The developing brain and early learning

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The United States' Reach Out and Read model

Reach Out and Read (ROR) is a paediatric primary care based intervention to encourage parents to read aloud to their young children. Doctors give books to children at each well child visit from 6 months of age to 5 years, and accompany these books with developmentally appropriate, individualised advice to the parents about strategies of enjoying books and reading aloud with their children. A growing body of peer reviewed research has shown this model to be effective in changing parental beliefs and behaviour and in accelerating language development in young children from low income families.

Scientific knowledge regarding early brain development has progressed rapidly, eliciting widespread academic and popular interest. Much of the new understanding of the brain in the early years of life emphasises the translation of early experiences into neuronal connections, which in turn may influence later child development. We report an evidence based innovation in paediatric primary care in the United States that builds on recent research in brain development to promote learning in infancy and early childhood, with specific reference to books and language.

BRAIN DEVELOPMENT

Our new and rapidly expanding understanding of early brain development has elucidated the anatomical and physiological consequences of early experiences. Children are born with all their neurones already formed. However, the connections between these neurones are in large part established and elaborated after birth, as the synapses proliferate, forming and branching dramatically during early childhood, and reaching a peak count by 3 years of age. Half of these synapses are lost by age 15, suggesting that they are more than are needed for function in any human setting.¹ Synapses are lost through the "pruning" of unused neural connections and the selective strengthening of those that are used to foster environmental adaptation.² Recent evidence suggests that this sensory pruning is directed, in large part, by the child's experience.

Thus, the child's experience, like a sculptor carving a complex statue from a large block of stone, shapes the child's brain. But such plasticity of the neural networks decreases with age, although it never completely disappears. As an example, language development is a key milestone of the first years. The infant's innate neural circuitry allows her brain to be able to recognise any phoneme. However, after less than a year in a certain linguistic environment, the child becomes increasingly able to differentiate only those phonemes she typically hears in her language and begins to lose the ability to perceive other phonemes.^{3,4} For example, individuals who have spent their first decade hearing Asian languages in which the phonemes *r* and *L* are interchangeable, are unable to differentiate those sounds.⁵ Positron emission tomography (PET) scans have shown that the *r* and *L* sounds are decoded in separate parts of the brain of an English speaking person, but these sounds are processed in the same part of the brain of someone in whose native language these phonemes are not differentiated.⁶

Another example is the difference in the ease of acquiring a second language in the early years compared to adolescence. If a child learns two languages in early childhood, he will speak both languages with sophisticated grammatical construction and accent. If a second language is learned in high school or college, even proficient speakers generally do not have as complete a mastery of grammatical construction or accent as early speakers or native speakers.⁷ Furthermore, PET scans have shown that when a child grows up learning two languages, all language activity is found in the same place in the brain.⁸ Children who learn a second language at a later age show two foci of language activity. One interpretation is that learning a second language later takes more effort than when language is learned at its developmentally optimal time because it is processed and wired in a different place. Acquisition of language in early childhood is captured by the expression that language is caught not taught. Acquisition of another language in later childhood or older is different and may

rely much more heavily on memorisation of words and rules of grammar.⁹

IMPORTANCE OF PARENTS READING ALOUD TO CHILDREN

Reading aloud to young children serves a number of important developmental purposes. The development of early literacy is a continuous process that begins early in life and is extremely dependent on environmental influences.¹⁰ Early literacy acquisition is a developmental process that takes place when optimal conditions are present in the child's environment. Reading to young children provides important language and picture based stimulation, acquaints them with the forms and cadences of written language, leaves them with a good understanding of how books and stories are put together, and provides them with positive associations and strong motivation around learning to read.¹¹ Studies have shown that parents use more language and more repetition when reading to young children than they do in other everyday activities, and that the short sentences, repetitive phrases, and limited vocabulary of picture books assist processing and acquisition of language.¹²⁻¹⁴ For all these reasons and more, the National Commission on Reading called reading aloud to children "the single most important intervention" in helping young children towards reading success.¹⁵

