



# Can Big Data Help Children Thrive? National Implementation of Research-Based Tools

Yair Sadaka



משרד החינוך



NEGEVINSPIRE  
INSTITUTE FOR NEURODEVELOPMENTAL SCIENCE,  
POLICY, INNOVATION, RESEARCH, AND EDUCATION



יד הנדיב  
Yad Hanadiv  
ياد هَنَدِيْف



שדרות



המוסד לביטוח לאומי





The Hospital for Sick Children

THE  
SLAIGHT FAMILY  
ATRIUM

SickKids

THE  
GARRON FAMILY  
CANCER CENTRE

← PARKING

170 ELIZABETH STREET

EMERGENCY →



## Israel advantages:



**Strong public  
health care  
system**



**Strong public  
education  
system**



**Strong welfare  
system**



# Overview

## Israeli National Datasets

Ministry of Health  
(TIMNA)

HMOs  
(EMRS)

Central Bureau of Statistics  
(CBS)



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**Well-baby clinics**  
\*Easily accessible  
( < 6 months)

**Hospitalization Database**  
\*Moderately accessible  
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**“Additional Registries”**  
( ~ 17)  
\*Not readily accessible  
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- Israeli birth cohorts, years 2014-2024, updates yearly
- Ages: birth – 5 years
- Number of sites: ~1000
- 70% of population



**Growth &  
Development**



**Edinburgh Postnatal  
Depression Scale  
(EDPS)**



**Blood Count  
Hb/MCV/MCH**



**Sociodemographic  
profile**



**Pregnancy &  
Delivery**



# “Additional Registries”

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## The list of databases made accessible to researchers

- |  |   |
|--|---|
| <b>01</b> Well-baby clinics  | <b>10</b> The National Registry of Renal Replacement Therapy                    |
| <b>02</b> Live births in Israel and infant mortality   | <b>11</b> The National Registry of Bariatric Surgeries                          |
| <b>03</b> Hospitalizations, visits to emergency medicine departments and visits <b>to the outpatient clinics</b> array | <b>12</b> The National Stroke Registry  |
| <b>04</b> Aggregated table of daily hospitalizations by sub-district   | <b>13</b> Mortality and causes of death data                                    |
| <b>05</b> Psychiatric hospitalizations   | <b>14</b> Aggregated table of daily death cases by sub-district                 |
| <b>06</b> COVID-19   | <b>15</b> Nachlieli - the National Vaccination Database                         |
| <b>07</b> Cannabis registry  | <b>16</b> Student health services   |
| <b>08</b> The Israel National Cancer Registry (INCR)   | <b>17</b> Socioeconomic index data table at statistical area and locality level |
| <b>09</b> The National Diabetes Registry   |   |

- Datasets we have available, have used, and are familiar with
- Datasets we have but haven't examined in depth
- Datasets that are missing



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# Electronic Medical Records

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## EMRs

Clalit's (Israel's largest HMO) longitudinal EMR  
\*Moderately accessible

### Size and longitudinal depth:

- ~7 million patient records
- Reported history length ~20-30 years

### Representative data set:

- ~60% of Israeli population
- In practice, different sub-datasets or extraction windows may be used per project



**Demographics & personal markers**  
(age, sex, socioeconomic/geographic indicators, etc.)



**Medications**  
both **prescribed/ordered** and **actually dispensed/fulfilled** through pharmacies



**Diagnoses**  
(community and hospital)



**Clinic visits / outpatient encounters**



**Hospitalizations**  
(admissions, discharges, inpatient episodes)



**Medical procedures**  
(in community and hospital settings)



**Laboratory results**  
(routine and specialized)



**Special registries**  
(condition- or program-specific registries)



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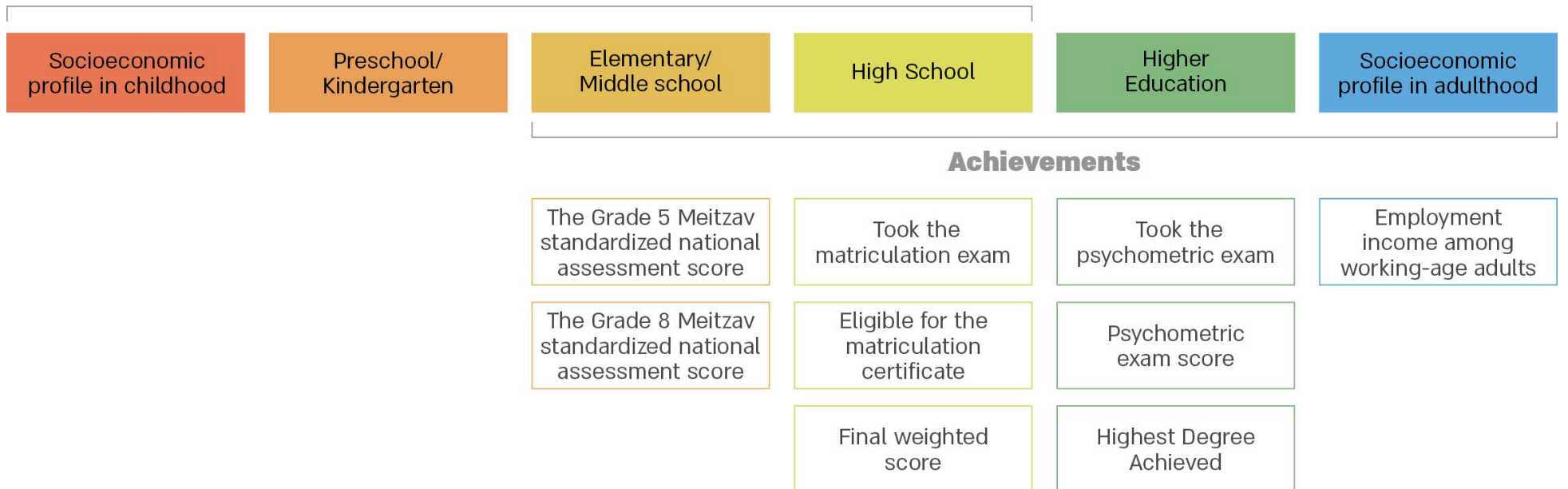
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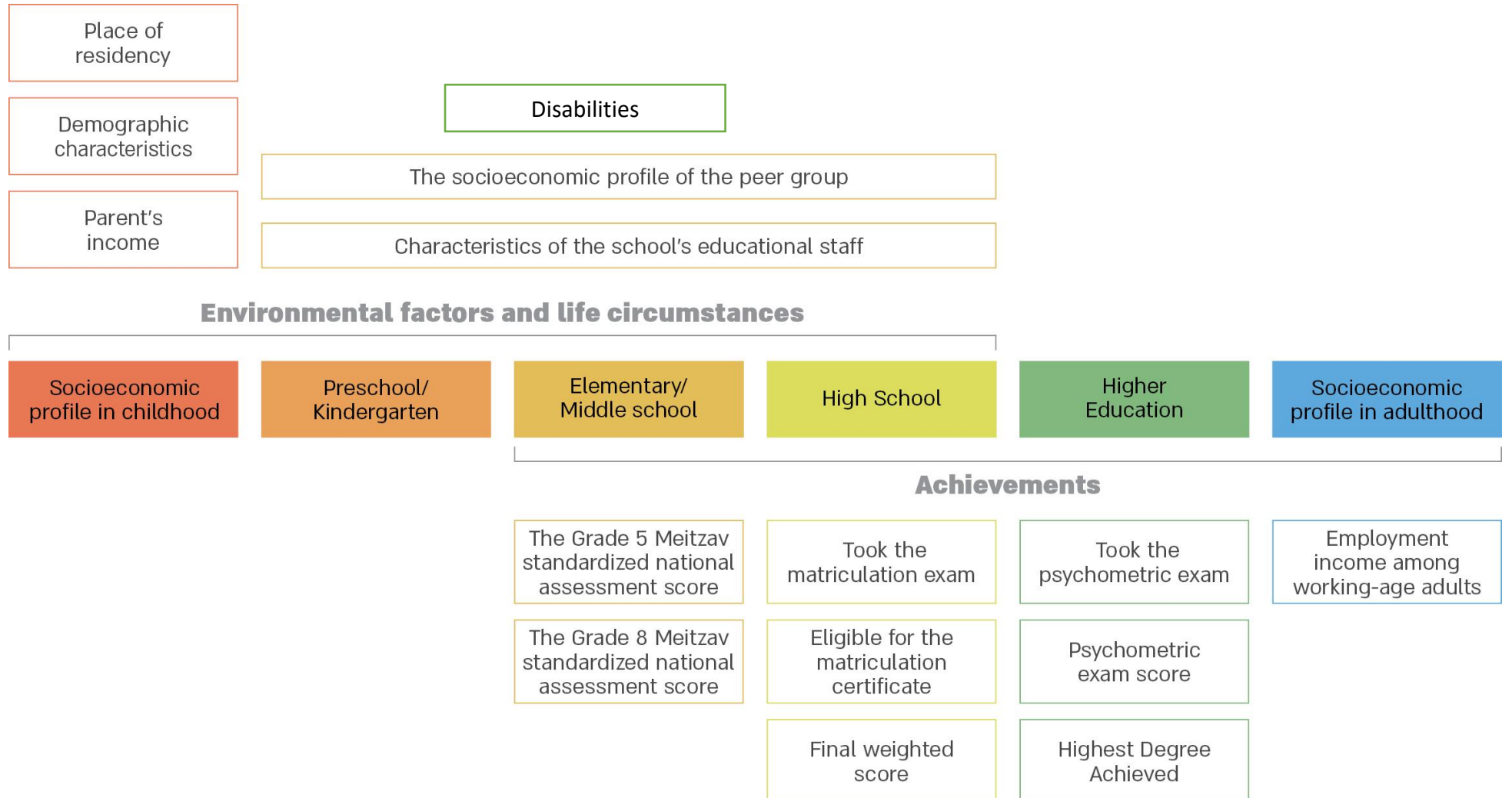
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# **what can we do with it?**

