How Promoting Literacy is Key to Early Brain and Child Development

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Disclosure

I have no relevant financial relationships to disclose.

I will not discuss off-label use or investigational use in my presentation.

Although...
I don’t know if “mouthing” is an approved use of board books.
Oh, that's so nice...
A stroll through the Early Brain
Reading Reality
Reach Out and Read
First, a story...
Part One

A Stroll Through the Early Brain
EARLY BRAIN AND CHILD DEVELOPMENT

from The Science of Early Childhood Development
Child development is a foundation for community development and economic development, as capable children become the foundation of a prosperous and sustainable society.

Brains are built over time.
Eco-biodevelopmental Model

Biological Program

Genetics and Neurobiology

Culture

Brain/Mind/Body

Behavior

Relational Experiences

Physical, Social and Mental Well-being

Childhood Experience
“Three-legged stool” for “predicting” developmental and health trajectories

- Genetic, Prenatal and Neurodevelopmental Factors
- Social-economic environment
- Attachment and Relational Patterns (ACE Scores)
Prenatal Toxins

- Smoking
- Alcohol
- Organo-pesticides
- Poor nutrition
- Heavy metals
The interactive influences of genes and experience literally shape the architecture of the developing brain and the active ingredient is the “serve and return” nature of children’s engagement in relationships with their parents and other caregivers in their family or community.
Brain = organ of social communication

Mind = exists between people

Mindsight = the ability to know the mind of others

The Social Brain
Dan Siegel, MD (2000)
Mind emerges from the activity of the brain

The flow of energy and information within and between brains

The Developing Mind

Emerges at the interface of neuropsycho logical processes and interpersonal experiences

The genetically programmed maturation of the brain responds to experience
Humans are “affiliating” beings - never developing in isolation....

....development proceeds through and by relationships.
Both brain architecture and developing abilities are built “from the bottom up” with simple circuits and skills providing the scaffolding for more advanced circuits and skills over time.
Toxic stress in early childhood is associated with persistent effects on the nervous system and stress hormone systems that can damage developing brain architecture and lead to lifelong problems in learning, behavior and both physical and mental health.
Toxic
Prolonged activation of stress response systems in the absence of protective relationships.

Three Levels of Stress Response

Positive
Brief increases in heart rate, mild elevations in stress hormone levels.

Tolerable
Serious, temporary stress responses, buffered by supportive relationships.

Source: Center on the Developing Child at Harvard University
Adversity & Toxic Stress

Toxic stress is the **key intergenerational transmitter** of social and health disparities
The benefits of widespread vaccination are mostly explained in terms of the lives vaccines save, and based on that measure alone, vaccines are the best investment to improve the human condition. However, there are two other equally important benefits that are not as widely known partly because they are harder to quantify.

The first is the reduction in sickness. I don’t mean just the acute sickness where a child is clearly suffering from the disease, but also the permanent disabilities caused by the disease. This is most noticeable when the disability presents with a clear symptom such as being paralyzed by polio or going deaf because of a pneumococcal infection. However, the largest disability is the effect on mental development. For example, severe cerebral malaria damages your brain even if you survive. When children have lots of diarrheal episodes or parasites in their intestines, they don’t get enough nutrition for their brains to develop fully.

The huge infectious disease burden in poor countries means that a substantial part of their human potential is lost by the time children are 5 years old. A group of researchers at the University of New Mexico conducted a study, covered in The Economist, showing the correlation between lower IQ and a high level of disease in a country. Although an IQ test is not a perfect measure, the dramatic effect you see is a huge injustice. It helps explain why countries with high disease burdens have a hard time developing their economies as easily as countries with less disease.

The second great benefit of vaccination is that as the childhood death rate is reduced, within 10 to 20 years this reduction is strongly associated with families choosing to have fewer children. While it might seem logical that saving children’s lives will cause overpopulation, the opposite is true. I mention this amazing connection often, since I remember how I had to hear it multiple times before the full implications of it became clear. It is the reason why childhood health issues are key to so many other issues, including having resources for education, providing enough jobs, and not destroying the environment. Only when Melinda and I understood this connection did we make the full commitment to health issues, especially vaccination.

