

A cluster of medical icons, each inside a hexagon, arranged in a loose grid. The icons include: a first aid kit, a stethoscope, a syringe, a doctor, a hospital bed, a pill bottle, a clipboard, two pills, two water droplets, a thermometer, and a laboratory flask.

# Vaccine Launch

David Ridley

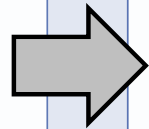
DUKE  
FUQUA

# Agenda

- What price for Gardasil in the US?
- ... in emerging markets?
- Conclusions, news, and next

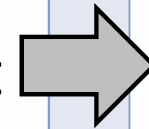
## Developing

- Pipelines
- Licensing
- Patents



## Commercializing

- Launching
- Reimbursement
- Pricing



## Competing

- Lifecycle
- Biosimilars
- Generics

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What factors for the Gardasil price?

# When do R&D costs matter?

- Before R&D costs are paid, they matter
  - Firms typically need to expect a high price in order to invest
- After R&D costs are paid, they don't matter
  - Sunk costs don't matter

# R&D costs versus revenue

- For successful drugs, R&D costs  $\ll$  revenue
- (For failed drugs, R&D costs  $\gg$  revenue = \$0)
- So industry critics want reporting of R&D costs
- And firms refuse

# What US price for Gardasil?

- <\$120
- >\$120



# What price in India?

- <\$50

- >\$50

# If price=\$120/dose, what is cost per QALY?

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## Assumptions (Source: Calkins 2009)

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- 3 Doses
  - \$120 Price/dose
  - \$20 Administration fee
  - 0 Alternative
  - 0.6% Probability cervical cancer if no Gardasil
  - 70% Probability cancer prevented by Gardasil
  - 0.8 QALY per year
  - 81.6 Years of life with Gardasil
  - 70 Years of life without Gardasil
  - ? Cost per QALY
-

# If price is \$120/dose, what is cost per QALY?

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## Assumptions (Source: Calkins 2009)

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3	Doses
\$120	Price/dose
\$20	Administration fee
0	Alternative
0.6%	Probability cervical cancer if no Gardasil
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81.6	Years of life with Gardasil
70	Years of life without Gardasil
?	Cost per QALY

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Change in cost  
Change in QALY

$$\frac{3 * (\$120 + \$20) - 0}{0.006 * 0.7 * 0.8 * (81.6 - 70) \text{ QALY}}$$

\$420  
0.039 QALY

\$11,000/QALY

\$26,000/QALY if 3% discount and 30 years  
= \$11K / (1/1.03)<sup>30</sup>

Also cost savings from not treating cancer,  
but distant future

# If year worth \$50,000, what is max price?

## Assumptions

3	Doses
?	Price/dose
\$20	Administration fee
0	Alternative
0.6%	Probability cervical cancer if no Gardasil
70%	Probability cancer prevented by Gardasil
0.8	QALY per year
81.6	Years of life with Gardasil
70	Years of life without Gardasil
\$50,000	Cost per QALY

$$\frac{\text{Change in cost}}{\text{Change in QALY}} = \$50,000$$

$$\frac{3 * (\text{price} + \$20) - 0}{0.006 * 0.7 * 0.8 * (81.6 - 70) \text{QALY}} = \$50,000$$

$$\frac{\$60 + 3 * \text{price}}{0.039 \text{ QALY}} = \$50,000$$

$$\text{Price} \leq \$630/\text{dose}$$

# US price for Gardasil

- US launch price = \$125/dose
- Cost effective
- Highest US vaccine price

Manufac.	Brand	CDC Price	Private Price
Merck	Gardasil	\$101	\$125
	ProQuad	\$81	\$124
	Varivax	\$62	\$78
	RotaTeq	\$57	\$70
	COMVAX	\$29	\$44
	RECOMBIVAX HB	\$24	\$59
	MMRII	\$18	\$47
	VAQTA	\$13	\$30
	PedvaxHIB	\$11	\$23
Sanofi	Menactra	\$76	\$94
	Pentacel	\$50	\$73
	ADACEL	\$31	\$37
	TriHIBit	\$27	\$43
	DECAVAC	\$17	\$19
	DAPTACEL	\$13	\$22
	Tripedia	\$13	\$21
	IPOL	\$11	\$23
	ActHIB	\$9	\$22