- **Developmental surveillance**



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# Developmental assessment



**Fine motor**



**Gross motor**



**Social**



**language**



**Nurse concern**



**Parental  
concern**

# Dataset:

**4,943,465**



**Developmental assessments**

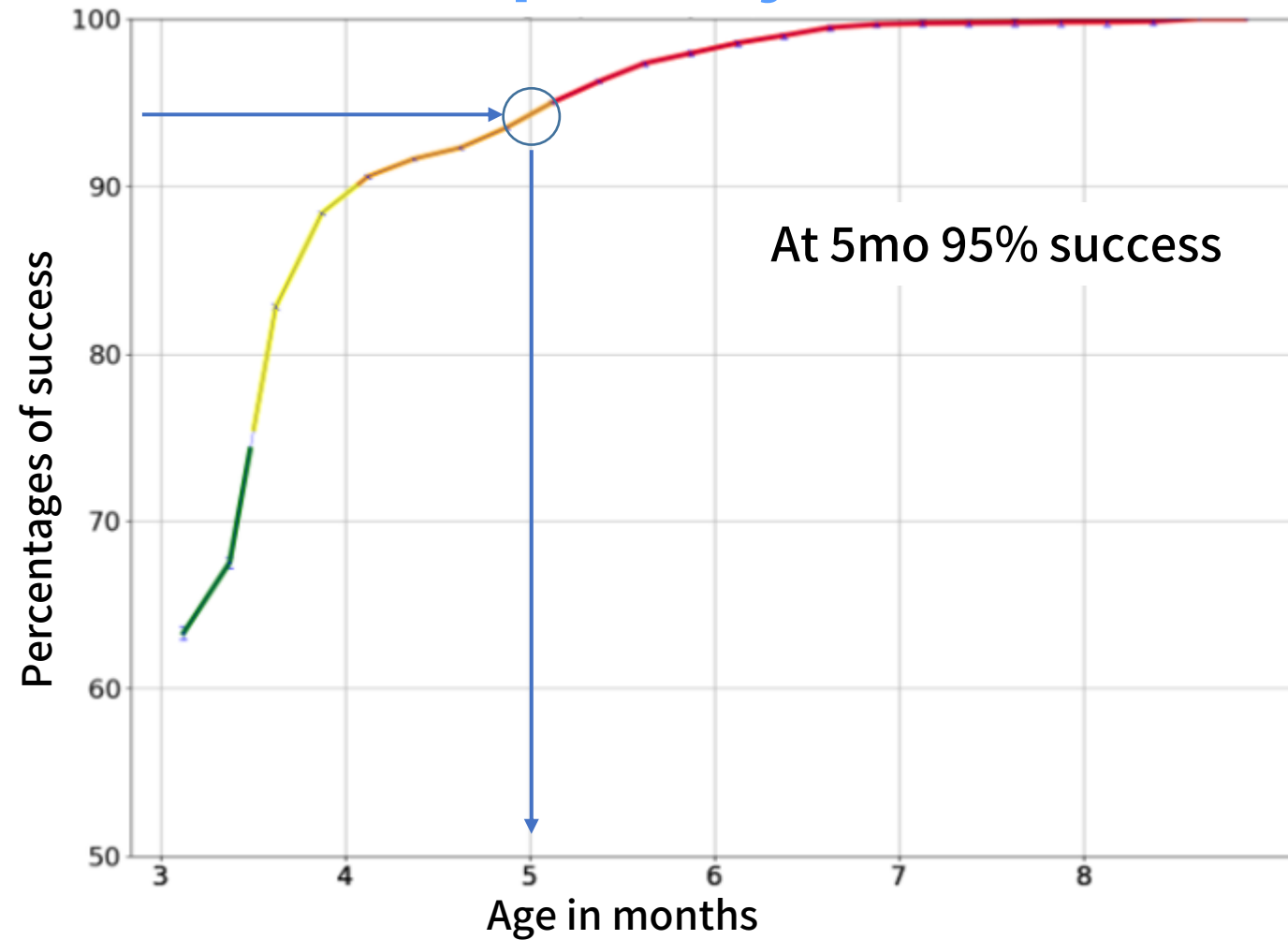
**839,574**



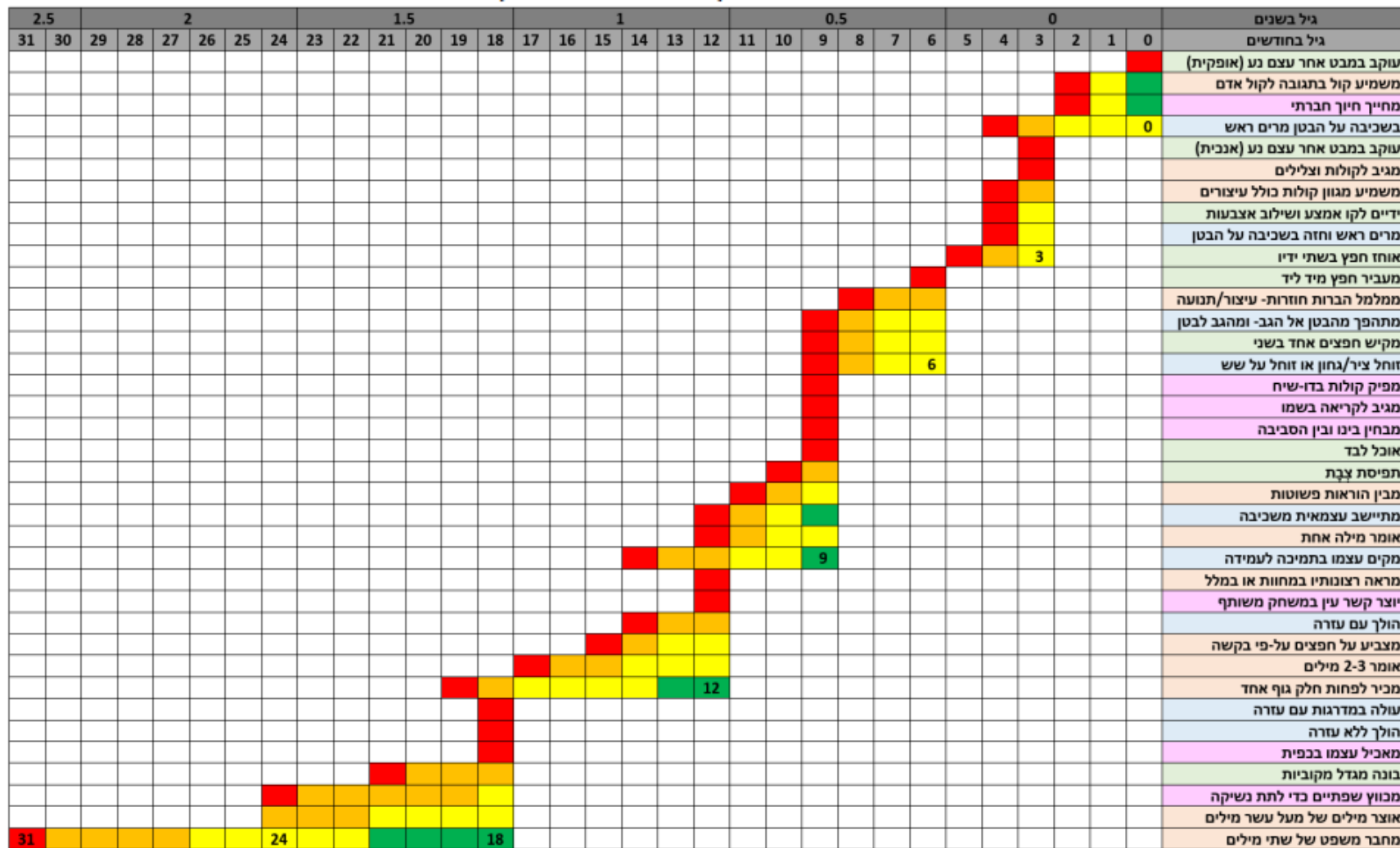
**Children**

# Tipat Halav Dataset

## Grasp an object




# Tipat Halav Israeli Surveillance (THIS) Scale



אחוזון
עד 75% מהילדים מבצעים
75-90% מהילדים מבצעים
90-95% מהילדים מבצעים
מעל 95% מהילדים מבצעים

תחום התפתחותי
חברה
שפה
מוטוריקה גסה
מוטוריקה עדינה

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*JAMA Network Open.* 2022;5(3):e222184. doi:10.1001/jamanetworkopen.2022.2184

March 14, 2022 1/14

JAMA  
Network | **Open**<sup>™</sup>



**Original Investigation** | Pediatrics

## Standardization of a Developmental Milestone Scale Using Data From Children in Israel

Tamar Sudry, MD; Deena R. Zimmerman, MD, MPH; Hadar Yardeni, MD; Adina Joseph, MD; Ravit Baruch, RN, MA; Itamar Grotto, MD, MPH, PhD; Dan Greenberg, MSc, PhD; Roni Eilenberg, MSc; Guy Amit, PhD; Pinchas Akiva, PhD; Meytal Avgil Tsadok, PhD; Yitzhak Rize, PhD; Hani Zaworbach, BSc; Moshe Uziel, BSc; Dror Ben Moshe, BSc; Irit Lior Sadaka, RN, MPH; Eitan Bachmat, PhD; Judah Freedman, MPH; Yair Sadaka, MD, PhD, MHA

# חוזר ראש שירותי בריאות הציבור



משרד הבריאות

לי תשרי תשפ"ב

## הנדון: תדריך לביצוע הערכות התפתחות לתינוקות ולפעוטות עד גיל שש שנים

תת היחידה המפיצה: הסיעוד בבריאות הציבור, המחלקה לאם ולילד  
מילות מפתח: התפתחות ילדים, בדיקת סינון, קשר הורה ילד, הדרכת הורים

### 1. מטרת הנוהל:

- 1 להכיר את תהליך ההתפתחות התקינה של התינוק/פעוט/ילד מלידה ועד לגיל 6 שנים.
- 2 ללוות ולהעצים הורים, להדריך בנושאי הורות, חיזוק קשר הורה- ילד, עידוד וקידום רכישת אבני הדרך ההתפתחותיים.
- 3 לאתר מוקדם ככל האפשר קשים בקשר הורה-ילד, ילדים שהתפתחותם אינה בטווח של בני גילם כדי לחזק, לכוון ולהפנות לאבחון ולהתערבות מוקדמים.

הוספת הערכה +

רשימת הערכות

מפת התפתחות

גיל מתוקן

גיל כרונולוגי

הצגה לפי



מדרגת גיל | 18 - 12 חודשים

לצפיה בבדיקה	ביצע	✓	הולך בעזרה 25/01/2021   1 שנים . 0 חודשים . 25 ימים	
לצפיה בבדיקה	ביצע	✓	אומר 2 - 3 מילים 25/01/2021   1 שנים . 0 חודשים . 25 ימים	
לצפיה בבדיקה	ביצע	✓	מכיר לפחות חלק גוף אחד 25/01/2021   1 שנים . 0 חודשים . 25 ימים	
לצפיה בבדיקה	ביצע	✓	מצביע על פי בקשה על חפצים מוכרים 25/01/2021   1 שנים . 0 חודשים . 25 ימים	

# ספרון הדרכה להערכה התפתחותית

מבוסס על הסולם ההתפתחותי הישראלי (THIS Scale)  
ועל נוהל שיפוט החלב בישראל



מלווה בהפניות לסרטונים ולעזרים גרפיים  
להערכה ההתפתחותית

### 1.3 מחייך חיוך חברתי



גיל 6 שבועות עד 3 חודשים

יצירת קשר עין עם התינוק היא תנאי מוקדם לביצוע משימה זו. הילד צריך לחוש בנוח, הבדיקה יכולה להתבצע בחיק ההורה. יש לבחון תגובה של הילד לקול גירוי או לפני אדם במהלך האינטראקציה. כדי לעודד חיוך, ניתן לקרב את הפנים עם חיוך רחב אל פניו של התינוק, ניתן לדבר בקול רך.

הסבר - התינוק מראה עניין באנשים, מגיב לאינטראקציה עם מבוגר ובהמשך צוחק בפעילויות משעשעות.



הילד מבצע את המשימה בהצלחה אם קיים חיוך חברתי כתגובה לקול, גירוי ו / או לפני אדם.



הפניה להערכה בביקור רופא טיפת חלב בגיל חודשיים. לחלופין, להפנות מיידית למעקב הרופא המטפל.



\*יש לוודא בדיקת סקר שמייעה בילוד.

הדרכה עידוד חיזוק קשר עין תוך דיבור אל הילד כאשר הוא ערני, בקול שקט, להרבות בחיוך. חשוב להיות קרובים אל פניו של התינוק - מרחק של עד 30 ס"מ, מכיוון שבגיל זה הראייה מוגבלת למרחק קצר.



