may enhance vocabulary knowledge of young children (Birckmayer, 2001; Neuman, 1996; Peifer & Perez, 2010). Peifer and Perez (2010) found in a cross-sectional study that two years after the start of extensive community based literacy programs comparable to BookStart (e.g., Raising a Reader, Prenatal to Three Initiative, Reach out and Read) parents visited the library more frequently. When parents accessed the library on a more regular basis they increased shared reading with children under the age of three (Birckmayer, 2001). Neuman (1996) showed that 4-year old HeadStart children of low-income parents had higher scores on posttests of the Peabody Picture Vocabulary Task and the Concepts of Print Test after a 12 week period during which parents had free access to books and received training in how to share books with young children during a book club.

More specifically, evaluations of BookStart in the United Kingdom have indicated that, unlike those parents not involved in the project, BookStart parents visited the library frequently in the six months after receiving the book package and advice on book sharing from health visitors when their children were about eight months old (Wade & Moore, 1998). From the questionnaire also appeared that BookStart parents

were more likely to use book sharing as a way to interact with their child. From a follow-up (Wade & Moore, 2003) comes evidence that BookStart children were better prepared for the first grades of elementary school than children not involved in BookStart. At the start of primary education Wade and Moore applied three observation scales from the Birmingham Baseline Assessment including ‘speaking and listening’, ‘reading’, and ‘writing’. Scores on the ‘reading’ scales revealed an effect for BookStart: Bookstart children were, as a whole, ahead of the comparison group.

However, there are complicating factors in the interpretation of these findings. We may, for instance, wonder whether any benefits of BookStart do not just accrue to the individual parent. We can expect three different responses to receiving a BookStart case and free access to a large collection of baby books in the library. Some parents comply and are willing to have their behavior determined by the BookStart project. These parents may intensify their habits of verbal interaction with their baby and share books with their baby from an early age as a result of the project. But in many other cases, receiving a BookStart package and free access to the library may hardly change parents’ behavior. Parents may go their own way, insisting on choosing the interaction patterns that they prefer, irrespective of whether they receive a BookStart case or not. It is especially higher educated parents who are aware of the need to verbally interact with young children from early on, and who may share books with their infant regardless of whether they participate in BookStart. Their mirror image are parents who do not expose their very young children to books under any circumstances. In other words, some people comply with BookStart while others do not. Such differences in compliance are problematic for a researcher interested in the unbiased estimation of the causal impact of BookStart on children’s language development. Therefore, our main question is *not* whether participating in BookStart stimulates language development. Because there are various responses to being assigned to BookStart, we tried to answer a different question: Does compliance with the BookStart suggestion to expose your young child to books from an early age increase infants’ early language development? In other words, we wanted to end up with an unbiased estimate of the critical relationship between children’s language development and BookStart, and we tested whether early language skills improved when parents changed their book sharing behavior due to BookStart.

This study

To test causal effects of BookStart on language development we focused on those parents who had responded positively to the invitation to collect a BookStart case at the library. The ‘control’ parents, by contrast, lived in similar areas where BookStart

was not yet adopted and had not received an invitation to participate in the program. The variable BookStart enabled us to locate and isolate the exogenous part of the variability in the potentially endogenously determined predictor ‘early book sharing’ (Murnane & Willett, 2011). We tested whether BookStart affected children’s early book exposure, over and above the impact of any personal factors (such as parents’ interest in reading, or personal beliefs about children’s development) that may affect children’s book exposure endogenously. This exogenous part of the variation in the extent to which babies are exposed to books in the first year is illustrated in Figure 1 by the medium-grey ellipse representing variation in book sharing overlapping the dark-grey ellipse representing variation in BookStart. To obtain an unbiased estimate of the causal impact of BookStart on language development we carried the part of the variation in book sharing that is exogenously determined by BookStart through to a second stage in the analyses in which we tested the effects of book sharing on language development. In this way we excluded the variance in book sharing that is determined endogenously and reflects participants’ personal choices and attributes.

In testing whether BookStart did affect a child’s language through changing parents’ book sharing behavior, we restricted ourselves to the overlap between the complete light-grey ellipse representing variation in the outcome language development and the darkened partial ellipse representing exogenous variation in book sharing (Figure 1).