The parental habit of reading aloud can be encouraged when children are as young as 6 months; they become interested in objects and pictures at this time. At this early age, the reading aloud does not involve "teaching" the child to read in any way—and in fact, may have more to do with pointing at pictures and naming them than with "reading a story". However, even at this early age, reading aloud or looking at books together tends to elicit focused parent-child attention with concentrated language stimulation, and a pleasurable interaction which offers opportunities to stimulate a wide range of developmental skills and abilities. An infant who is held on a parent's lap, looking at pictures, for example, of baby faces in a sturdy board book, is experiencing focused social and emotional stimulation from the parent, exercising her fine motor skills (as she bats at the pictures in the book and attempts to turn the page—or even as she grabs the book and transfers it to her mouth), and exercising her memory and her curiosity, even as she becomes familiar with the words that the parent is applying to the pictures.

Reading aloud to young children does not teach them how to read. What it does do is help them grow up with specific early literacy skills, which make it more

likely that they will succeed in learning to read on schedule—and with strong positive associations with books and reading, which make it more likely that they will want to succeed. In the United States, more than a third of first grade children are not able to read at grade level, and are therefore at high risk for reading below grade level all through school.^{16, 17} This in turn places them at high risk for overall school failure, truancy, and dropping out, along with other childhood and adolescent problems related to school failure. The risk is disproportionately high for children from low income families, who, as a group, grow up with parents who themselves completed fewer years of school, with fewer books in the home, and with a lower chance of being read to.¹⁸

DESCRIPTION OF REACH OUT AND READ

While reading aloud to young children is considered important by experts, many parents are not doing it. A recent national survey in the United States found that 16% of parents of children age 3 years and younger do not read at all with their children, and 23% do so only once or twice a week.¹⁹ Among low income children, who face the highest risk of reading problems, the percentage of parents who read aloud regularly is lower; 1999 data showed that 85% of children in households above the poverty threshold were read to three or more times a week, but only 69% of children in households below the poverty threshold. The percentage who are read to also increases with maternal education, from 61% of the children whose mothers have less than a high school education, rising steadily with educational level to 93% of those whose mothers have graduate or professional training.²⁰

While there is no single answer to how to help parents promote learning in their children, paediatricians in the United States have a special opportunity to encourage parents to read aloud because they enjoy regular and repeated contacts with infants and their parents, and because parents are eager for, and trusting of, guidance that addresses their infants' overall wellbeing, not just physical health. Parents want advice and help from their paediatricians when it comes to issues of learning and development in addition to health. In one study, 54% of parents wanted more specific information on how to encourage learning in their young children. In the same study, only 23% of parents mentioned that they discussed this issue with their paediatricians.¹⁹ Reach Out and Read is a new initiative in paediatric primary care that attempts to address this issue in a specific, concrete manner.

The Reach Out and Read model was developed in 1989 by paediatricians and

early childhood educators working in a large paediatric primary care clinic serving many low income children. The model has three components, and has been designed to operate in the special circumstances of the medical setting. First, the paediatrician (or other paediatric primary care giver) gives each child a book at each health supervision visit from 6 months to 5 years of age. The books are chosen to be developmentally and culturally appropriate, and as appealing as possible, with brightly coloured pictures; board books are available for young infants, and bilingual books are available where appropriate and where possible. Second, the paediatrician gives the parent developmentally appropriate anticipatory guidance about how best to enjoy the book with the child, advising, for example, that it is normal for a 6 month old to mouth the book immediately, but that the baby will enjoy having the parent point to pictures and offer names, or helping a parent understand that a 2 year old may have a short attention span, or may want to hear the same book over and over. This anticipatory guidance is linked, whenever possible, to other areas of developmental and behavioural guidance, so that a discussion, for example, of sleep behaviour and bedtime routines can include advice about a bedtime story, along with a book that is likely to be successful in that context for that child. The third component of the programme involves volunteer readers in clinic waiting rooms who read aloud to children while they are waiting for their visits, and thereby model techniques of reading aloud for parents.²¹