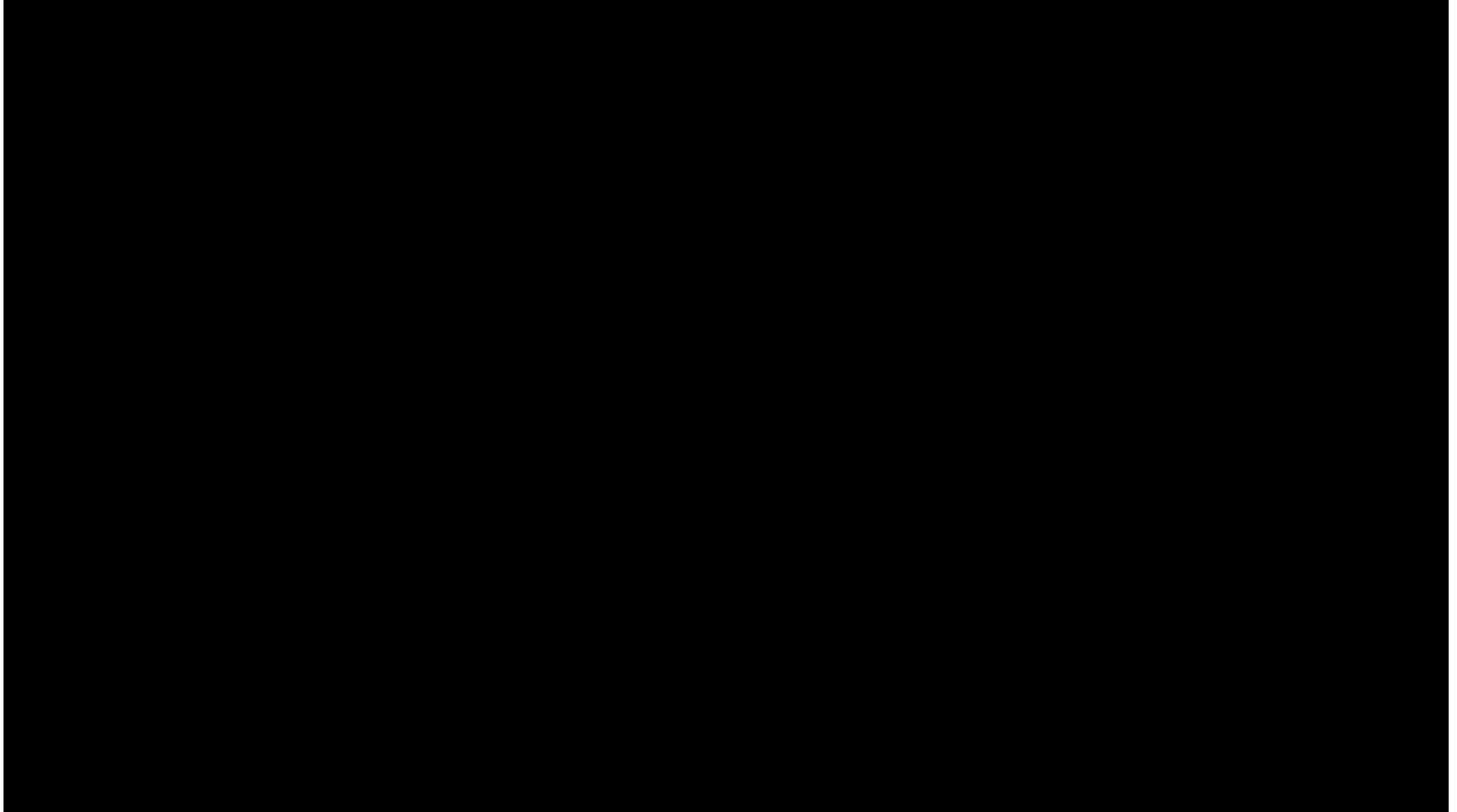
נספחים

ללא



אביזרים







ללא



# **what can we do with it?**

- Developmental surveillance
- **National developmental report**

# Trends of Developmental Milestone Attainment in Israeli Children Between 2016-2020:A National Report

 Irena Girshovitz,  Guy Amit,  Inbal Goldshtein, Deena R. Zimmerman, Ravit Baruch,  Pinchas Akiva,  Meytal Avgil Tsadok,  Yair Sadaka

doi: <https://doi.org/10.1101/2023.02.05.23285482>

**This article is a preprint and has not been peer-reviewed [what does this mean?]. It reports new medical research that has yet to be evaluated and so should not be used to guide clinical practice.**



**Abstract**

Full Text

Info/History

Metrics

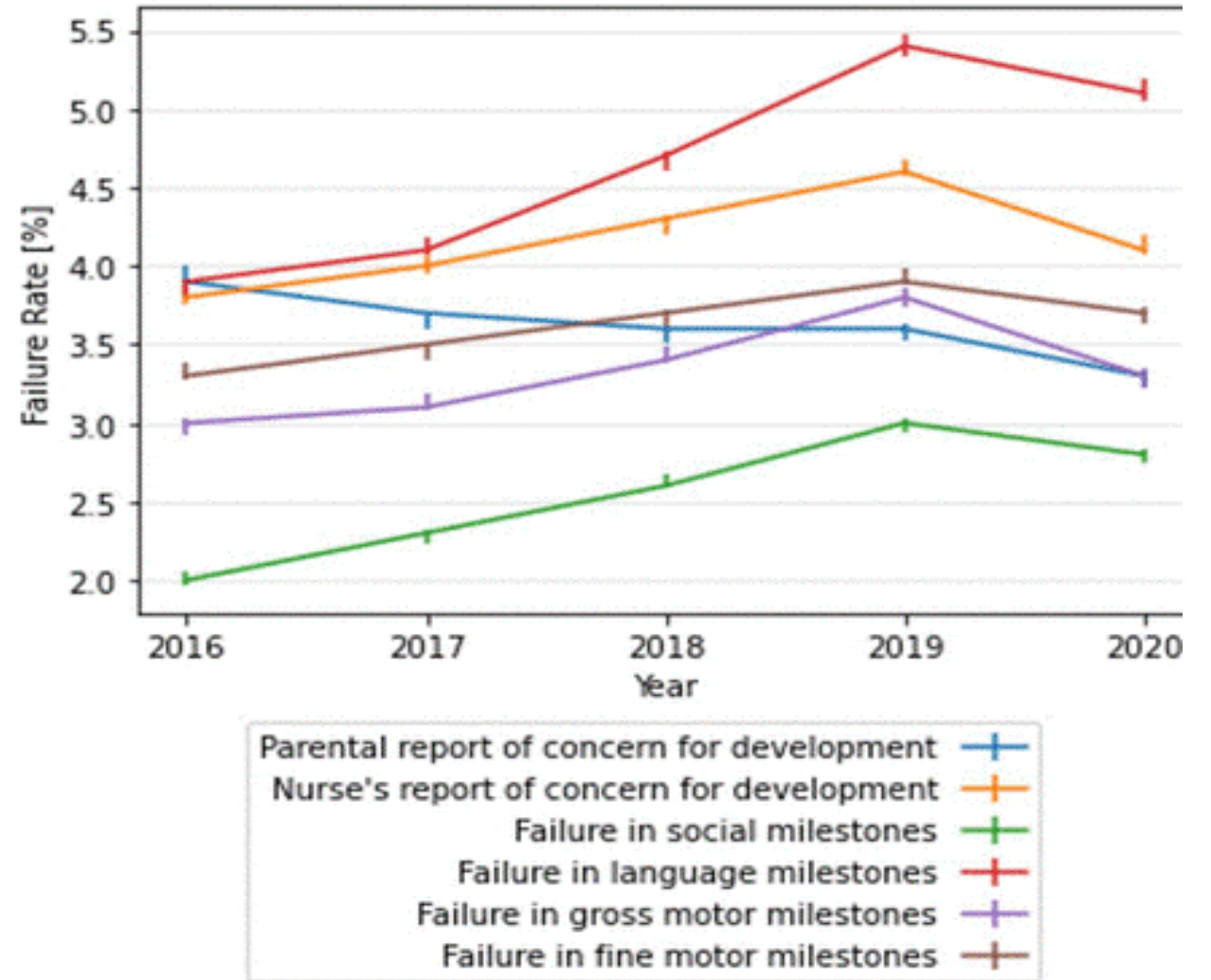
 Preview PDF

## Abstract

**Background** The early years of children's lives are critical for their healthy

# General trends

- A gradual increase over the years in the failure rate
- Most prominent and common in the field of language
- Despite the fact that children are failing more, parents are less concerned



# National dashboard



עדכון אחרון: 01/01/21, 10:00

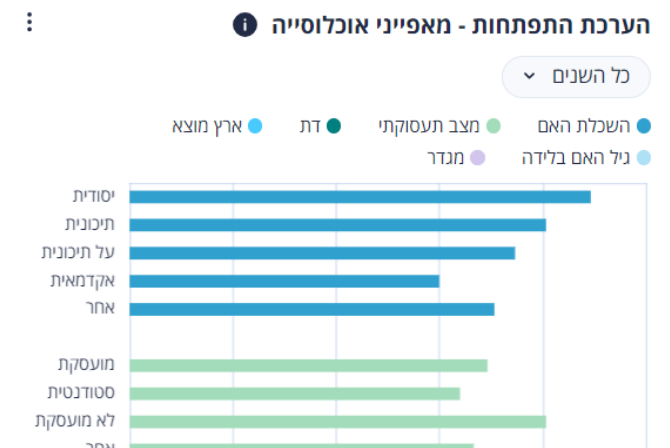
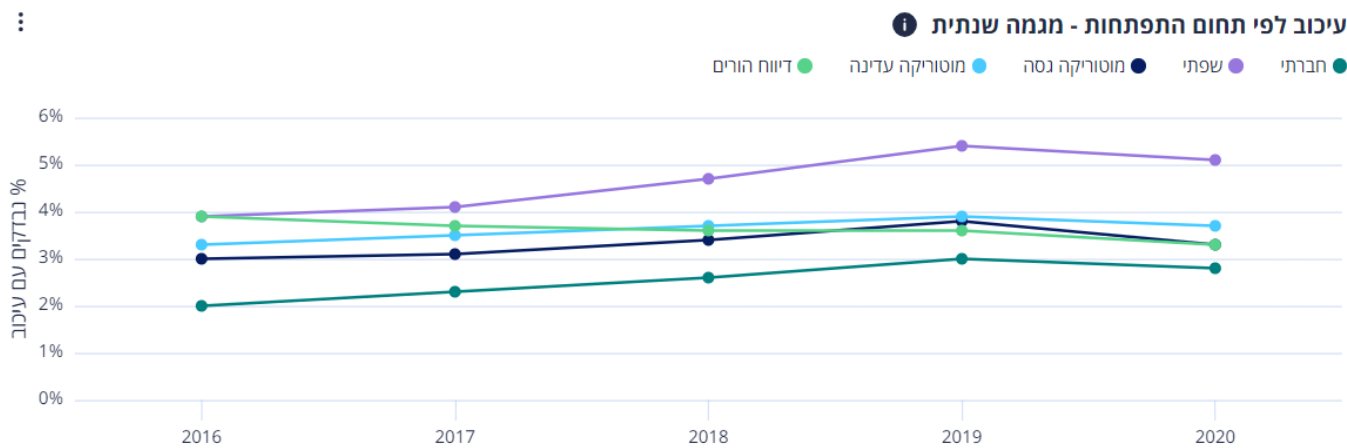
לעולם התוכן <