The connection of health to education, jobs, and the environment points back to the tremendous value of high-quality international aid—and why it’s essential that donor nations not cut their spending on it. Melinda and I have committed $10 billion from the foundation over the next 10 years to help make this the Decade of Vaccines. However, this will fall well short of what is needed.

The group which helps poor countries purchase vaccines and increase vaccine coverage is the GAVI Alliance and like the polio campaign its success will depend on donor generosity.

*The logarithm of disability-adjusted life years (DALYs) lost to 28 representative and important human infectious diseases. Source: Christopher Eppig, University of New Mexico*
Significant Adversity Impairs Development in the First Three Years

Number of Risk Factors

Source: Barth, et al. (2008) via Center on the Developing Child at Harvard University
Risk Factors for Adult Heart Disease are Embedded in Adverse Childhood Experiences

Source: Dong, et al. (2004) via Center on the Developing Child at Harvard University
**SMOKING & COPD**

- Regular Smoking by Age 14
- COPD

Adverse Childhood Experiences Score

- 0
- 1
- 2
- 3
- 4 or more
Childhood Experiences vs. Adult Alcoholism

![Bar Chart]

- ACE Score
- % Alcoholic
- 0
- 1
- 2
- 3
- 4+

The chart illustrates the relationship between ACE scores and the percentage of alcoholics. As the ACE score increases, the percentage of alcoholics also increases.
DEPRESSION

With a Lifetime History of Depression

% With a Lifetime History of Depression

ACE Score

Women
Men

0 1 2 3 >=4

0 20 40 60 80

0 20 40 60

0 20
SUICIDE

% Attempting Suicide

ACE Score

0
1
2
3
4+

IV Drug Use

N = 8,022
p < 0.001
Creating the right conditions for early childhood development is likely to be more effective and less costly than addressing problems at a later age.
Three Promising Domains for EBCD Innovation
Jack Schonkoff, MD

Reduce emotional and behavioral barriers to learning.

Enhance the healthy development of children by transforming the lives of their parents.

Reconceptualize the health dimension of early childhood policy and practice.
The New World of Pediatrics:

“Developmental Assurance”

Building a healthy mind & brain for social purpose.

“Child health is a nation’s wealth.”

National Research Council and Institute of Medicine 2004
School Readiness Skills

Emotional self-regulation

Behavioural self-regulation

Empathy and perspective-taking

Communicating needs, desires & interests in a pro-social way

Understanding cause & effect sequences

Interest, motivation, persistence

Early Childhood Resource Center, RTI
The Developing Mind

Mind emerges from the activity of the brain.

The flow of energy and information within and between brains.

The Developing Mind

Emerges at the interface of neuropsychological processes and interpersonal experiences.

The genetically programmed maturation of the brain responds to experience.
Five Numbers To Remember
700 New Neural Connections per Second

Postnatal development of human cerebral cortex around Broca's Area (FCBm); camera lucida drawings from Golgi-Cox preparations. a: newborn; b: 1 month; c: 3 months; d: 6 months; e: 15 months; f: 24 months.
(from Conel, 1939-1959)
18 Months:

**Sampling Experience**

![Graph showing vocabulary growth of children from different SES backgrounds.](image)

*Figure 2. The widening gap we saw in the vocabulary growth of children from professional, working-class, and welfare families across their first 3 years of life. (See Appendix B for a detailed explanation of this figure.)*
90-100% Chance of Developmental Delays when Children Experience 6-7 Risk Factors
3:1 Odds of Adult Heart Disease after 7–8 Adverse Childhood Experiences
$4–$9 in Returns for Every Dollar Invested in Early Childhood Programs
Part Two

