

# **Poliovirus Vaccines Given at Birth**

**by**

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# Intestinal Infection with Attenuated Poliovirus – Variation with Age

<b>Age</b>	<b>Total for all types</b>	
<i>days</i>	<b>no.</b>	<b>%</b>
<b>0-7</b>	<b>37/39</b>	<b>95</b>
<b>8-35</b>	<b>55/75</b>	<b>73</b>
<b>36-70</b>	<b>81/109</b>	<b>74</b>
<b>71-140</b>	<b>70/76</b>	<b>92</b>

# Infection of Newborn Infants with Attenuated Poliovirus 3

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Dose (TDC <sub>50</sub> )	Infants infected/ Infants fed
100-1000	4/4
30-100	7/9
10	2/3
2.5	3/9
1	3/10

# Half-Life of Transplacentally-Acquired Poliovirus Antibodies as Determined at Intervals after Birth

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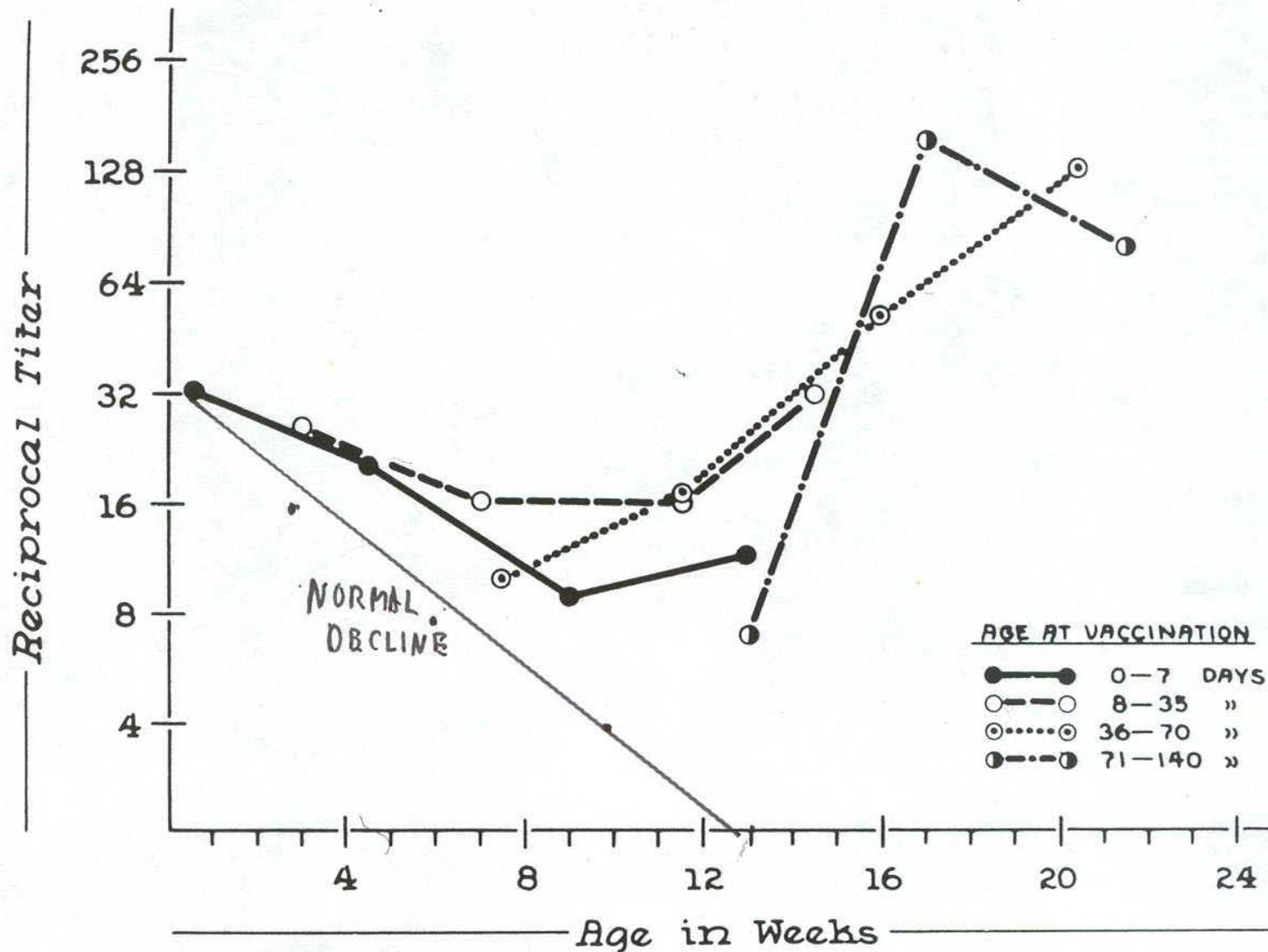
**Geometric Mean Antibody Half-life in Days by Type\***