\$125  
2008

Manufac.	Brand	CDC Price	Private Price
GSK	Rotarix	\$82	\$103
	Pediarix	\$49	\$71
	Twinrix	\$39	\$78
	Kinrix	\$32	\$48
	BOOSTRIX	\$31	\$36
	Infanrix	\$14	\$21
	Havrix	\$12	\$27
	ENGRIX B	\$10	\$21
Wyeth/Lederle	Prevnar	\$66	\$84

Source: Centers for Disease Control (CDC). September 2008  
Higher price of adult and ped. Excludes influenza which is about \$20

Maker	Vaccine	Brand	CDC Price	Private Price
Merck	DTaP-IPV-HIB-HEPB	Vaxelis	\$ 98	\$ 151
	Hep A	Vaqta	\$ 40	\$ 79
	Hep B	Recombivax HB	\$ 32	\$ 67
	Hib	PedvaxHIB	\$ 16	\$ 30
	HPV 9-valent	Gardasil9	\$ 225	\$ 288
	MMR	M-M-RII	\$ 61	\$ 92
	MMR/Varicella	ProQuad	\$ 165	\$ 270
	Pneumo 15-valent	Vaxneuvance	\$ 162	\$ 223
	Pneumo 23-valent	Pneumovax23	\$ 82	\$ 117
	Rotavirus	RotaTeq	\$ 79	\$ 96
	Varicella	Varivax	\$ 132	\$ 174
Sanofi	Dengue	Dengvaxia	\$ 96	\$ 104
	DTaP	Daptacel	\$ 21	\$ 29
	DTaP-IP-HI	Pentacel	\$ 68	\$ 115
	DTaP-IPV	Quadracel	\$ 46	\$ 62
	e-IPV	IPOL	\$ 16	\$ 43
	Hib	ActHIB	\$ 11	\$ 13
	Meningococcal	MenQuadfi	\$ 108	\$ 167
	RSV	Beyfortus	\$ 395	\$ 495
	DT	Tenivac	\$ 23	\$ 37
	DTaP	Adacel	\$ 36	\$ 48

\$288  
for 2  
2024

Maker	Vaccine	Brand	CDC Price	Private Price
GSK	DTaP	Infanrix	\$ 21	\$ 29
	DTaP-Hep B-IPV	Pediarix	\$ 64	\$ 98
	DTaP-IPV	Kinrix	\$ 47	\$ 61
	Hep A	Havrix	\$ 39	\$ 83
	Hep A-Hep B	Twinrix	\$ 76	\$ 126
	Hep B	Engerix-B	\$ 36	\$ 69
	Hib	Hiberix	\$ 11	\$ 13
	MMR	Priorix	\$ 61	\$ 92
	Meningococcal B	Bexsero	\$ 142	\$ 224
	Meningococcal	Menveo one-vial	\$ 106	\$ 157
	RSV	Arexvy	\$ 198	\$ 280
	Rotavirus	Rotarix	\$ 105	\$ 139
	DTaP	Boostrix	\$ 36	\$ 47
	Zoster	Shingrix	\$ 121	\$ 198
Dynavax	Hep B	Hepelisav-B	\$ 75	\$ 141
Grifols	DT	TDVAX	\$ 19	\$ 28
Moderna	Covid-19	Spikevax	\$ 86	\$ 128
Pfizer	Covid-19	Comirnaty	\$ 98	\$ 115
	Meningococcal B	Trumenba	\$ 131	\$ 179
	Pneumo 20-valent	Prevnar 20	\$ 178	\$ 253
	RSV	Abrysvo	\$ 227	\$ 295
VBI	Hep B	PreHevbrio	\$ 34	\$ 66