In other words, it was only the variation in book sharing that was affected by BookStart, and we capitalized upon this when estimating the effect of book sharing assessed when children were approximately eight months old on later language development. Thus, the estimate will not provide any information about the impact of book sharing on language development for individuals who did not participate in BookStart (striped part in Figure 1). It should be noted that by using BookStart to provide an unbiased estimate of the causal relationship between exogenously determined book sharing at eight months and language development about seven months and one year later, we may lose some precision and power resulting in a rather conservative estimate of effects of BookStart, which may make it harder to reject the null hypothesis of no relationship between book sharing and language development.

It should be noted that BookStart can be used as an instrument to study causal effects of an early start with book sharing at 8 months on language development at 15 and 22 months only if two additional conditions are fulfilled. Logically, the instrumental variable, BookStart, must be related to book sharing, because if those variables are unrelated we cannot isolate that part of the variation in book sharing at 8 months that is affected by BookStart. If the relationship is weak it will be difficult to

detect a relationship with language development unless the sample is extremely large. A second condition is that BookStart cannot be related to the outcome variables, i.e., language development at 15 and at 22 months. If BookStart is related to the outcome measures, we cannot know whether BookStart is actually instrumental in promoting language development or just an endogenous variable that reflects individual differences. For instance, parents may collect the BookStart case and visit the library because it enriches their collection of books, but they read anyhow to their baby. In other words, we will then not be able to distinguish endogenous from exogenous explanations of the relationship between book exposure and language development.

In sum, our main aim in this study was to test the hypothesis that BookStart is likely to affect a child's early language development at 15 and 22 months by promoting an early start with book sharing. We were interested only in the unbiased estimation of the causal impact of BookStart through book sharing on children's language development, and therefore excluded those connections between book sharing and language skills that could be compromised by the personal choices of parents with

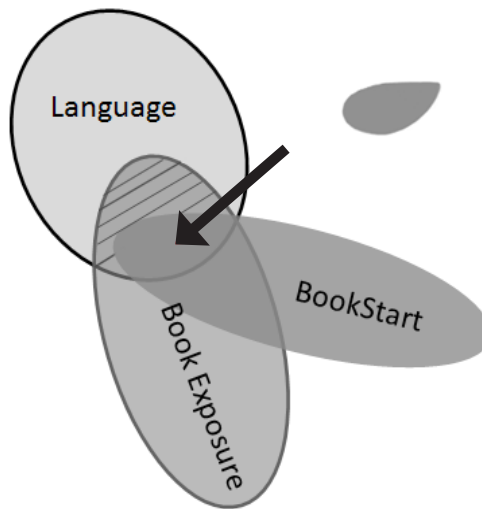


Figure 1. Venn diagram showing the three main variables used in this study: language development at 15 and 22 months as *outcome variables*, book exposure at 8 months as *predictor*, and BookStart as *instrumental variable*. We hypothesize that it is endogenous variables, such as how the parent values verbal interaction with infants, that mainly determine the variability in book exposure at 8 months. A much smaller part of variability in early book exposure may relate to the extraneous variable BookStart (darkened partial ellipse). The aim of this study was to test whether there is indeed an overlap between this darkened partial ellipse and the light-grey ellipse representing language development. In that case (overlap here represented by the leaf-shaped part extracted from the diagram), we may conclude that language development for some part does depend on BookStart, and is therefore a viable intervention. If there is hardly any overlap between the three variables, or none at all, we should conclude that there is no evidence for BookStart as an effective intervention.

different motivations, and perhaps different efforts to initiate verbal interactions with their infant from an early age. We restricted ourselves to working with those connections between language development at 15 and at 22 months and an indicator of book exposure around 8 months that overlapped with the instrumental variable BookStart.