**Interval after**

<b>Birth (days)</b>	<b>I</b>	<b>II</b>	<b>III</b>	<b>All</b>
<b>15-40</b>	<b>15 (5)</b>	<b>14 (10)</b>	<b>13 (13)</b>	<b>13</b>
<b>41-70</b>	<b>25 (9)</b>	<b>26 (8)</b>	<b>25 (4)</b>	<b>25</b>
<b>71-100</b>	<b>22 (7)</b>	<b>26 (12)</b>	<b>28 (11)</b>	<b>25</b>
<b>&gt;101</b>	<b>41 (12)</b>	<b>29 (9)</b>	<b>38 (4)</b>	<b>35</b>
<b>All</b>	<b>26</b>	<b>22</b>	<b>21</b>	<b>23</b>

\*Number of determinations in parenthesis

Pagano JS, et al. *Pediatrics* 1962 May:794-807.



Plotkin SA, et al. Second International Conference on Live Poliovirus Vaccines, PAHO, Washington DC, June 1960, 294-301.

# Variation of Intestinal Infection and Antibody Response According to Age

Age of infants (days)	Proportion of infants that excreted poliovirus in feces		Proportion of infected infants with antibody response	
	No.	(%)	No.	(%)
<u>Premature</u>				
3	44/47	94	14/25	56
<u>Term</u>				
<5	21/24	88	10/18	56
5 to <30	63-81	78	37/44	84
30 to 60	57-81	70	45/48	94
60 to 180	87/09	89	66/69	96

Plotkin SA, et al. Pediatrics June, 1959:1041-1062.

# Antibody Response to Intestinal Infection with Attenuated Poliovirus

## -- Variation with Age

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<b>Age</b>	<b>All types</b>	
<i>days</i>	<b>no.</b>	<b>%</b>
<b>0-7</b>	<b>10/19</b>	<b>53</b>
<b>8-35</b>	<b>21/30</b>	<b>70</b>
<b>36-70</b>	<b>32/40</b>	<b>80</b>
<b>71-140</b>	<b>26/29</b>	<b>90</b>

# Effect of Transplacentally Antibodies on Intestinal Infection with Attenuated Poliovirus

Type 3 cord-blood Antibody titer	Infants given virus (No.)	Infants that Did not excrete Virus in feces (No.)	Duration of excretion of virus in feces	
			Range (days)	Means (days)
< 8	8		7 to 38	25
8	4		10 to 25	18
32	9		9 to 39	22
128	8		15 to 56+	26
512	25	2 (8%)	13 to 19	24
2,048	15	1 (7%)	4 to 34+	16
>2,048	3	1 (33%)	10 to 20	15
<b>ALL</b>	<b>74</b>	<b>4 (5%)</b>	<b>4 to 56+</b>	<b>23</b>