Source: Centers for Disease Control (CDC). March 2024  
Higher price of adult and ped. Excludes influenza which is about \$20

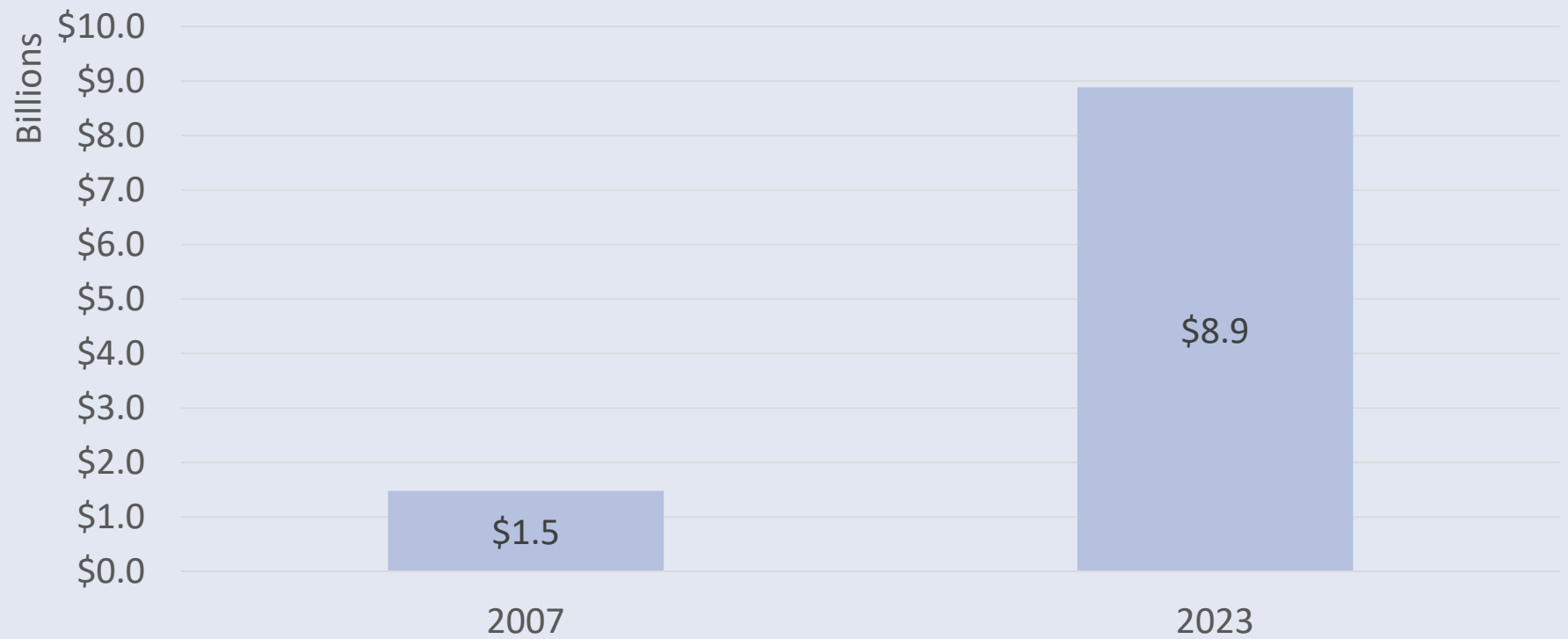
# Vaccines for Children Program

- Allocated by Centers for Disease Control and Prevention (CDC)
- Pays for about 1/2 of childhood vaccines in US
- Children ( $\leq 18$ ) eligible if
  - Medicaid
  - Uninsured
  - American Indian or Alaska Native
  - Underinsured
- Includes flu, human papillomavirus, measles, ...