As an examination room intervention, paediatricians have found that the opportunity to tie the book and the literacy guidance to common childhood issues such as sleep behaviours, autonomy, attention spans, tantrums, or the importance of routine, can help many parents and children effectively incorporate books into their daily lives. Additionally, many physicians have found that the book is a highly useful tool for developmental surveillance in the examination room, and materials have been developed to help define the developmentally appropriate milestones of book handling and book related cognitive function.²¹ As a tool for the physician in the examination room, a picture book can elicit a wide range of language responses from a child, offering a physician the opportunity to observe vocabulary and clarity of diction, in addition to the fine motor skills used in book handling. As a tool for the parent in the home, a book can help the parent deal successfully with many of the exigencies and complexities of daily life with a small child. For example, parents may learn to use books and stories to

help an active child relax at naptime, or to bring one or two favourite board books along when they anticipate having to wait with their child.

Since its inception in a single paediatric clinic, Reach Out and Read has spread widely throughout the United States, and is now in more than 1400 clinics, hospitals, health centres, and paediatric practices. A training curriculum and materials for medical professionals and programme coordinators, and start-up funding for books to new programmes are provided with support from public and private funds. Additional related initiatives developed by paediatricians and other staff at Reach Out and Read sites have included outreach to enrol parents and children in libraries, so that even low income parents can have access to a wide variety of books, and partnerships with adult and family literacy programmes so that referrals can be made for parents who want to improve their own literacy skills.

RESEARCH FINDINGS

Initial research studies focused on the question of whether the intervention changed parental behaviour. In a preliminary study, parents who had received books and guidance at an earlier visit were four times more likely to report that their children liked being read to, or that they had recently looked at books with their children. The effect was strongest among those families receiving government assistance—that is, among those with most limited incomes.²² In another controlled longitudinal study, the parents in the intervention group showed a tenfold increase in the frequency of reading aloud at least three nights a week.²³ In a study looking specifically at immigrant families, mostly Spanish speaking, the rate of “frequent book sharing” doubled in those families receiving the ROR intervention.²⁴ A randomised controlled longitudinal study of “child centred literacy orientation” (CCLO), a measure of whether a parent cites reading aloud as a favourite activity or as a regular bedtime practice, found that CCLO was significantly increased in a group of parents receiving the ROR model intervention compared to a control group which received safety counselling.²⁵ And a study performed in non-English-speaking families showed positive changes in attitudes, awareness, and practices, even among those for whom books in the appropriate languages were not available.²⁶

Several studies have now looked at children's language scores. In a controlled longitudinal study, using a modified version of a standard parent report instrument, there were significant increases in both receptive and expressive language scores for children 18 months

and older in the intervention group; these gains were seen both with respect to specific words which were included in the books given out and also with respect to the general test.²⁷ Another study tested children's language skills directly, and found that scores on a standard picture vocabulary test were significantly higher for both expressive and receptive language in children who had received the ROR intervention than in children from a well matched clinic without the intervention. Following a multivariate analysis, the adjusted mean differences were 8.6 points for receptive, and 4.3 points for expressive, representing large, statistically and clinically meaningful differences. What is more, the researchers documented a dose-response effect, wherein the more ROR contacts a child had, the higher his expressive and receptive language scores.²⁸

Most recently, a study found similar differences between the receptive vocabulary scores of children at two very similar clinics, one with ROR in place for three years, and one with the intervention in place for three months.²⁹

STRATEGIES FOR IMPROVING LITERACY

Why is such a simple and inexpensive intervention so effective? The answer may have to do with the special meaning of books in many cultures as symbols of success in school, and all that that success means for one's life chances. The delight of parents when their infants respond with interest to a picture book reflects the value parents place on their children being intellectually oriented. Consistent with this, the recent United States national poll found that one of the areas in which parents most wanted information from paediatricians was about children's learning.¹⁹ In addition, parents' ratings of physician helpfulness are significantly higher when ROR is part of the visit.