# Analysis of Effect of Various Combinations of Antibody Titers in Colostrum and Serum on Infection Rate

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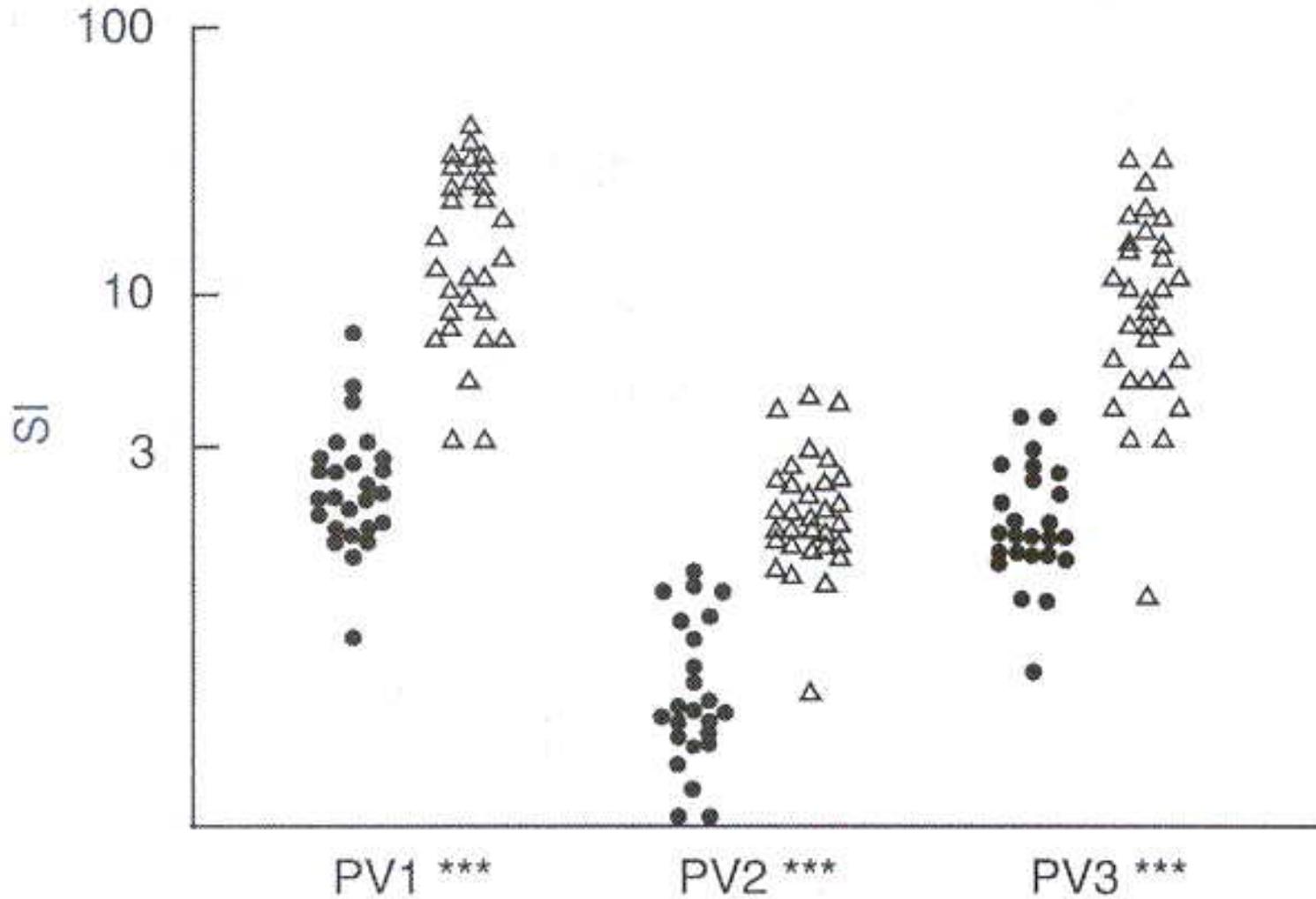
## Antibody Titers

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Serum	Colostrum	Infection	Rate %
$\geq 128$	$\geq 256$	6/20	30
$\geq 128$	$\leq 64$	10/16	63
$\leq 32$	$\geq 256$	2/6	33
$\leq 32$	$\leq 64$	16/18	89