## הערכת התפתחות בטיפות חלב

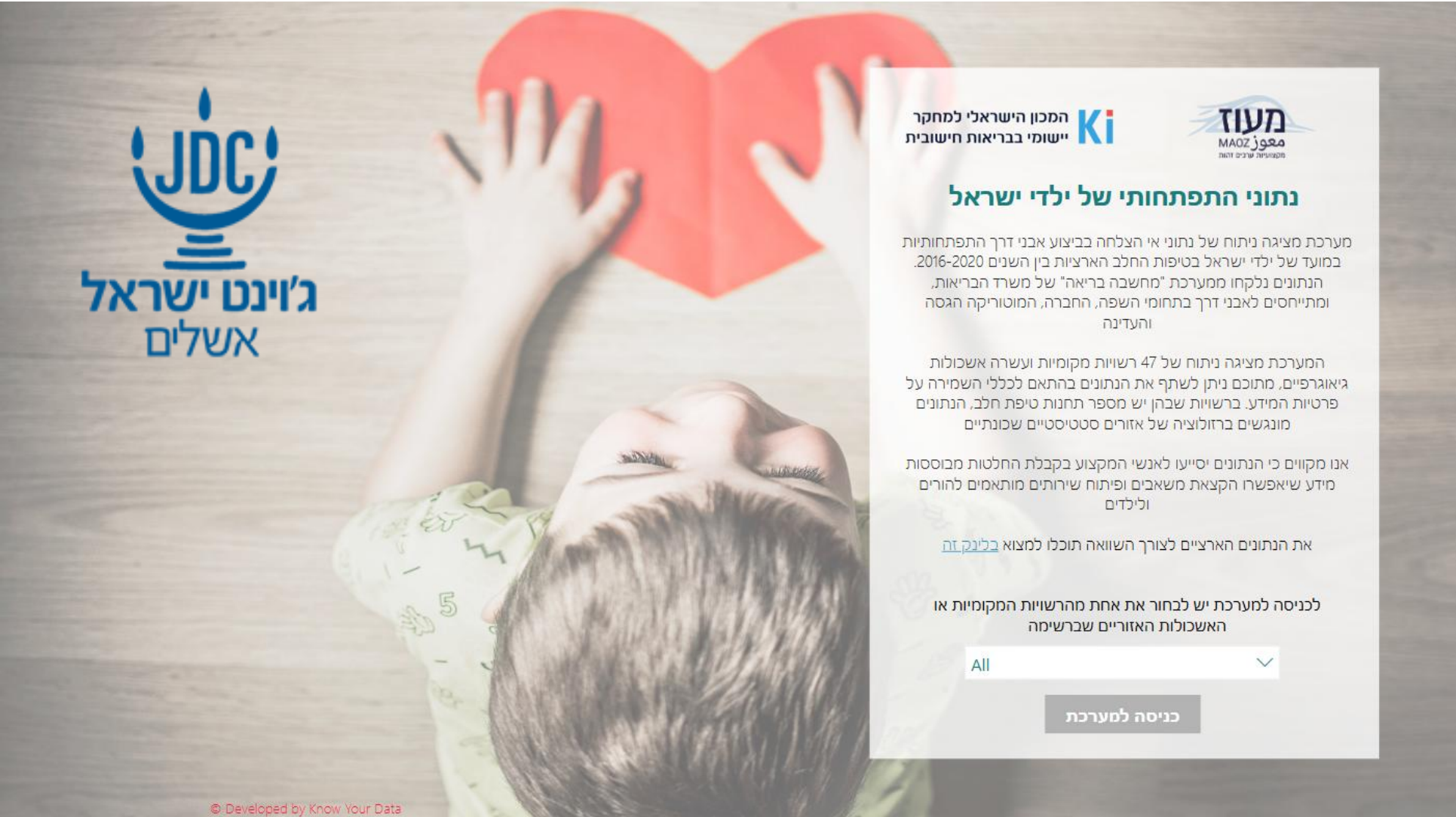
מבט נתונים ראשי | לינקים בנושא


השנים הראשונות בחייהם של ילדים נחשבות לתקופה חשובה בתהליך ההתפתחותי שלהם. בישראל, מבוצעות הערכות התפתחות לתינוקות ולפעוטות עד גיל שש שנים במסגרת טיפות חלב כחלק מסל השירות הניתן לכלל ילדי ישראל. **לקרוא עוד**

[מבט נתונים ראשי](#)




# Municipal dashboard





ג'וינט ישראל  
אשלים

המכון הישראלי למחקר  
יישומי בבריאות חיישובית **Ki**



מעוז  
MAOZ  
מסגרות שבים זהות

### נתוני התפתחותי של ילדי ישראל


מערכת מציגה ניתוח של נתוני אי הצלחה בביצוע אבני דרך התפתחותיות במועד של ילדי ישראל בטיפות החלב הארציות בין השנים 2016-2020. הנתונים נלקחו ממערכת "מחשבה בריאה" של משרד הבריאות, ומתייחסים לאבני דרך בתחומי השפה, החברה, המוטוריקה הגסה והעדינה.

המערכת מציגה ניתוח של 47 רשויות מקומיות ועשרה אשכולות גיאוגרפיים, מתוכם ניתן לשתף את הנתונים בהתאם לכללי השמירה על פרטיות המידע. ברשויות שבהן יש מספר תחנות טיפת חלב, הנתונים מוגשים ברזולוציה של אזורים סטטיסטיים שכונתיים.

אנו מקווים כי הנתונים יסייעו לאנשי המקצוע בקבלת החלטות מבוססות מידע שיאפשרו הקצאת משאבים ופיתוח שירותים מותאמים להורים וילדים.

את הנתונים הארציים לצורך השוואה תוכלו למצוא [בלינק זה](#)

לכניסה למערכת יש לבחור את אחת מהרשויות המקומיות או האשכולות האזוריים שברשימה

All 

כניסה למערכת

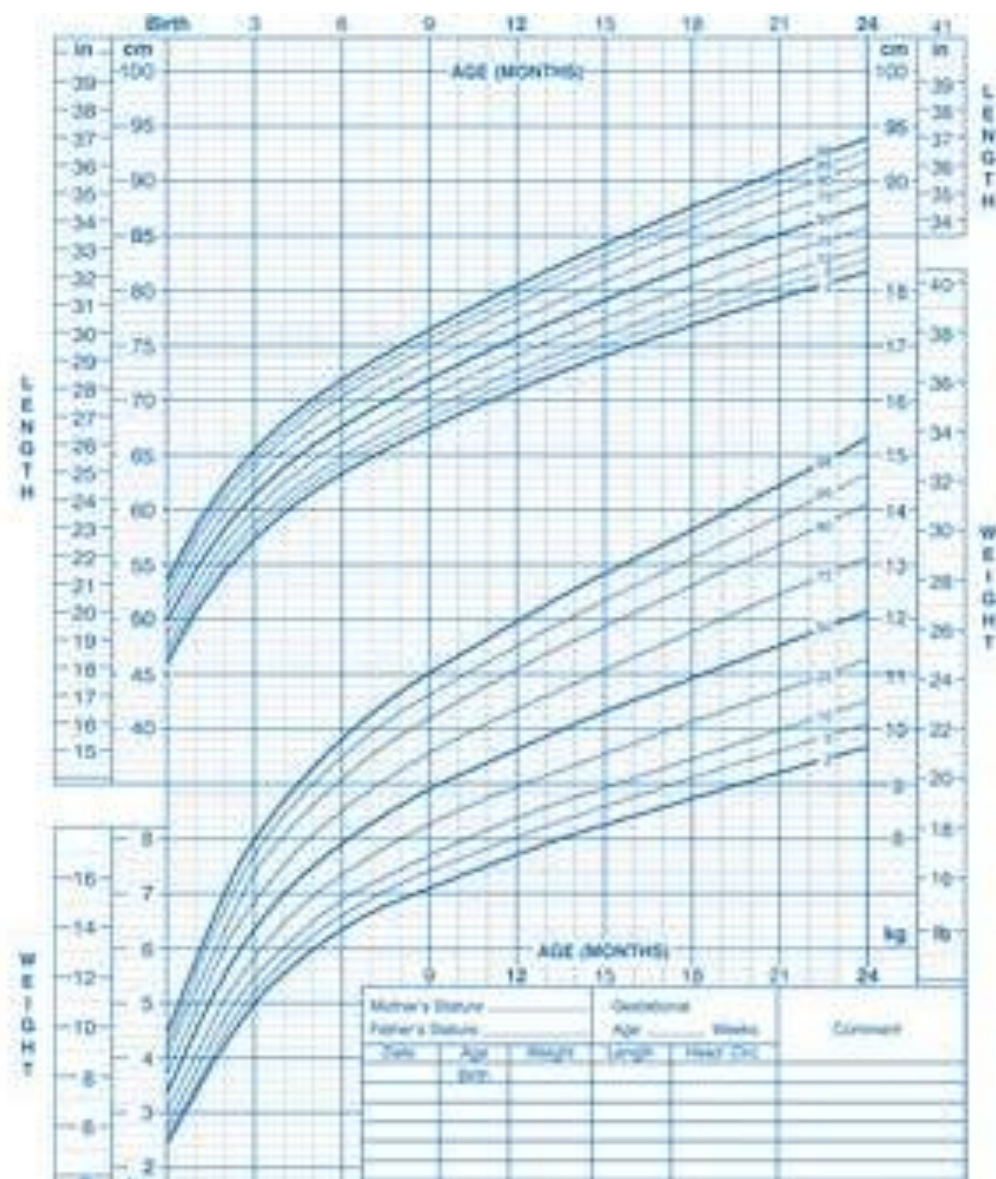
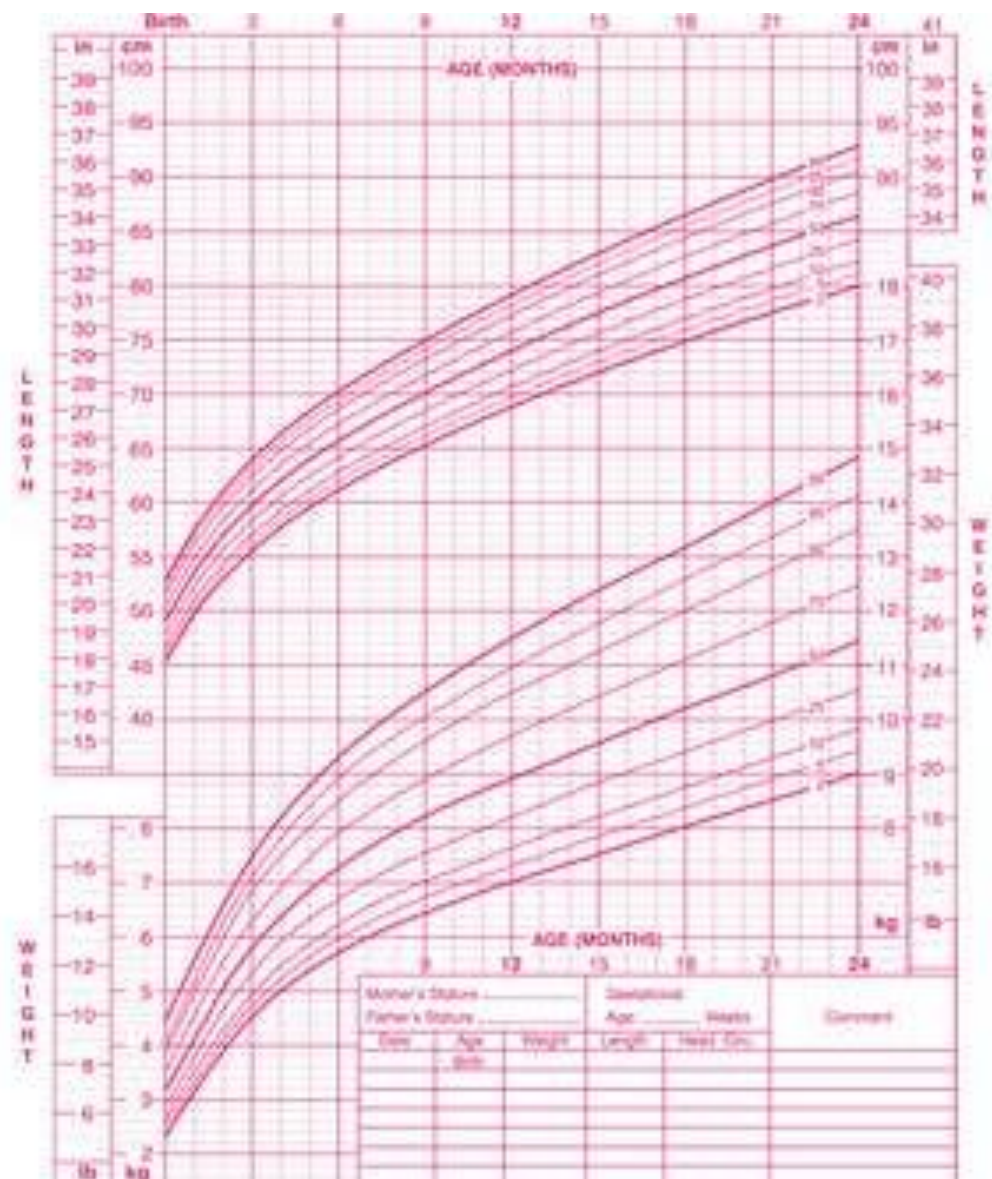
© Developed by Know Your Data