Reading Reality
<table>
<thead>
<tr>
<th>By Age 3…</th>
<th>Welfare</th>
<th>Professionals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vocabulary Size</td>
<td>525 words</td>
<td>1100 words</td>
</tr>
<tr>
<td>IQ</td>
<td>79</td>
<td>117</td>
</tr>
<tr>
<td>Utterances</td>
<td>178/hour</td>
<td>487/hour</td>
</tr>
<tr>
<td>Encouragements</td>
<td>75,000</td>
<td>500,000</td>
</tr>
<tr>
<td>Discouragements</td>
<td>200,000</td>
<td>80,000</td>
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</tbody>
</table>
Children from low-income families hear as many as 20 million fewer words than their more affluent peers before the age of 4.
### Parental Reading

<table>
<thead>
<tr>
<th>% Children ages 0-5 read to daily</th>
<th>State</th>
<th>National</th>
<th>State Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>46.1</td>
<td>47.8</td>
<td>38</td>
</tr>
</tbody>
</table>

**% Daily reading by poverty level**

<table>
<thead>
<tr>
<th>Poverty Level</th>
<th>State</th>
<th>National</th>
<th>State Ranking</th>
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</thead>
<tbody>
<tr>
<td>Less than 200% FPL</td>
<td>33.3</td>
<td>40.3</td>
<td>49</td>
</tr>
<tr>
<td>200-399% FPL</td>
<td>51.4</td>
<td></td>
<td>26</td>
</tr>
<tr>
<td>400% FPL or greater</td>
<td>52.2</td>
<td>58.9</td>
<td>43</td>
</tr>
</tbody>
</table>

**% Daily reading by race/ethnicity**

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>State</th>
<th>National</th>
<th>State Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>White (non-Hispanic)</td>
<td>50.8</td>
<td>55.0</td>
<td>41</td>
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<tr>
<td>Non-White</td>
<td>30.5</td>
<td>37.8</td>
<td>49</td>
</tr>
<tr>
<td>Black (non-Hispanic)</td>
<td>/</td>
<td>38.1</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>/</td>
<td>33.4</td>
<td></td>
</tr>
<tr>
<td>Other/Multiple Race</td>
<td>/</td>
<td>46.4</td>
<td></td>
</tr>
</tbody>
</table>

**% Daily reading by age**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>State</th>
<th>National</th>
<th>State Ranking</th>
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</thead>
<tbody>
<tr>
<td>Children age 0-3 years read to daily</td>
<td>49.5</td>
<td>48.3</td>
<td>26</td>
</tr>
<tr>
<td>Children age 4-5 years</td>
<td>41.0</td>
<td>47.0</td>
<td>44</td>
</tr>
</tbody>
</table>

### Early Childhood Literacy Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>State</th>
<th>National</th>
<th>State Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Children served by ROR</td>
<td>6.0</td>
<td>12.8</td>
<td>44</td>
</tr>
<tr>
<td>% Children in/near poverty served by ROR</td>
<td>15.2</td>
<td>26.0</td>
<td>38</td>
</tr>
<tr>
<td>Number of children age 0-5 per public library</td>
<td>893</td>
<td>1,368</td>
<td>14*</td>
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</table>

### School Performance

<table>
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<tr>
<th>Performance Measure</th>
<th>State</th>
<th>National</th>
<th>State Ranking</th>
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</thead>
<tbody>
<tr>
<td>% Students at or above Proficient in reading, Grade 4</td>
<td>33</td>
<td>30</td>
<td>19</td>
</tr>
<tr>
<td>% Children age 6-17 who have repeated at least one grade</td>
<td>5.7</td>
<td>11.3</td>
<td>4*</td>
</tr>
</tbody>
</table>

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Racial/Ethnic Distribution among Children Age 0-5 in Wisconsin (N~410,000)

Income Distribution among Children Age 0-5 in Wisconsin (N~410,000)
The Problem:
One-Third of Children Enter School
Unprepared to Learn

The Science:
Early Exposure to Language is Criticall

Low-income children are at a disadvantage before school begins

A TYPICAL MIDDLE-CLASS 5-YEAR-OLD IS ABLE TO IDENTIFY 22 LETTERS AND SOUNDS OF THE ALPHABET, COMPARED TO JUST 9 LETTERS FOR A CHILD FROM A LOW-INCOME FAMILY.