Plotkin et al. Amer J Dis Child 1966

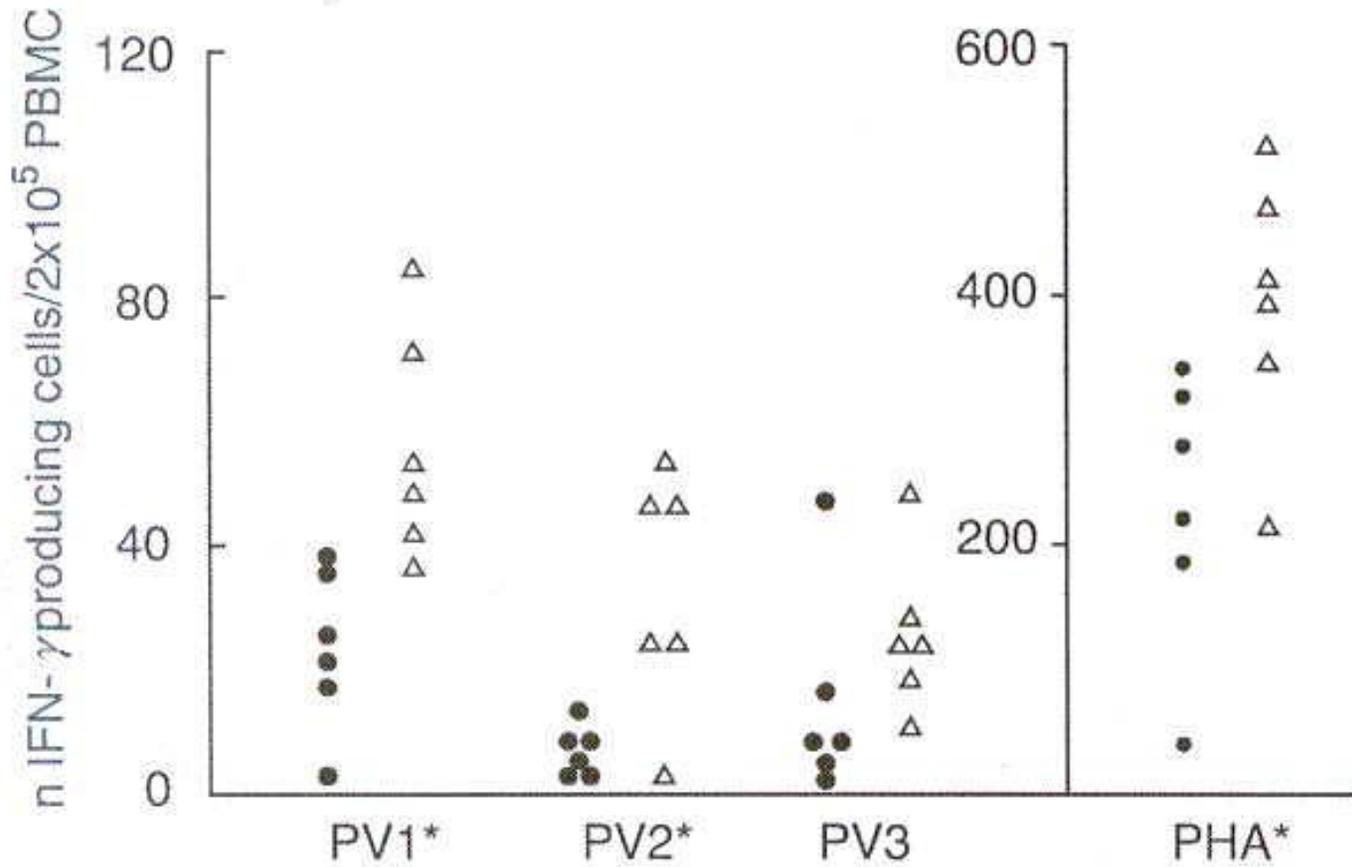
# Cell proliferation



- Infants    △ Adults    Vekemans J et al. Clin Exp Immunol 2002; 127:495-498.