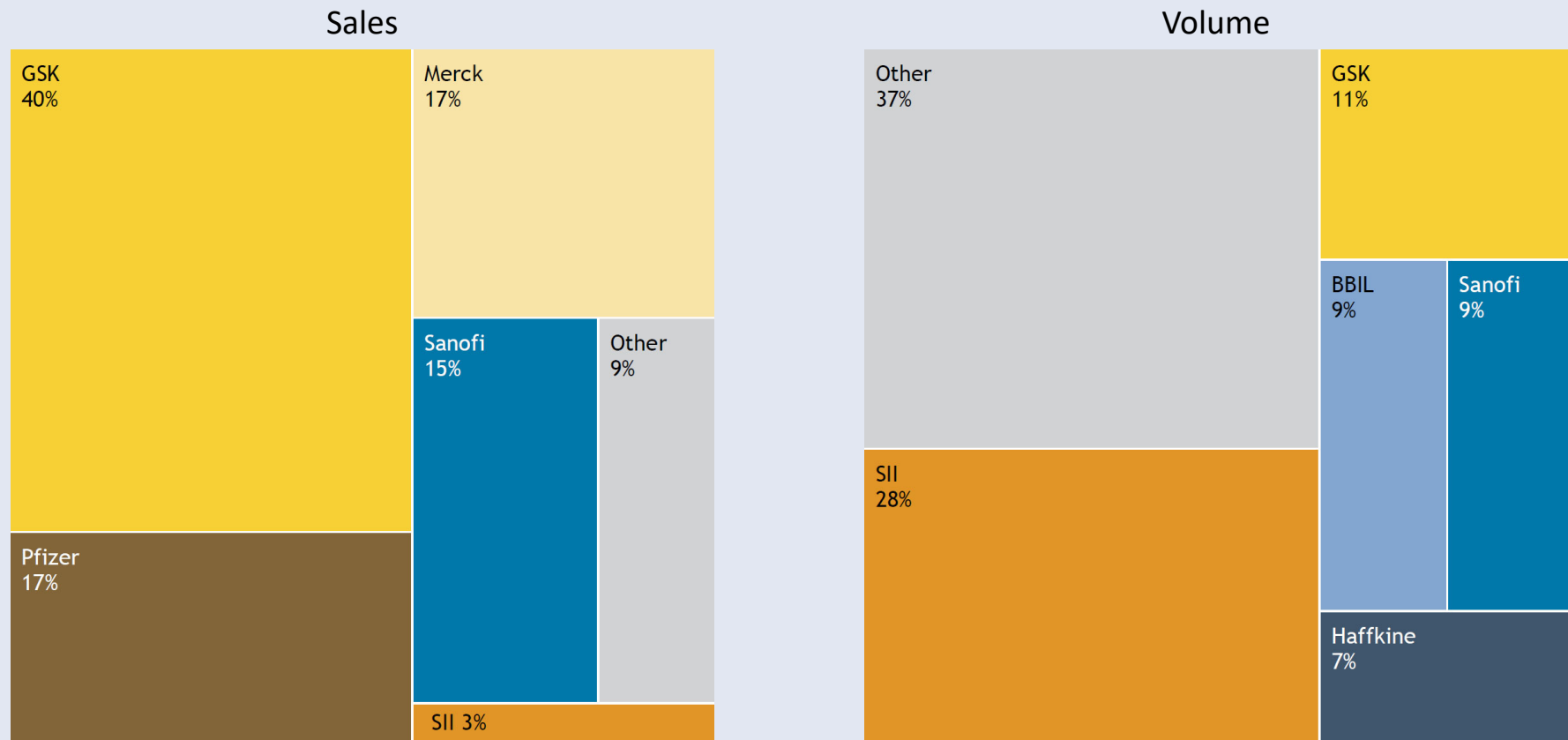


# Gardasil revenue



Source: Ridley using data from Merck SEC 10K filings

# Global vaccine makers, 2019



Source: World Health Organization report using 2019 data.  
SII = Serum Institute of India. BBIL = Bharat Biotech International Limited