Method

Participants

Parents of babies around 8 months in 35 BookStart sites all over the Netherlands were invited to participate in the study. These parents had collected the BookStart case at the local library. A control group of parents not involved in BookStart was recruited through 35 child health care centers in comparable sites where BookStart had not yet been implemented during the period in which our study took place. These parents received invitations to complete the book exposure list and a questionnaire about background variables from employees of the child health care centers when they were around 8 months old ($SD = 1.39$; $N = 782$). Families were included in the final sample if (a) Dutch was the first or second home language, and (b) they had completed the questionnaire at 8 months, and the MacArthur-Bates CDI when the child was about 15 ($SD = 1.47$) and/or 22 months ($SD = 1.47$). Six questionnaires were not included in the final analyses because Dutch was not the first or second language at home. In all, 640 parents completed the MacArthur-Bates CDI when the children were approximately 15 and 22 months in addition to the questionnaire at 8 months. A group of 142 parents completed the first questionnaire, but did not complete the CDI language skills list at 15 months, nor at 22 months, and were therefore excluded from the analyses. The excluded group did not differ from the included group in gender and age but had a lower average level of parent education ($t(780) = -3.44$, $p < .05$). Average education levels on a scale from 0 (no education for both parents) to 6 (both parents received a university degree) of the included and excluded families were 4.25 ($SD = 1.32$) and 3.83 ($SD = 1.42$), respectively.

Procedure

Parents received an invitation letter to participate in the study that also gave information about the research purposes. The letter explained that we were interested in shared reading with babies, and contained a link to a website with the background questions, the book exposure list (to be completed at 8 months), and the MacArthur-

Bates CDI language skills list, a language test to be completed at 15 and 22 months. If parents did not have access to the online version but were willing to participate, we provided a paper version of the questionnaires. On each occasion at most 14 parents used this option. Completing each of the three questionnaires took about 20 minutes. A reminder was sent four weeks after the invitation. Parents received a small present after completing a questionnaire (for instance a baby calendar).

Measures

The description of questionnaires administered when the child was aged around 8, 15, and 22 months is limited to the variables involved in this report: background information (age, gender, parent education), condition (participating in BookStart or not), book exposure list, and MacArthur-Bates CDI language scores. Not reported in this study are questionnaires about parental beliefs concerning book reading to young children; the frequency of home activities (book reading, television viewing, listening to music); the incidence of problems like dyslexia in the family; and children's temperament.

Questionnaire. Background information included age, gender of the child, and parent education. Both parents indicated their highest education level on a 7-point scale: primary education, lower secondary vocational education, higher secondary education, higher vocational education, college or pre-university/university. A 7-point scale combining the education levels of both parents was composed, ranging from 0 (no education for both parents) to 6 (both parents received a university degree).

Book exposure list. To assess an early onset of book sharing we preferred an unobtrusive measure, the book exposure list, to shared-reading frequency as reported by the parent when the child was approximately 8 months old. We preferred an unobtrusive indicator for book sharing - assessing how familiar parents are with popular baby books - to a questionnaire, because in an experiment where parents receive flyers about the importance of an early start with book sharing, their responses to questions about book sharing may easily be compromised by socially desirable answers. From previous research we know that for children of preschool and kindergarten age, book exposure lists completed by parents do predict language and literacy skills (Mol & Bus, 2011). The book exposure list, modeled on the title recognition lists by Cunningham and Stanovich (1990), consisted of images of 63 baby book covers among 23 fake covers (cf. Mol, Neuman, & Strouse, 2014; Sénéchal, LeFevre, Hudson, & Lawson, 1996). The list was composed of baby books that were available in book stores and libraries at the time of the study. Parents were asked to tick all covers they recognized as "real". The total score was the proportion of correctly recognized baby books minus the proportion of foils ticked.

Language development. To assess the language development of the children at 15 and 22 months we used the shortened Dutch version of the MacArthur-Bates CDI (Fenson, Bates, Dale, Goodman, Reznick, & Thal, 2000; translated into Dutch by Zink & LeJaegere, 2003). The list included 55 words (e.g., *ooh, ah, car, book, flower*). For each word we asked parents to indicate whether the child could produce (expressive language scale) or comprehend (receptive language scale) it. The raw scores on both scales were added up to serve as an indicator of language development.