# what can we do with it?

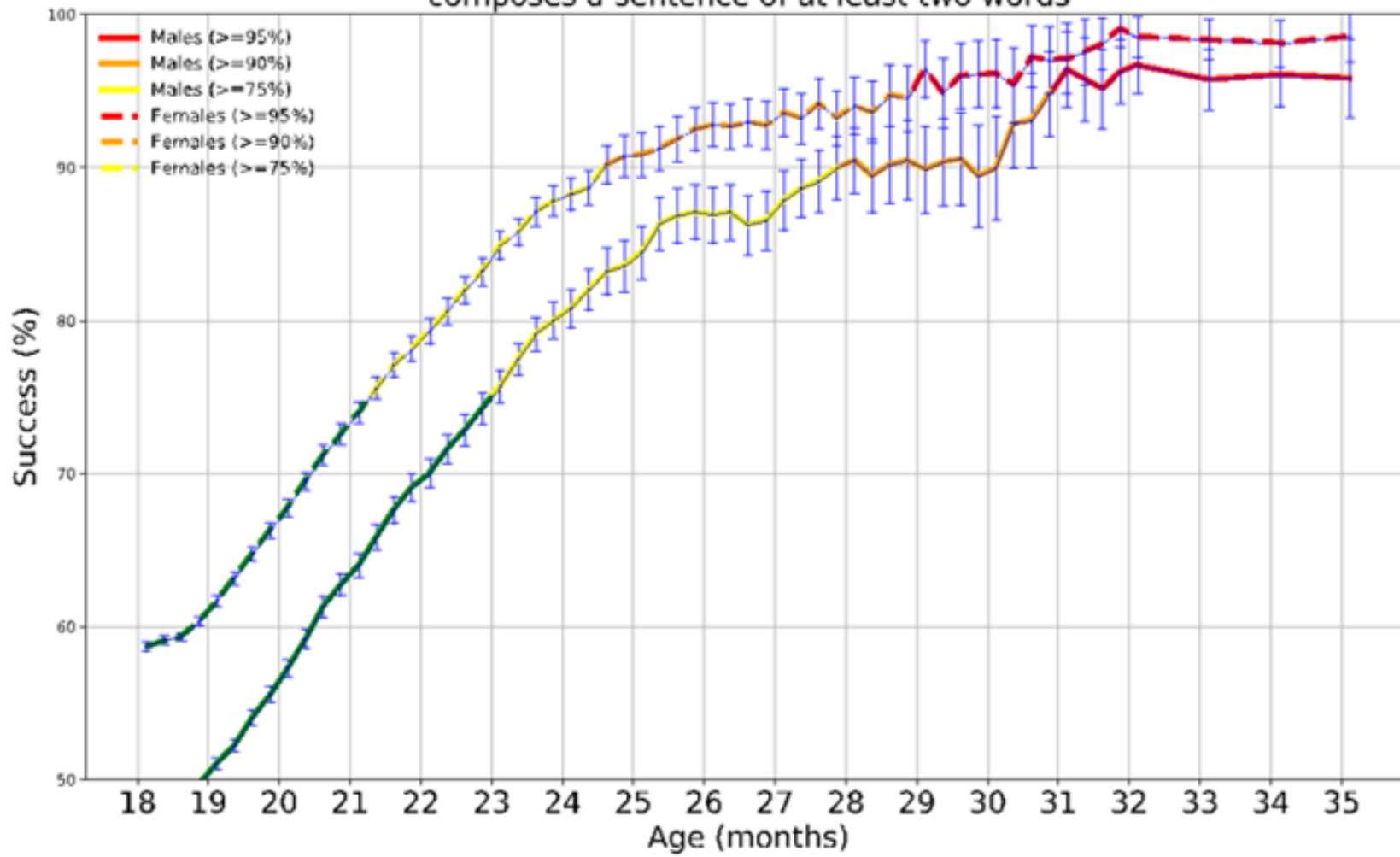
- Developmental surveillance
- National developmental report
- **Sex specific developmental scale**

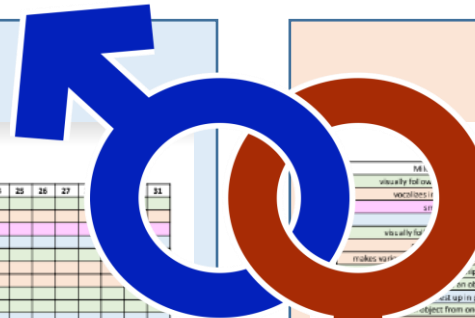


Sex differences



composes a sentence of at least two words





**THIS-Boys Developmental Scale**

Milestones \ Age (months)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
visually follows a moving object horizontally																												
visually follows a moving object vertically																												
responds to rattling sound																												
reaches for object																												
grasps an object																												
transfers an object from one hand to the other																												
uses two objects playfully																												
uses a dialogue																												
responds when addressed by name																												
responds differently to familiar and stranger																												
feeds self																												

**THIS-Girls Developmental Scale**

Milestones \ Age (months)	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
visually follows a moving object horizontally																														
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responds to rattling sound																														
reaches for object																														
grasps an object																														
transfers an object from one hand to the other																														
uses two objects playfully																														
uses a dialogue																														
responds when addressed by name																														
responds differently to familiar and stranger																														
feeds self																														
uses thumb-fingers grasp																														
understands simple instructions																														

**PEDIATRICS**

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**Volume 153, Issue 4**  
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ARTICLES | MARCH 28 2024

## Sex-Specific Developmental Scales for Surveillance

Tamar Sudry, MD; Guy Amit, PhD; Deena R. Zimmerman, MD; Meytal Avgil Tsadok, PhD; Ravit Baruch, MA; Hadar Yardeni, MD; Pinchas Akiva, PhD; Dror Ben Moshe, BSc; Eitan Bachmat, PhD; Yair Sadaka, MD, PhD, MHA



stands up on one leg for 2 seconds																														
familiar with at least three prepositions																														
plays with peer group																														
dresses independently																														
understandable speech																														
uses correct verbs and tense to describe a picture																														
answers orientation questions such as name or age																														
jumps on one leg																														
walks heel to toe																														
crosses a human figure																														
copies geometrical shapes such as X and triangle																														

**False alerts for boys**  
6%

counts three cubes																														
familiar with at least three prepositions																														
plays with peer group																														
understandable speech																														
uses correct verbs and tense to describe a picture																														
answers orientation questions such as name or age																														
jumps on one leg																														
walks heel to toe																														
crosses a human figure																														
copies geometrical shapes such as X and triangle																														

**Potential missing of girls at risk-** 20%

# what can we do with it?

- Developmental surveillance
- National developmental report
- Developmental Delay Score (DSS)
- Sex specific developmental scale
- **Transient vs persistent developmental delay**

**Original Investigation** | Pediatrics

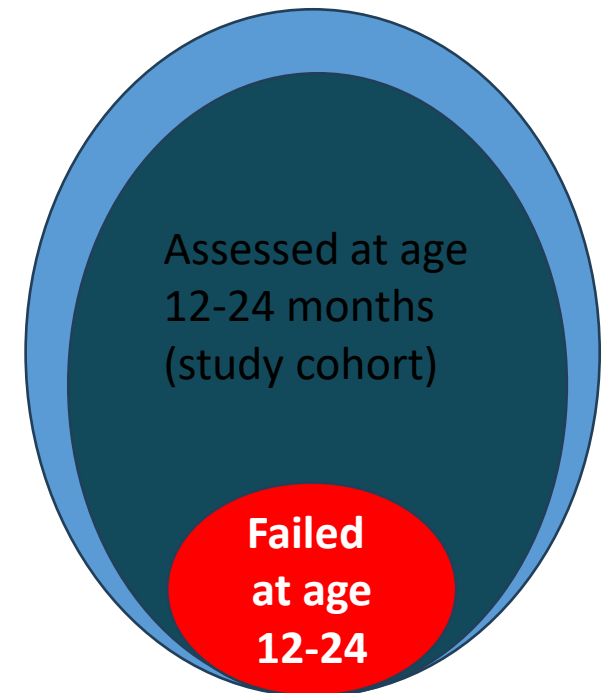


# Differentiating Transient From Persistent Developmental Delays in a Nationwide Infant Cohort

Yonatan Bilu, PhD<sup>1</sup>; Guy Amit, PhD<sup>1</sup>; Keren Mayer Lapidot, MA<sup>2,3</sup>; [et al](#)

# Study cohort

- Out of 530,000 children born on term 2014-2012 and assessed at age 9-12 months:
  - 38,000 **failed** some milestone
- Around 90% were assessed at age 12-24 months
- 20%-30% **failed** again



# Study design

Exclusion Assessment Window  
(GA<37w, unknown GA)

Covariate Assessment Window  
(demography, obstetrics)

Predict

Milestone  
assessment

Milestone  
assessment

Observation period

Age (m)