(WORDEN AND BOETTCHER, 1990; EHRI AND ROBERTS, 2006)

MIDDLE-INCOME CHILD’S LETTER RECOGNITION (22 LETTERS)

LOW-INCOME CHILD’S LETTER RECOGNITION (9 LETTERS)
One-third of children enter school unprepared to learn.
According to newly released results from the 2009 reading test administered as part of the National Assessment of Educational Progress, Wisconsin fourth-graders are performing only as well as the national average while the state's eighth-graders still do better than average.

**Average reading scores**

<table>
<thead>
<tr>
<th></th>
<th>WISCONSIN</th>
<th>NATION</th>
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</thead>
<tbody>
<tr>
<td><strong>FOURTH GRADE</strong></td>
<td>ADVANCED=268</td>
<td>PROFICIENT=238</td>
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<tr>
<td></td>
<td>'92 260</td>
<td>'94 260</td>
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<td></td>
<td>259 259</td>
<td>259 259</td>
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<td></td>
<td>258 258</td>
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</table>

**EIGHTH GRADE**

|          | ADVANCED=323 | PROFICIENT=281 | BASIC=243 |
|          | '92 325     | '94 326 | '98 327 | '03 328 | '05 329 | '07 329 | '09 329 |
|          | 325 326     | 325 327 | 325 327 | 325 328 | 325 329 | 325 329 | 325 329 |
|          | 326 327     | 326 328 | 326 328 | 326 329 | 326 329 | 326 329 | 326 329 |
|          | 327 328     | 327 329 | 327 329 | 327 329 | 327 329 | 327 329 | 327 329 |
|          | 328 329     | 328 329 | 328 329 | 328 329 | 328 329 | 328 329 | 328 329 |
African-American reading scores

Wisconsin's black students had a lower average score on the fourth-grade reading test than black students in any other state in the 2009 National Assessment of Educational Progress. The state had the second lowest average score, which tied with the scores of three other states, for black students on the eighth-grade reading test.

Average reading scores

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<td>270</td>
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<td>'07</td>
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<td>265</td>
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Source: National Assessment of Educational Progress

Journal Sentinel
Reading difficulty contributes to school failure, which increases the risk of absenteeism, school dropout, juvenile delinquency, substance abuse, and teenage pregnancy — all of which perpetuate the cycles of poverty and dependency.

**School intervention is too late.** Innate interest in learning and curiosity can be irreparably damaged if reading is not enjoyable at an early age.
Reading to children may not be a natural skill for adults.

Reading at all may not be something an adult is capable of.

Reading problems may have been an issue for generations.
When I think about children growing up in homes without books, I have the same visceral reaction as I have when I think of children in homes without milk or food or heat: It cannot be, it must not be. It stunts them and deprives them before they’ve had a fair chance.

— Perri Klass, MD
Why Reading?
Reading is the fundamental skill for learning
Awareness of books

- Understanding of printed words and what they represent
- Using background knowledge and strategies to obtain meaning from print
- Fluent reading
In the great green room...
Some people there are who, being grown, forget the horrible task of learning to read. It is perhaps the single greatest effort that the human undertakes, and he must do it as a child.

John Steinbeck
Extended Vocabulary and Language Development

Phonological Awareness
("dog" vs "dark")

General Aspects of Language Development

Knowledge of narrative

Speech Discrimination
("coat" vs "goat")
Literacy as a Family Activity

Part of routine and ritual

Physical closeness

Parent “teaching” to child

Sharing family and other stories
Letter and early word recognition

General Aspects of Print Awareness

Comprehension of physical text
Emergent Literacy: the early display of an awareness by children that print conveys information. It is an amalgamation of children’s oral language development and their initial attempts at reading and writing. Such attempts include “reading” the pictures of a book, or scribbling. Emergent literacy, if supported by meaningful interaction in oral and written language, evolves into full literacy skills. (Teale & Sulzby, 1986)
Dialogic Reading: the adult helps the child become the teller of the story by becoming the listener, questioner, and audience for the child.
The babe in the cradle knows about the dragon; he needs the stories to know about Saint George.