### ELISPOT analysis



Vekemans J et al. Clin Exp Immunol 2002; 127:495-498.

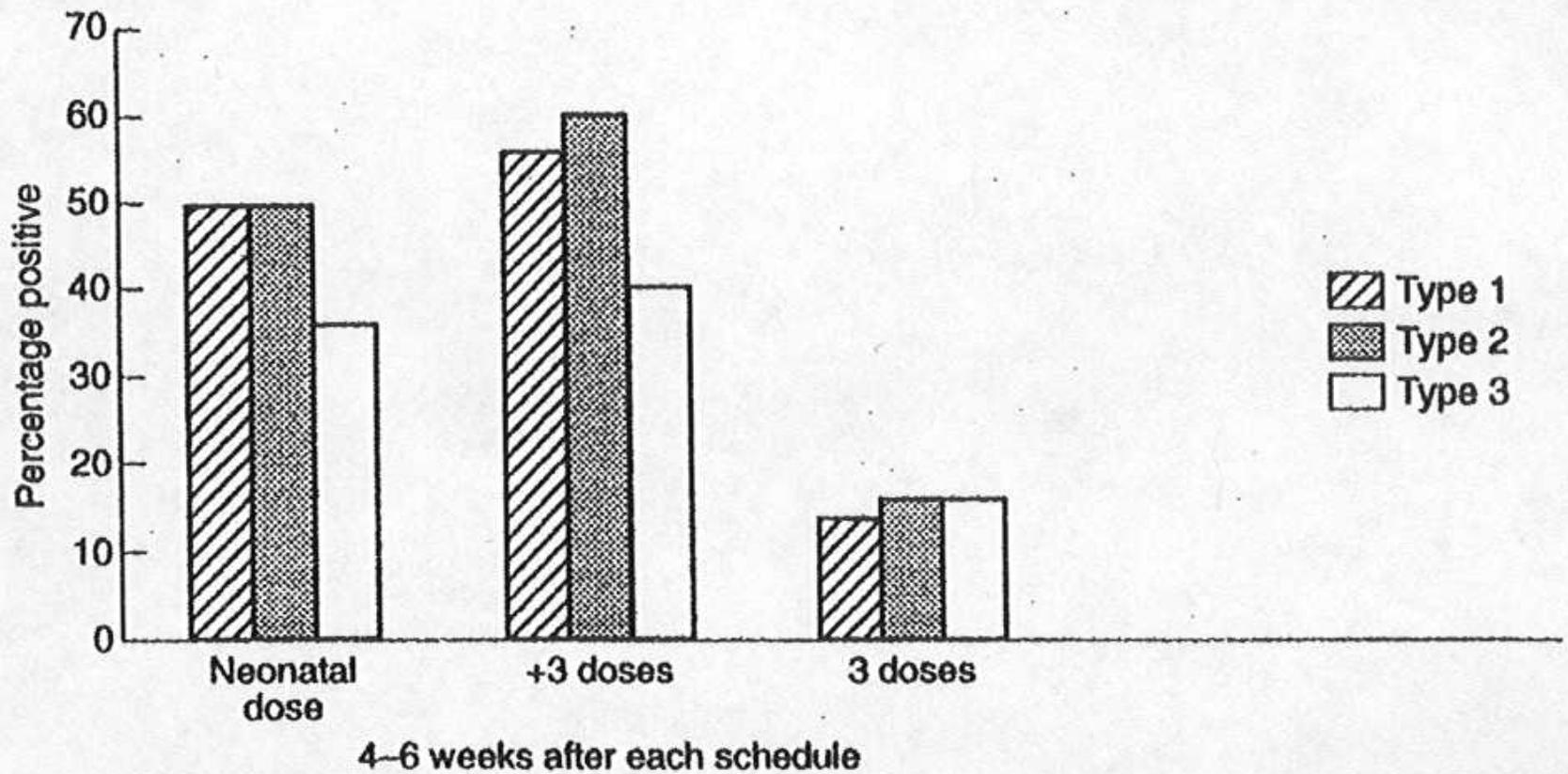


FIG. 2. Mucosal antibody response to different OPV schedules.