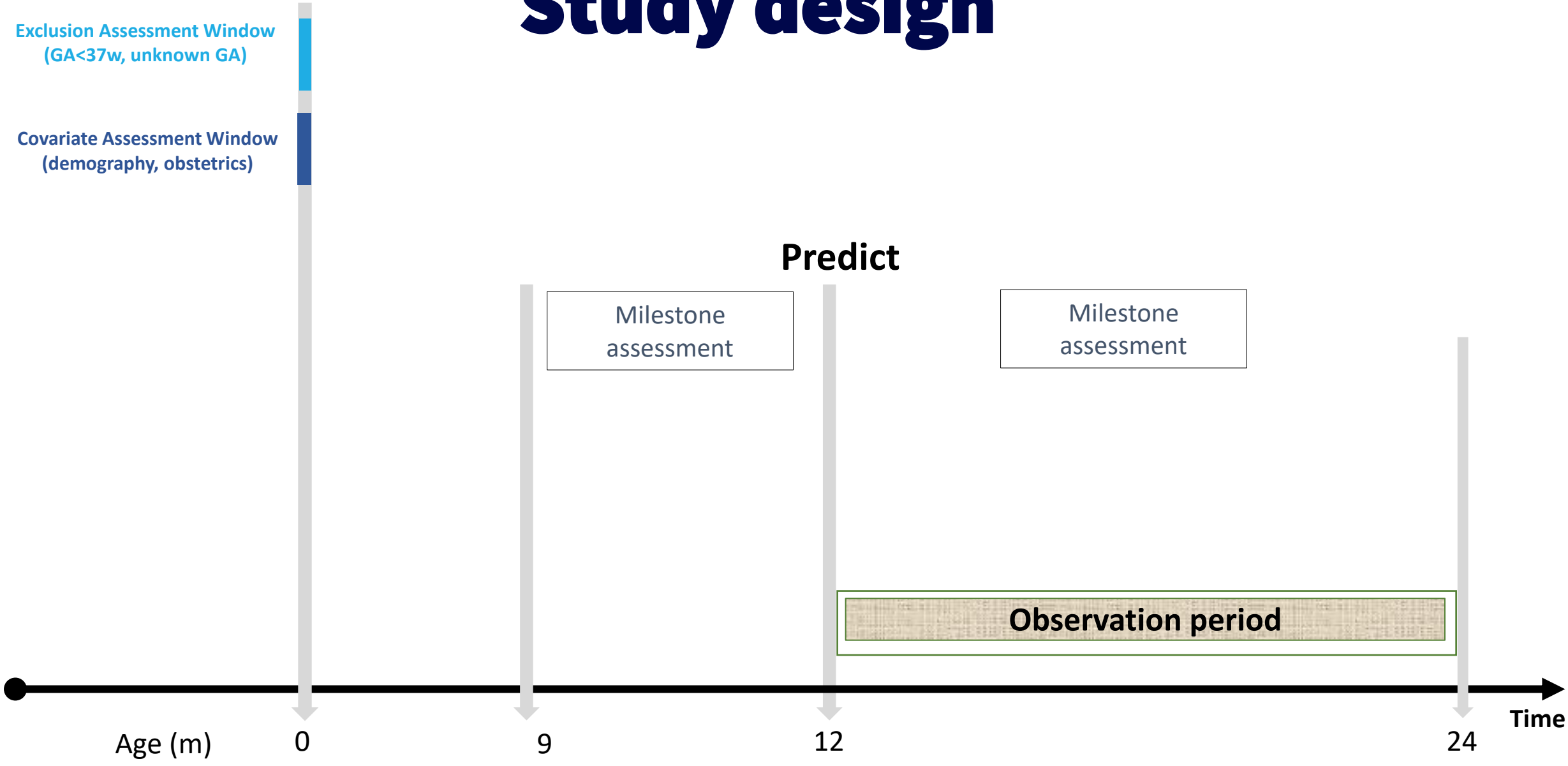
0

9

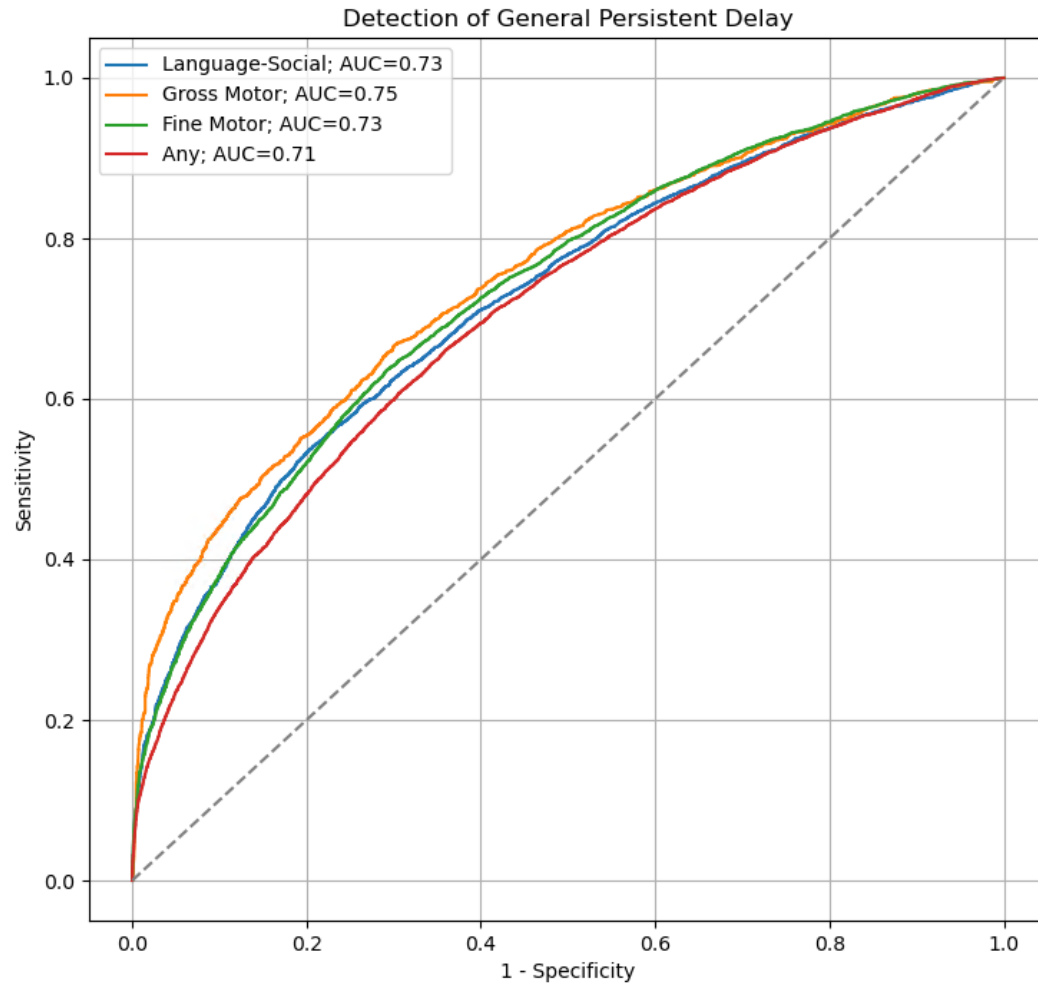
12

24

Time



# Results: machine learning model

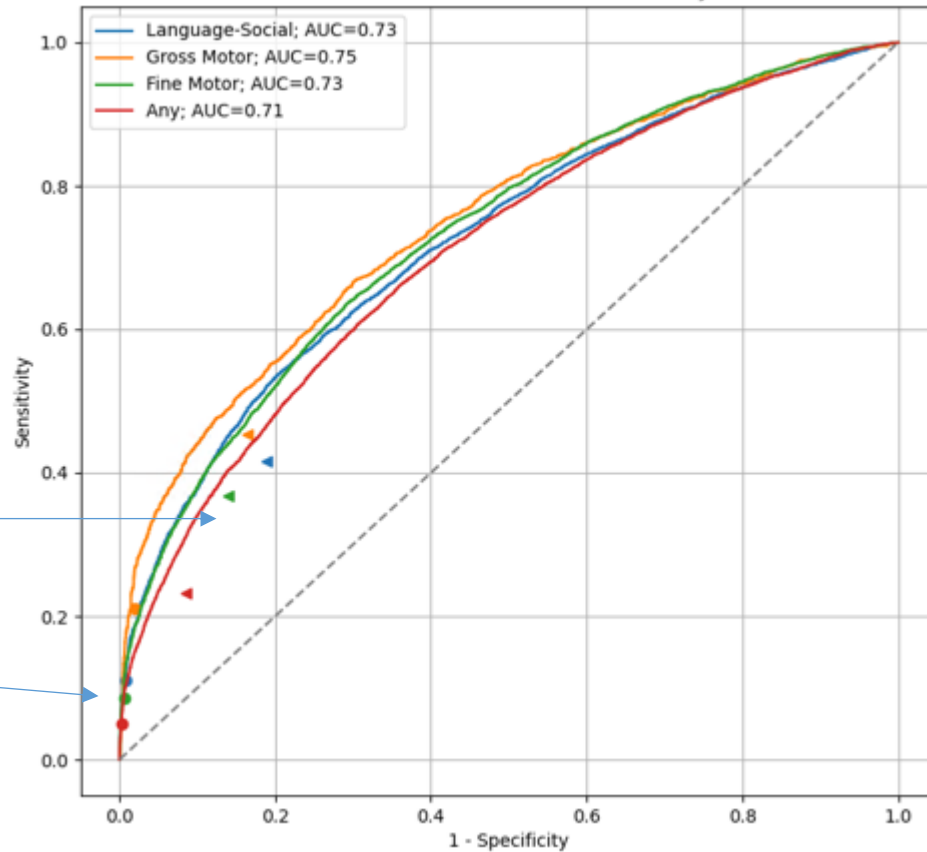


# Results: simple decision rules

- Rule of **two**: A child is at risk if they **fail** milestones from an additional domain (i.e. **two** different developmental domains)
- Rule of **three**: A child is at risk if they **fail** milestones from all **three** developmental domains
- In many settings simplicity > AUC

# Results: simple decision rules

Detection of General Persistent Delay



Rule of two

Rule of three

# what can we do with it?

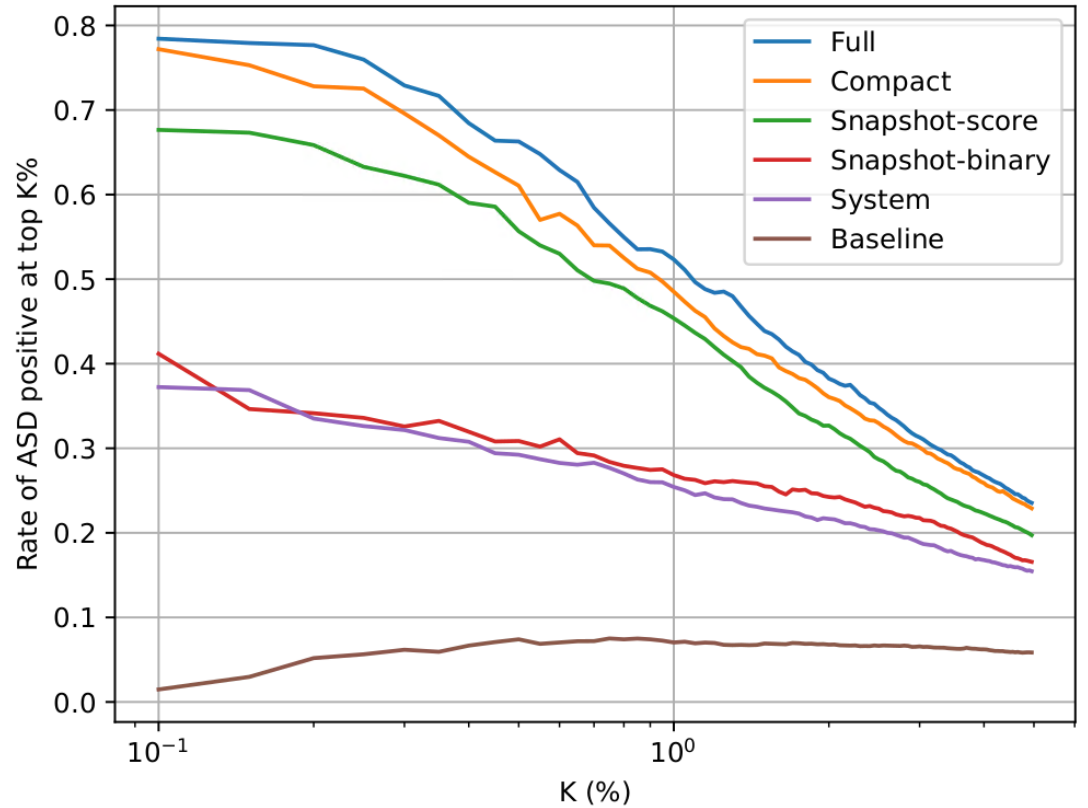
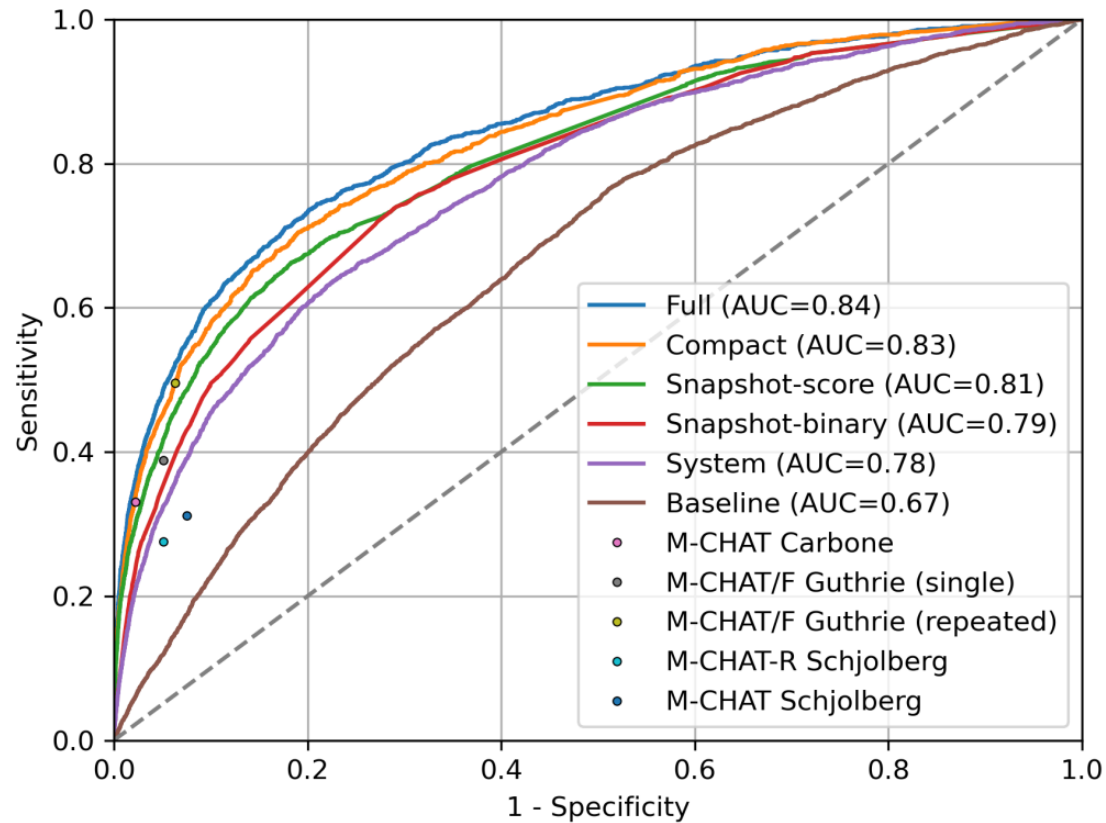
- Developmental surveillance
- National developmental report
- Developmental Delay Score (DSS)
- Sex specific developmental scale
- Transient vs persistent developmental delay
- **Early ASD prediction**