Books are durable, particularly the board books that we give to infants. Unlike pamphlets that often last only long enough to be thrown away, a picture book gets used day after day, each time reinforcing the paediatrician's message that reading aloud is important. The intervention is less dependent on parents remembering, because children often initiate (that is, demand) reading aloud. Reading aloud can become a standard and much enjoyed part of everyday household routine; as soon as parents and children discover how enjoyable it is, they come to look forward to it, and even to expect it and depend on it. It may quickly become an essential piece of a young child's routine—for example at bedtime, or other transition moments. Picture books are the necessary tools for reading aloud, although story telling and

other literacy related activities can proceed without them. Among lower income families, between 10% and 40% report having no children's books at all until they get their first ROR book. Ten years ago, there were very few ethnically appropriate picture books. Now, the selection is much wider, including many titles in Spanish, and bilingual titles in both Spanish and English. Through a special collaboration with Scholastic Inc., we have been able to make available a limited number of selected titles in bilingual editions for the 11 other languages most often requested by the clinics implementing ROR: Arabic, Bengali, Bosnian, Cambodian, Chinese, Haitian Creole, Korean, Polish, Portuguese, Russian, and Vietnamese.

ADAPTATION BY FAMILY PHYSICIANS AND PAEDIATRICIANS IN OTHER COUNTRIES

Just as part of the joy of providing medical care to children is the pleasure of watching a child's development unfold, those who offer child health care are by definition in the business of offering parents strategies to encourage healthy development. Reach Out and Read is unique, in that it offers doctors a simple evidence based intervention for low income children, which has been shown to promote parents reading to their children and to improve developmental outcomes in the vital area of language development. This proven efficacy puts the model into a very important category: it is, then, something that doctors can do to effect a known change in the home environment and in language abilities, changes which relate directly to the child's potential for reading and school achievement. The willingness, even eagerness, of paediatric clinicians in the United States to take on this additional arena of concern, even in an era of financial pressures and increased administrative responsibilities, speaks to their understanding of the importance of early brain development for later learning, and of the importance of later learning and school achievement in children's lives.

We would argue that the evidence cited above should impel the adoption of early literacy promotion following the ROR model as a standard part of paediatric primary care/child health supervision during the first five years of life, supported by professional organisations, government bodies, and insurers. We recognise that the ROR model was developed specifically to fit into the ways in which paediatric primary care is delivered in the United States, and that in order for the model to succeed in other countries, with other health care systems, it will have to be adapted and

rethought by those who understand those systems well. Our experience suggests that the core of the intervention will be intact as long as health care providers use their "medical authority" when they recommend reading out loud, and as long as they give parents the tools, the books, that they need to follow those recommendations. We would urge that the ROR approach be adopted by those who care for the health and development of young children everywhere. Promoting development and environmental stimulation is part of taking care of children's health, and leads to healthy development, which leads to success, in school and in life.

FURTHER INFORMATION

For those interested in receiving a manual describing how to implement Reach Out and Read, contact: Reach Out and Read National Center, 29 Mystic Avenue, Somerville, MA 02145, USA; www.reachoutandread.org.

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IMAGES IN PAEDIATRICS.....

Auto-intussuscepting foreign body

A 5 year old girl underwent laparotomy for small bowel obstruction. She had been unwell for several days but there was no other significant history. Abdominal x ray examination confirmed high intestinal obstruction but no cause could be identified.

At operation an ingested squeezable bulb from a toy (inset) was found to be inducing intussusception into itself, preventing further forward movement (main picture). Most swallowed foreign bodies will pass through the bowel, although perforation from needles is possible. Intussusception is more unusual but has been reported where objects are made from deformable materials. Furthermore, imaging is made difficult by the radiolucency of objects showing only the level of the obstruction. The possibility of bolus obstruction should be remembered, especially in childhood where there may be no history of ingestion.

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