# Examples of Intestinal Resistance Despite Absent Serum Antibody

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	Infant A	Infant B
<b>1st Dose (3d.)</b>		
Fecal Virus	+	+
PV Antibody	—	—
<b>2nd Dose (24d.)</b>		
Fecal Virus	—	—
PV Antibody	—	—
<b>WV Exposure (18m)</b>		
Fecal Virus	+	+
PV Antibody	+	+

# Excretion of Virus After Challenge with Type 1 Vaccine at 6 months of Age by Infants Who Received No Vaccine at Birth and by Those Who Received Vaccine but Responded in Different Ways

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Controls:  
no oral vaccine  
at birth

Type 1 oral vaccine at birth *but*  
failed to fulfill criteria for antibody  
response at 3 months

Type 1 oral vaccine at birth: either  
excreted virus, or fulfilled  
criteria for antibody response  
at 3 months.

**Excreted  
(no.)**

5/6

7/10

5/11

**Median Duration  
of Excretion  
(days)**

15+

20+

7

Sabin AB, et al. Pediatrics April 1963:641-650

# Percentage of Infants Showing Antibody Titers >1:128 to Polio Virus

Schedule of OPV	No. of Infants	Type 1	Type 2	Type 3
Neonatal	51	5.8	2.0	2.0
+3 doses	51	29.5	31.3	25.4
Only 3 doses	89	20.2	11.2	19.1
+5 doses	49	55.1*	61.2*	42.8*
Only 5 doses	25	12.0	12.0	16.0

\*  $P < 0.001$  compared to the respective percentages with only 3 and only 5 doses of OPV  
Sabin et al.

# Studies of IPV at Birth (1)

Country and Schedule	<u>% Seropositive</u>			
	1	2	3	
India				
0, 1.5, 2.5	CB	NA	NA	NA
	6w	48	64	100
	10w	80↑	68↑	76
	20w	88↑	88↑	100↑
Israel				
0, 6	CB	100	100	100
	3.5m	67	76	67
	7m	80↑	98↑	71↑

# Studies of IPV at Birth (2)

Country and Schedule		<u>% Seropositive</u>		
		1	2	3
Israel				
0, 2	CB	97	97	NA
	1m	100	100	97 ↑
	3m	100 ↑	100 ↑	97 ↑
Israel				
0, 2	CB	100	100	90
	1m	100	100	94 ↑
	3m	100	100 ↑	98 ↑