Original Investigation | Pediatrics

# Early Prediction of Autistic Spectrum Disorder Using Developmental Surveillance Data

Guy Amit, PhD; Yonatan Bilu, PhD; Tamar Sudry, MD; Meytal Avgil Tsadok, PhD; Deena R. Zimmerman, MD, MPH; Ravit Baruch, RN, MA; Nitsa Kasir, MA; Pinchas Akiva, PhD; Yair Sadaka, MD, PhD, MHA



# what can we do with it?

- Developmental surveillance
- National developmental report
- Developmental Delay Score (DSS)
- Sex specific developmental scale
- Transient vs persistent developmental delay
- Early ASD prediction
- **The SEED trial**

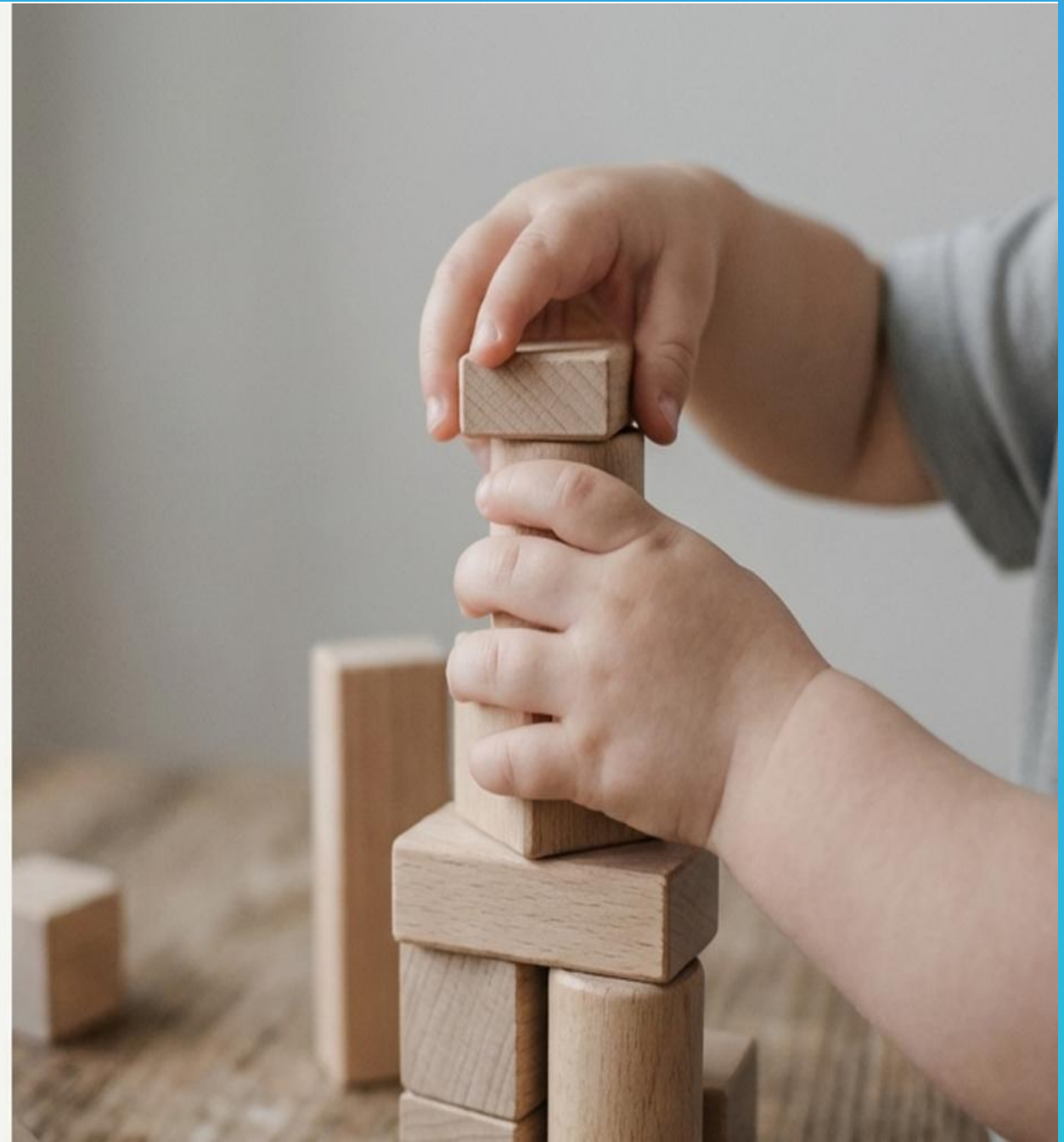


# The SEEDS Trial:

Study of Early Effects of Developmental Support

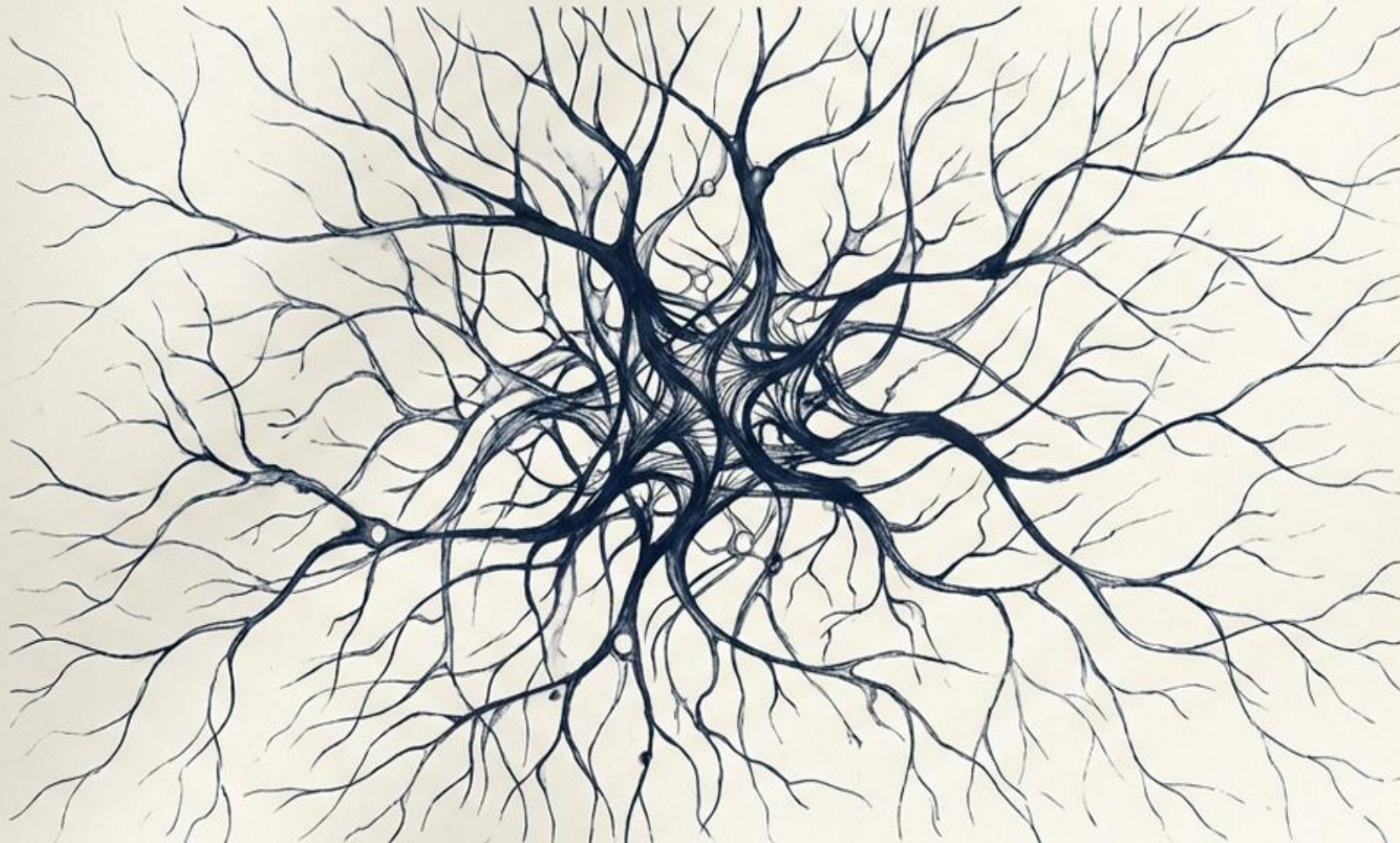


art



# The First Years are Forever

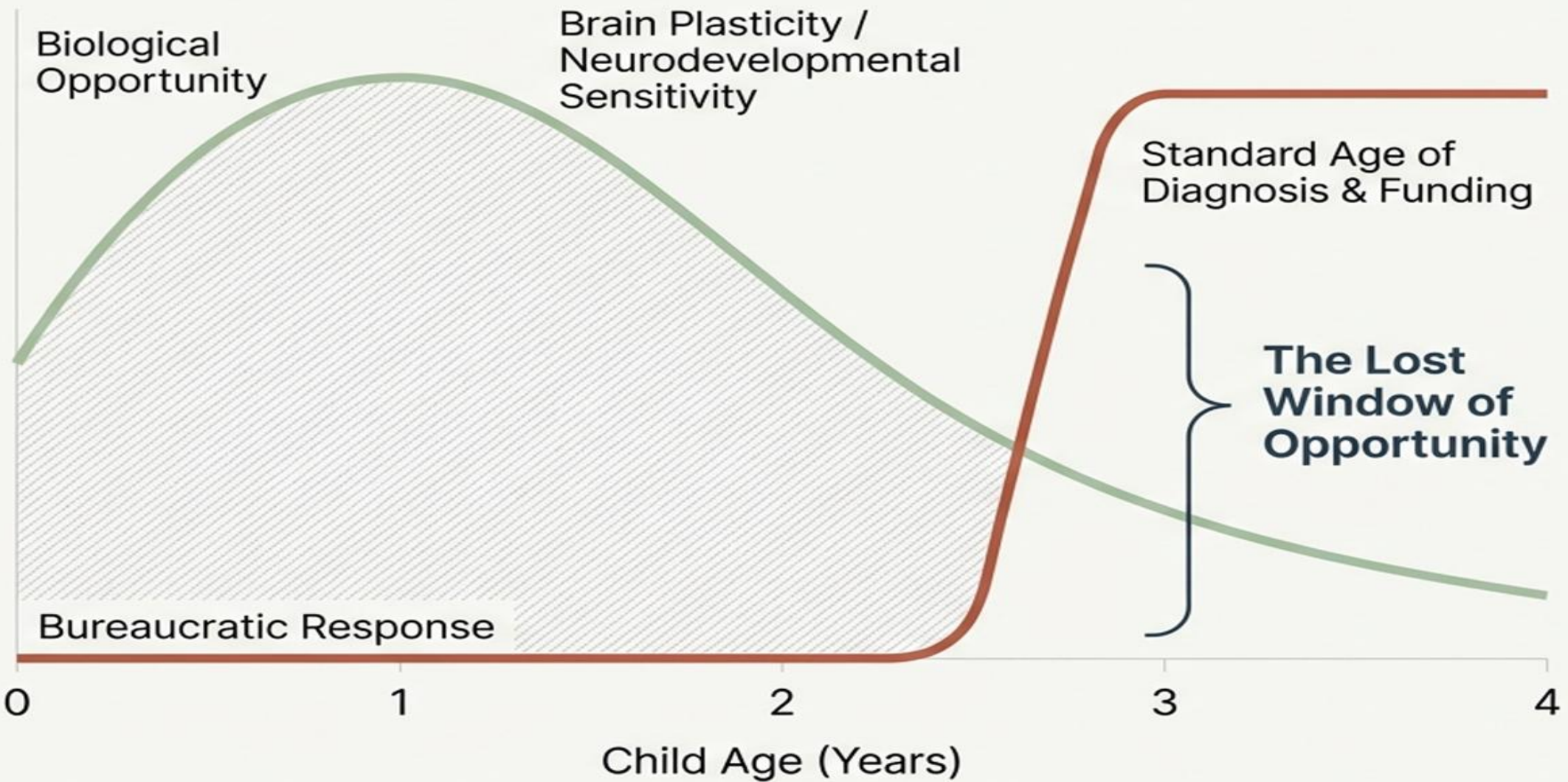
9–18 Months: A Window of Peak Plasticity



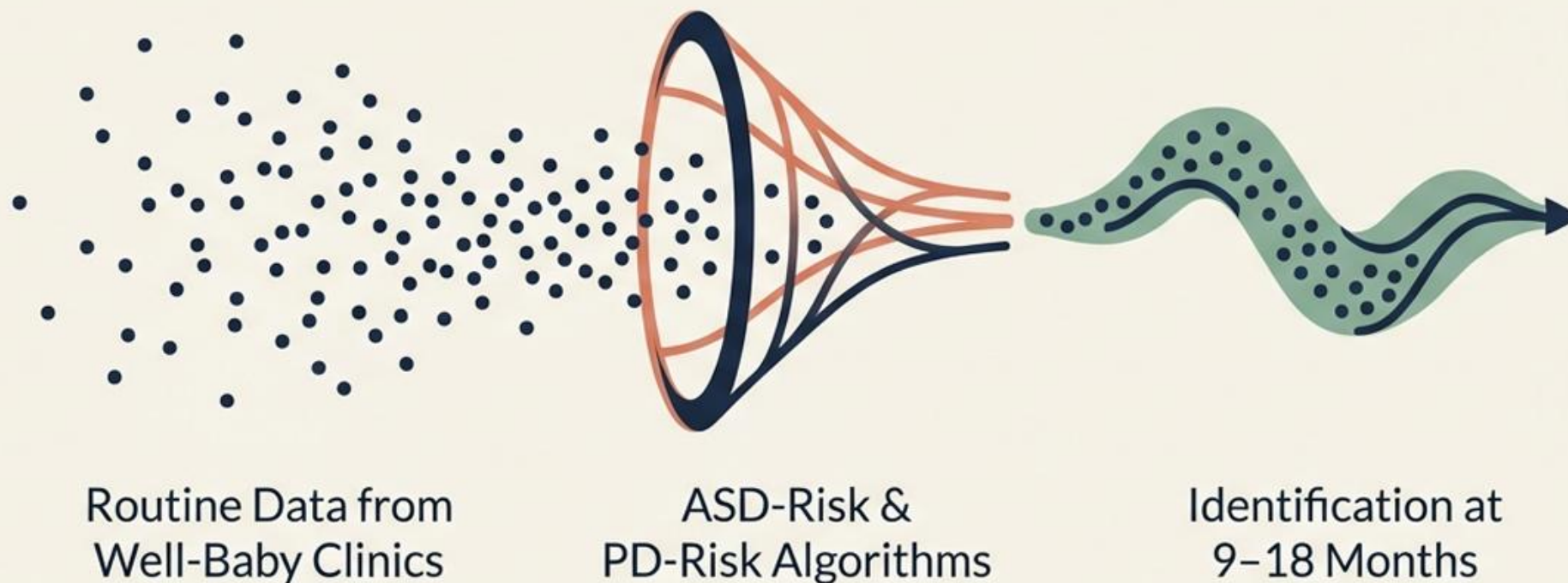
Developmental neuroscience confirms this is a **sensitive period** where **environmental input** defines cognitive and adaptive trajectories.