Plan of analysis

The Instrumental Variable Estimate approach (Murnane & Willett, 2011) involves the statistical modeling of two hypothesized relationships: (a) between the potentially endogenous predictor ‘book exposure’ and the BookStart instrument, and (b) between the outcome measure ‘language development’ and the exogenous predictor ‘book exposure’. We can fit the two models simultaneously using Simultaneous-Equations Modeling (SEM). In Figure 2 the α and β paths together reflect the notion that the instrument BookStart is related to the predictor ‘book exposure’ and BookStart is related indirectly via book exposure to the outcome measure ‘language skills’. By having

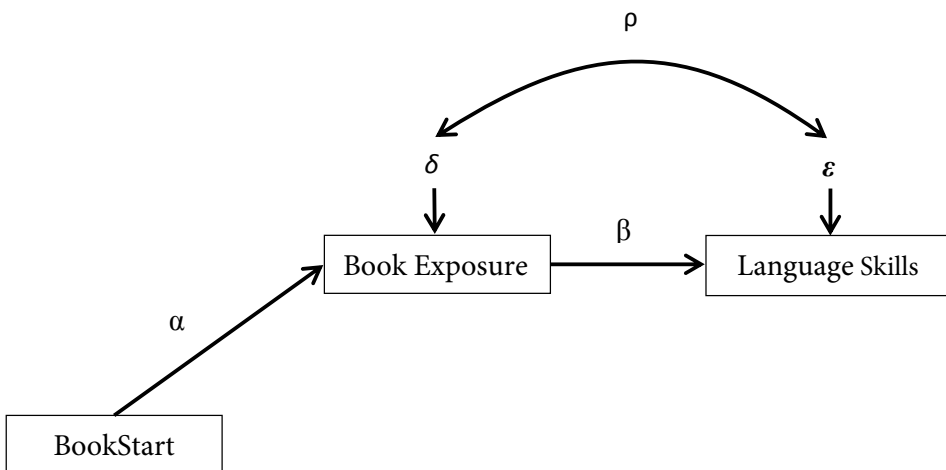


Figure 2. Path model with links that were tested in a large sample via assessments when children were 8, 15, or 22 months old. Book exposure at 8 months was assessed via a book exposure list, and language skills at 15 ($N = 584$) and 22 months ($N = 561$) via the MacArthur-Bates CDI. The first residual, δ , is that part of book exposure that is not predicted by BookStart. The second residual, ϵ , is that part of language development that is not predicted by book exposure. It is the link between the two residuals that ensures that only the part of variation in book exposure that has been predicted by BookStart determines the magnitude and direction of β . Thus, it is only the exogenous part of book exposure that determines the estimate of β . The absence of an arrow representing a direct path between the BookStart instrument and outcome measure ‘language skills’ exposes one of the critical assumptions of an Instrumental Variable Estimation.

BookStart predict the potentially endogenous predictor ‘book exposure’ we make a distinction between book exposure variation that is related to BookStart and therefore exogenous, and the unpredicted part or residual, which contains any endogenously determined variance of book exposure (like a parent’s belief that book reading to infants is important). Both parts, the endogenous as well as exogenous, may be correlated with the outcome measure ‘language development’ but it was only the exogenous part that we wanted to use in order to estimate β . Via the covariation between the residuals δ and ε any endogenous component of book exposure can be related to the outcome language skills.

Results

For our outcome we chose as measure of language development the overall score on word knowledge, which takes a value of 110 if children know all words receptively and expressively, and a value of 0 if they do not know any word either receptively or expressively. Note in Table 1 that children on average knew more than a third of the words at 15 months; seven months later, at 22 months, they knew about twice as many. The book exposure list is a continuous variable that represents how many book covers parents recognized minus the number of fake covers they checked. To evaluate the impact of book exposure at 8 months on language development at 15 and 22 months,

Table 1 Descriptives of the general information provided on the questionnaire ($N=640$)