# Antibody Responses of Premature Israeli Infants to IPV at 0, 2 mos. (A) or 2 mos. (B)

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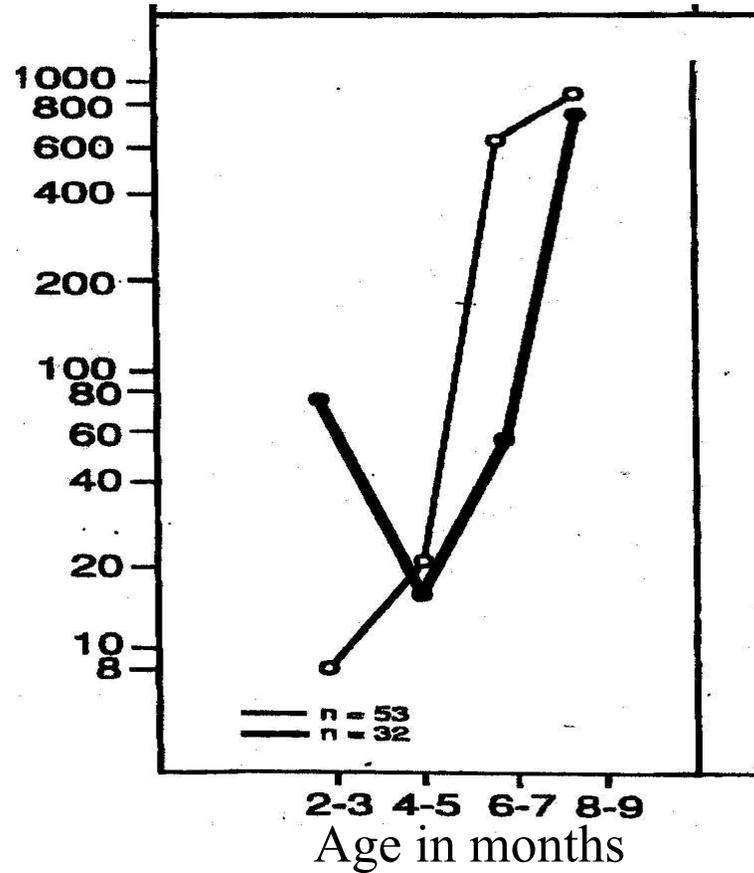
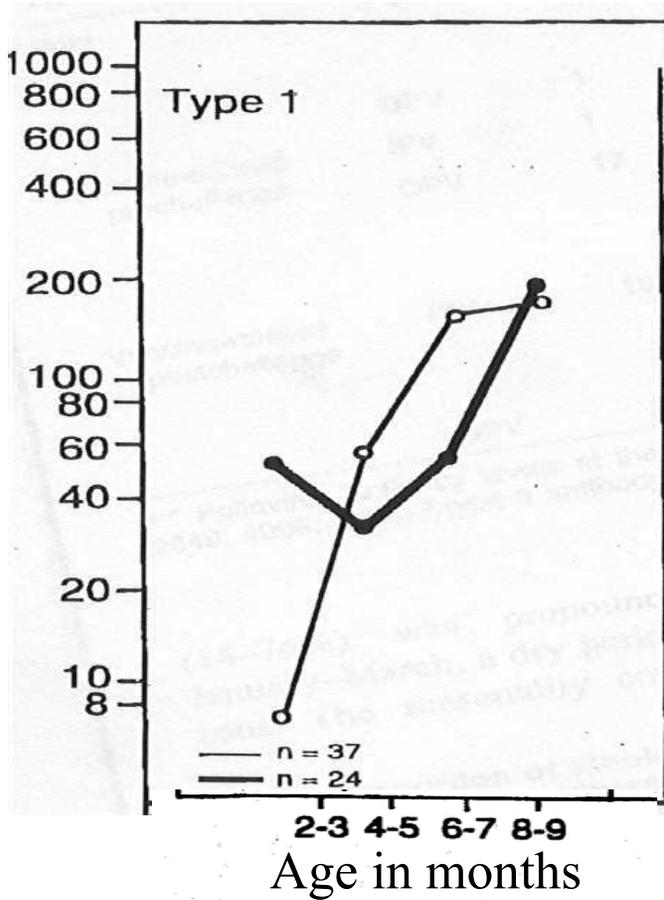
	Types					
	1		2		3	
<u>Birth</u>	A	B	A	B	A	B
% Seropos.	100	98	100	100	90	93
GMT	189	163	402	288	39	32
<u>1 Mo.</u>	A	B	A	B	A	B
% Seropos.	100	94	100	98	94	81
GMT	117	79	214	153	38	23
<u>3 mos.</u>	A	B	A	B	A	B
% Seropos.	100	98	100	98	94	81
GMT	98	81	317	106	218	72

(Doses 2, 4, 6, m.)

### OPV-group

### IPV-group

Geometric means (log scale)



# Conclusions

1. Both OPV and IPV at birth induce immune memory for antibodies
2. Immunity to infection is induced by prior local replication or high serum titers
3. Maternal antibodies (IgG and IgA) reduce but do not entirely prevent vaccination
4. Nevertheless, booster doses are necessary
5. Neonatal doses enhance and accelerate protection