**The Consequence:** Missing this window limits the efficacy of later interventions.

# The Diagnostic Threshold Creates a 'Wait to Fail' Reality



# Moving from Reactive to Proactive Identification



Utilizing Israel's universal infrastructure to identify high-risk infants *before* they meet criteria for formal diagnostic evaluation.

# A Pragmatic Solution for Real-World Impact



- Evaluate pre-diagnostic intervention

# Four Pathways of Support



## Individual Aide

1:1 support in mainstream daycare



## Specialized Daycare

Multidisciplinary therapeutic setting



## Parent-Guided

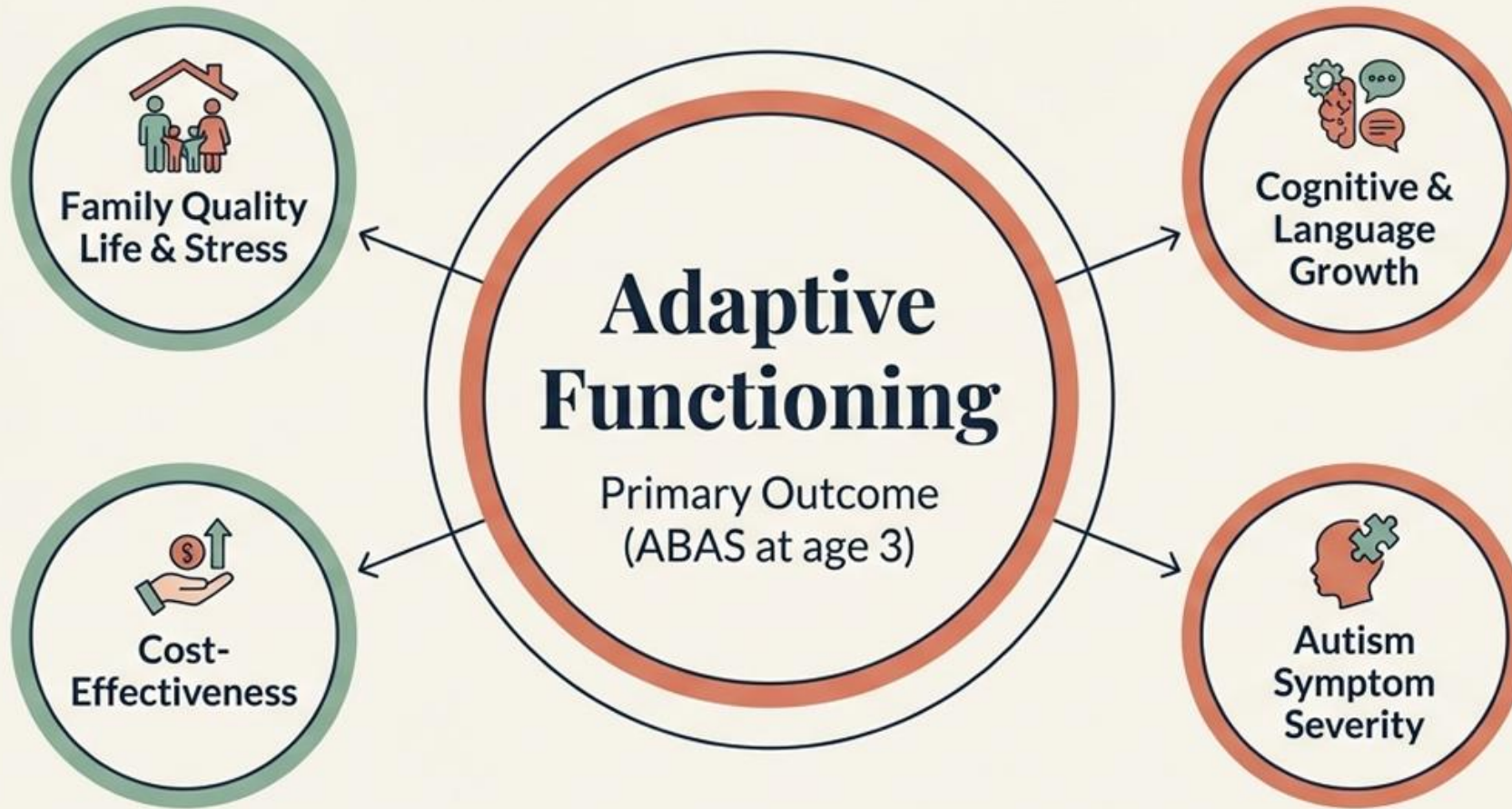
Coaching by nurses in well-baby clinics



## Care-as-Usual

Control group:  
Routine surveillance

# Measuring Adaptive Functioning and Family Wellbeing



Focusing on the child's ability to navigate the world and the family's resilience.

# A Cross-Sector National Partnership



Governance Structure: Funders participate in the steering committee for governance but remain independent of data analysis and interpretation to ensure scientific integrity.

# A Vision for Need-Driven Care

**The Shift:** Decoupling support from diagnosis.



**Final Takeaway:** Validated, scalable, and economically sustainable early childhood support for the entire population.





**Thank you**