	Sample mean ($N = 640$)	BookStart ($N = 394$)	Control ($N=246$)	p -value
<i>Covariates:</i>				
• Age in months	8.14 (1.39)	8.10 (1.44)	8.20 (1.29)	.384
• Gender (boys)	50%	49%	52%	.477
• Education level (maximum score: 6)	4.25 (1.32)	4.35 (1.31)	4.11 (1.31)	.024
<i>Endogenous predictor:</i>				
• Book exposure list (% correct books minus foils)	16.63 (10.77)	17.66 (11.29)	14.99 (9.68)	.002
<i>Instrument:</i>				
• BookStart	62%	-	-	-
<i>Outcomes:</i>				
CDI (maximum score: 110)				.222
• at 15 months ^a	41.20 (19.73)	40.41 (19.94)	42.46 (19.36)	
• at 22 months ^a	80.06 (20.26)	79.62 (20.61)	80.84 (19.67)	.496

Note. ^aAt 15 months $N = 584$ (61% BookStart); at 22 months $N = 561$ (64% BookStart)

we treated this variable as a potentially endogenous *predictor* in our analyses. The *instrumental variable* in the model is the dichotomous variable BookStart. Of the total number of participants, 62% received the BookStart package. In Table 1 we provide descriptive statistics for the subsample of families who participated in BookStart (BookStart = 1), and for the subsample not living in a BookStart area (BookStart = 0). Note that age and gender were the same in the two groups, as is to be expected if the same criteria are applied for group selection. The level of parental education was somewhat higher in the BookStart group, see Table 1. We therefore treated education level as a covariate, to improve the precision of the estimates. At 15 and 22 months the BookStart and control groups did not differ in scores on the CDI lists, which indicates that there were no direct effects of BookStart on language development. However, there were statistically significant differences in the book exposure scores between the two groups. The BookStart group scored almost 3 points higher than the control group. This confirms that there is a relationship between the potential instrument, BookStart, and the potentially endogenous predictor ‘book exposure’. This means that the data meet the condition that the instrumental variable must be related to the predictor, for using BookStart as instrumental variable.

We argued that variation in the predictor ‘book exposure’ is potentially endogenous. The choice of whether to buy and borrow books for sharing with your baby may depend not only on collecting the BookStart case but also on many unseen characteristics of the family or parent, each of which may also affect language development. In order not to end up with a biased estimate of causal effects of BookStart on language development via book exposure we used a two-stage approach in analyzing the data. At the first stage the potentially endogenous predictor ‘book exposure’ was obtained by regressing this variable on BookStart. At the second stage, we used the predicted score on ‘book exposure’ in place of the corresponding observed values, and regressed language development on the book exposure predictor obtained in the first stage.

Using the SEM approach we estimated the impact of BookStart on language development at 15 months through book exposure at 8 months; see Table 2. Estimates, corrected standard errors, and approximate p values for the model parameters at both stages are provided in the upper and lower panels of Table 2. In the upper panel we can inspect the first path, which links the extraneous variable BookStart to the potentially endogenous predictor ‘book exposure’. The relationship is strong and statistically significant ($p < .01$). The estimate indicates that the BookStart parents scored 2.66 points higher on the book exposure list than the parents who did not participate in BookStart, an effect that equaled $.25 SD$ (Mean difference (2.67) / Standard Deviation in sample (10.77)). Thus, we might characterize BookStart as a useful instrument

Table 2 Estimation of the effects of the extraneous variable bookstart on language development at 15 months through book exposure at 8 months

First stage: Outcome - Book Exposure

	Parameter Estimate	Standard Error
Intercept	14.956***	.722
<i>Instrument:</i>		
BookStart	2.666**	.921
R^2	.014	

Second stage: Outcome - language development at 15 months, raw score on CDI

	Parameter Estimate	Corrected St. Error
Intercept	38.593***	1.481
Book Exposure (predicted values)	.157*	.075
R^2	.008	
ρ	.005	

Note. [†] $p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$

Table 3 Estimation of the effects of the extraneous variable bookstart on language development at 22 months through book exposure at 8 months.