GK Chesterton
Reading should be fun!
Part Three

Reach Out and Read
Reach Out and Read prepares America’s youngest children to succeed in school by partnering with doctors to prescribe books and encourage families to read together.
In the exam room, health care providers trained in the developmental strategies of early literacy encourage patients to read aloud to their young children, and offer age-appropriate tips.
Prescription for Reading

Name: ______________________________________
Date: ________________ Age: ________________

Rx Read Books
☐ Every night at bedtime
☐ For ____ minutes every day
☐ As needed

Refills: as requested at local public library

Signature: ______________________________________

Dipesh Navsaria, MPH, MSLIS, MD
Pediatrician & Occasional Children’s Librarian

Families: Please visit reading.pediatrics.wisc.edu for more information on the joy of sharing books together and how it can make a huge difference in your child’s life.
The primary care provider gives every child between the ages of 6 months and five years a new, developmentally-appropriate children’s book to take home and keep.

"It is a great thing to start life with a small number of really good books which are your very own."

- Sir Arthur Conan Doyle, 1908
Volunteers in clinic waiting rooms read aloud to children, showing parents and children the techniques and pleasures of looking at books together.
Our goal is not about

Teaching a child to actually read early

It is about learning to love books.
Nearly 90% of all young children see a child health provider at least annually for a check-up, while less than one-third are in any childcare setting, the next most common contact with a formal service system.

Evidence

14 studies published in peer-reviewed medical journals

ROR increases the likelihood that children at-risk will be read to regularly.

ROR improves language scores in young children at-risk.

ROR improves the home literacy environment.

There is more extensive published research available supporting the ROR model than for any other psychosocial intervention in general pediatrics.
The British *Millennium Cohort Study Pediatrics*, February 2010

12,500 children given vocabulary tests at age 5

Delays of almost a **year** in the poorest homes

“The research shows that a child who is read to every day at age 3 has a vocabulary at age 5 that is **1.92 months more advanced** than a child who has exactly the same observable characteristics (including income group), but who is not read to every day at age 3.”
“More affluent family circumstances are clearly associated with better parenting behaviours. At age 3, 78% of the richest children were read to daily and 91% had regular bedtimes, much higher than the corresponding numbers for the lowest income group.”
“Nevertheless, it is still the case that 45% and 70% of the lowest income parents practiced these beneficial behaviours, providing grounds for optimism that good parenting can be adopted and extended in even the most disadvantaged families.”
“Of the families who seemed to be nonreaders or limited book readers, 21% had children at risk for developmental problems, compared with 12% of the families who were book readers...Families for whom book reading was uncommon were almost twice as likely to have a child with delays.”
“By 6 months of age, children whose parents read aloud frequently outperformed children whose parents read rarely; this pattern continued through 24 months of age.”

“Differences in communications skills increased with age, and the magnitude of the discrepancy between groups increased steadily with the age of the child.”

“Another critical focus for future studies is to operationalize parenting behaviors/perceptions into developmental promotion interventions that are brief and workable in busy primary care settings, following the example of effectiveness research established by the Reach Out and Read program.”
Examples

Videos courtesy of Reach Out and Read – Massachusetts
Initially not focused

Receives book: his joy is apparent!

Child

Calms, brings hands to midline, focuses

Rudimentary attempts to turn/stroke pages

Proud of his interest and glee

What did we see?

Parent

Lets him explore book because provider said it was “ok”

Has questions and is clearly engaged
Nyla

12–15 months
What did we see?