First stage: Outcome - Book Exposure

	Parameter Estimate	Standard Error
Intercept	15.587***	.742
<i>Instrument:</i>		
BookStart	2.008*	.928
R^2	.008	

Second stage: Outcome - language development at 22 months, raw score on CDI

	Parameter Estimate	Corrected St. Error
Intercept	77.069***	1.600
Book Exposure (predicted values)	.177*	.080
R^2	.010	
ρ	.005	

Note. [†] $p < .10$; * $p < .05$; $p^{**} < .01$; $p^{***} < .001$

that explained about 1.4% of the differences in scores on the book exposure list. At the second stage, we examined the second path linking the predicted values of the potentially endogenous predictor ‘book exposure at 8 months’ to children’s subsequent language development at 15 months. We made sure that it was only the exogenous first part that determined the estimate of β by providing a “back door” route via the covariation between the residuals δ and ε . Thus, the estimate of regression slope β depended only on extraneously determined book sharing. Note in the lower part of Table 2 that the effect of the book exposure list on language skills was significant. The overlap between BookStart and the book exposure variable explained a significant part of the variance in the language test – R^2 equaled 0.8%, which indicates a small effect size.

In Table 3 we present the impact of book exposure at 8 months on language development at 22 months. If exactly the same participants had been included as in analyses concerning language skills at 15 months the upper part of Table 3 would have been exactly the same as the upper part of Table 2. However, because the groups that completed the CDI at 15 and 22 months differed a bit, there were some differences in the group of participants explaining the discrepancies between the upper parts of Tables 2 and 3. The prospective connection between book exposure at 8 months and the development of language skills at 22 months was statistically significant, and somewhat stronger than the connection that we found at 15 months; the overlap between BookStart and book exposure explained 1% of the differences in scores on the language test at 22 months.

Using SEM to estimate the fit of models simultaneously we obtained an estimate of the correlation between the residuals in the models (ρ). In both models (at 15 and 22 months) the estimated correlation between the errors (δ and ε) equaled .005, which is a small and insignificant correlation. Such a small error correlation indicates that the path by which the endogenous variation in book exposure could be linked to language development was not significant. In other words, removing the arrow between the errors would not change the results for the two models (at 15 and 22 months) significantly.

Discussion

An important educational-policy issue in the Netherlands is how to improve young children's educational attainments efficiently so that the number of children who are behind in language development at the start of primary education can be minimized. In this study we wanted to test how important it is to stimulate parents "to nourish the child's mind through book sharing" in the first year as is suggested to parents of newborn babies (Hillary Clinton, www.toosmall.org). We therefore focused on outcomes of a nation-wide project, BookStart, which promotes an early start with book sharing by offering parents exemplary materials, free access to the library and advice about book sharing with young children, and information about the importance of book reading. Results suggest a causal relationship between an early start with book sharing as a result of BookStart and early language skills. If parents complied with the BookStart suggestion to start in the first year of life with book sharing, their children's language scores in the second year were higher than those of a similar group of children who had not been exposed to BookStart. To the best of our knowledge it is a unique finding that extraneous incentives to book sharing affect language development assessed as early as 15 months. It should be emphasized that it is not likely that scores on the instrument to assess book sharing just reflected the information that BookStart parents received about the importance of this activity. In contrast to previous studies of early book reading inventions in which parents reported how often they read to their child (e.g., Burnett, Daniels, & Bailey, 2014), we used an unobtrusive measure – the book exposure list – as indicator of parent-child book sharing.

This study is one of the few to provide evidence for a causal relationship between an exogenous stimulus to an early start with book sharing, and children's language skills as measured by the MacArthur-Bates CDI. This finding is even more remarkable when we take into account that the BookStart approach, targeting all newborn children in the Netherlands, is low in dosage and budget. Participating in BookStart meant that, when the baby was about three months, parents received an example of a booklet appropriate for babies, had access to age-appropriate reading materials through the local library, could receive advice about book sharing with babies if they wanted, and could see examples of parent-infant book sharing on websites. Apart from these opportunities, parents did not receive intensive coaching of infant-parent interaction as in other Dutch book reading projects like *Boekenpret* [fun with books] and *Voorleesexpres* [book reading express]; parents themselves were responsible for taking their own benefits out of the intervention. We cannot be certain that this low-

profile approach to stimulating book sharing with babies is effective for all Dutch families, since not all educational levels were equally well represented in the current sample. In particular, the lowest educated group (only primary education or special education) was underrepresented.

Effects of BookStart through book exposure at 8 months on language development at 15 and 22 months were small. It is possible that such outcomes are to be expected at this early age due to the small variation in children's scores on language tests. Because other studies into the effects of early interventions on cognitive development report effect sizes comparable to those reported here (Coley, Lombardi, Sims, & Votruba-Drzal, 2013; Loeb et al., 2007), this may in fact apply. It should also be mentioned that we took great care to estimate effects in only the group of parents that changed their behavior due to BookStart, which may have resulted in rather conservative estimates of effect sizes. As we wanted to isolate influences of exogenous variance determined by BookStart from many possible endogenous factors (i.e., parental attitude towards book reading, knowledge about the importance of verbal interaction with babies) we preferred the Instrumental Variable Estimation to a regular linear regression in this study. Thus, we increased the probability of accepting the null hypothesis and finding low effect sizes, as the approach currently used is very strict in calculating effect sizes (Murnane & Willett, 2011).

There is some evidence that book sharing is a stronger predictor of language development at 22 months than of development at 15 months. To explain this finding we hypothesize that a book-reading routine expands over time, which may cause effects to increase (Raikes et al., 2006). An early start may improve the children's interest in books, so that children's pleasure in sharing books grows and parents and children spend more and more time on reading. Once parents are convinced that reading to young children is pleasant (e.g., Bingham, 2007), reciprocal influences between language skills and book sharing may be set in motion (Raikes et al., 2006), affecting later language and reading skills (Mol & Bus, 2011). When parents experience how engaging parent-child book sharing can be they may realize that in fact it is possible to create verbal exchanges with very young children and increase the frequency of book sharing. In other words, our findings agree with the hypothesis that if parents persist in a reading routine individual differences in language score will grow and will become stronger over time (Belsky et al., 2007; Deming, 2009).

Limitations and future directions

In this study we did not have the opportunity to randomly assign participants to the BookStart or control condition – the preferred approach for testing effects of

interventions (see What Works Clearinghouse standards). In analyzing the data we chose therefore to use the Instrumental Variable Estimation procedure, a statistical model that enabled us to control for impact of endogenous variables that could affect the language outcomes in the current intervention study. As we wanted to isolate influences of exogenous variance determined by BookStart from endogenous factors (i.e., parental attitude and knowledge) we preferred this approach to a regular linear regression, even though it increases the probability of accepting the null hypothesis and finding low effect sizes.

Our BookStart group consisted of only those parents who actually collected the BookStart case, and not the *intent-to-treat* group, i.e., all parents who received an invitation to participate in BookStart. This selection of the experimental group might have distorted the results as the parents, who actually collected the BookStart case, might have been more motivated for book sharing than the parents in the control group. As a result we may have overrated the effect of BookStart on book sharing, even when attempts are made, as we did here, to exclude effects of endogenous characteristics of parents. On the other hand, control parents were willing to complete a questionnaire about book sharing, which may indicate that they, too, were interested in such activities with infants.

Because the data were collected via questionnaires, parents most in need of BookStart, from low educational background or bilingual families, might not have participated. About 1% of the parents in the sample belonged to the lowest educated, whereas this percentage is 8.29% for the Dutch population as a whole (*Centraal Bureau voor de Statistiek* [Statistics Netherlands], 2010). The lowest educated parents were underrepresented in both the control and BookStart groups, which may have caused rather homogenous scores on the book exposure list and language test. If more lowest educated parents had participated this might have led to more variation in answers, possibly resulting in greater effect sizes. Outcomes of a waiting-room study at child health care centers a year after this study in which we assessed the participation-rate of BookStart among the parents of six to nine months old babies, confirmed that the lowest educated parents were participating least in the project. More attention should therefore be paid to how these parents can be involved in a low-dosage intervention as BookStart.

Our results indicate that an early start with reading is important for the development of preschool language skills, and that effects of BookStart on parental reading behaviors are “real”. We tried to exclude the possibility that the project is effective only because it is embraced by parents who, due to personal choices and interests, agree with the importance of book sharing from an early age. BookStart is a

compound of several elements that each may be important in promoting parent-baby verbal interaction and early development of language skills: Explaining new parents the importance of interacting verbally with babies, showing parents how they can share stories with very young children, and, probably most important, providing free access to appropriate materials.

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