Child:
- Constant, happy babble: exposed to language & books
- Eagerly explores book with eyes/hands/mouth
- Calms and tunes to Dad when she reads
- Holds book and turns pages easily
- Describes enjoyment of quality time; notice joint attention
- Points to objects to engage and teach

Parent:
- Allows Nyla control of book
- Encouraged not to give up
- Points to objects to engage and teach
Child

- Uses complex language and proper grammar
- Recognizes letters
- Asks and answers questions
- Anticipates outcomes
- Elaborates on storyline
- Lets child tell story
- Respond to and expand on child’s questions

What did we see?

Parents can...

- Encourage interest in books and reading
- Provide books about child’s specific interests
We are not wise enough, we adults, to know what books will be right for any child at any particular moment, but the richer the book, the more imaginative, the more emotionally true, the more beautiful the language, the better the chance it will minister to a child’s deep inarticulate fears.

—Katherine Paterson

*The Horn Book*, Jan/Feb 1991
Beware of the "developmentally appropriate" book which is marketed as such.
### Selected Statistics for Major Sources of Spoken and Written Language (Sample Means)

<table>
<thead>
<tr>
<th></th>
<th>Rank of Median Word</th>
<th>Rare Words per 1000</th>
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</thead>
<tbody>
<tr>
<td><strong>I. Printed texts</strong></td>
<td></td>
<td></td>
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<tr>
<td>Abstracts of scientific articles</td>
<td>4389</td>
<td>128.0</td>
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<tr>
<td>Newspapers</td>
<td>1690</td>
<td>68.3</td>
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<tr>
<td>Popular magazines</td>
<td>1399</td>
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<tr>
<td>Adult books</td>
<td>1058</td>
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<tr>
<td>Comic books</td>
<td>867</td>
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<td>Children’s books</td>
<td>627</td>
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<td>Preschool books</td>
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<td>Popular prime-time adult shows</td>
<td>490</td>
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<td>Popular prime-time children’s shows</td>
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<td>Mr. Rogers and Sesame Street</td>
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<td><strong>III. Adult speech</strong></td>
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<td>Expert witness testimony</td>
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<tr>
<td>College graduates to friends, spouses</td>
<td>496</td>
<td>17.3</td>
</tr>
</tbody>
</table>

Adapted from Hayes and Ahrens (1988).
For more depth...

“What the Dormouse Said...”:
An accessible guide to the shadowy lands between child development, reading & children’s literature.

Available now at www.navsaria.com
a freely distributable 50+ page PDF
Read aloud together daily.

Have a bedside lamp for your child and allow reading time every night possible.

Limit screen time to less than two hours a day.

No TV, computers or video games in bedrooms.

Audio Books are fine.

Visit your school and public libraries.

Have reading be fun, not a chore.
Access Community Health Centers:
South Side
Wingra Clinic
William T Evjue Clinic

UW Health – 20 South Park

UW Health – East Towne

UW Health – West Towne

UW Health – University Station
Already Established

American Family Children’s Hospital – Inpatient Reading Library
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A 600+ book professionally-curated collection spanning all ages from infants to teens.

AFCH Inpatient Reading Library

Compliant with infection control standards

Amazing future extensions and opportunities
UW Health Pediatric Hematologist Dr Carol Diamond thinks William Steig’s *Amos & Boris* is a tale of a great friendship.

AFCH Inpatient Reading Library & UW Health Reach Out and Read
The Ira and Ineva Reilly Baldwin Wisconsin Idea Endowment

“I shall never be content until the beneficent influence of the University reaches every home in the state.”
— UW President Charles Van Hise, 1904
“Just one more story, ppleaseease!”
“While schools can do much to raise achievement among children who initially lag behind their peers, all too often pre-school gaps set in train a pattern of ever increasing inequality during school years and beyond. Any drive to improve social mobility must begin with an effective strategy to nurture the fledgling talent in young children so often lost before it has had a chance to flourish.”

The Sutton Trust