# 4Cs of price

1. Cost-effectiveness

↑value

2. Cost

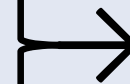
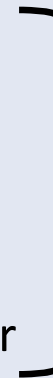
↑variable cost

3. Competition

different/better

4. Conscience

employees want  
patient access



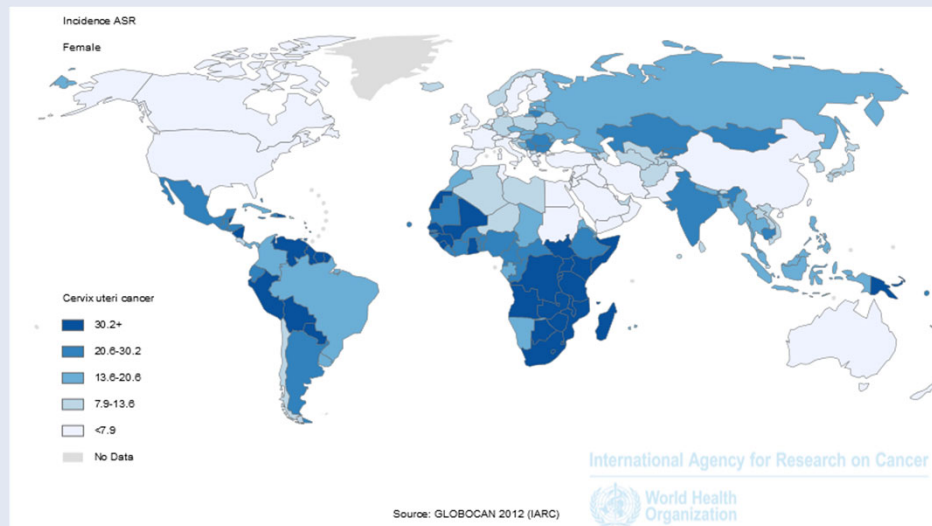
↑price

# Agenda

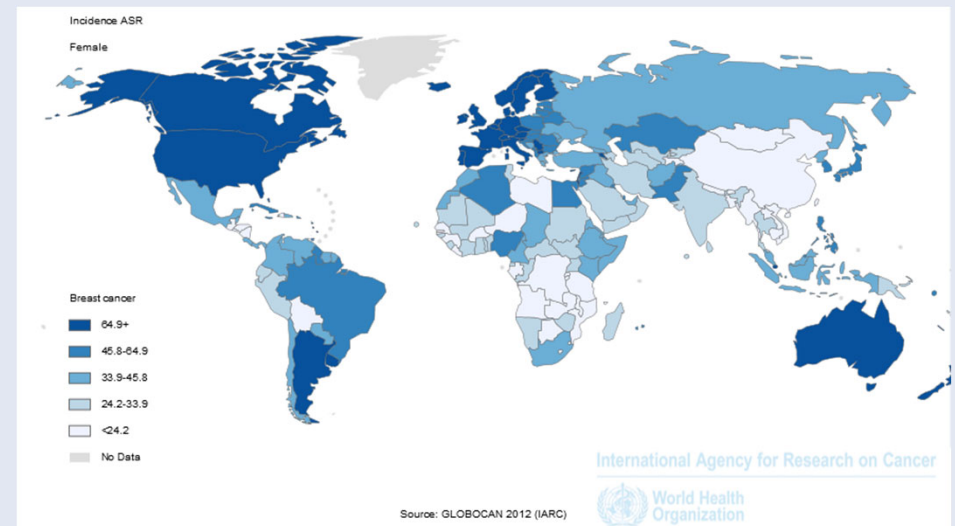
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# Global market

## Incidence of Cervical Cancer



## Incidence of Breast Cancer

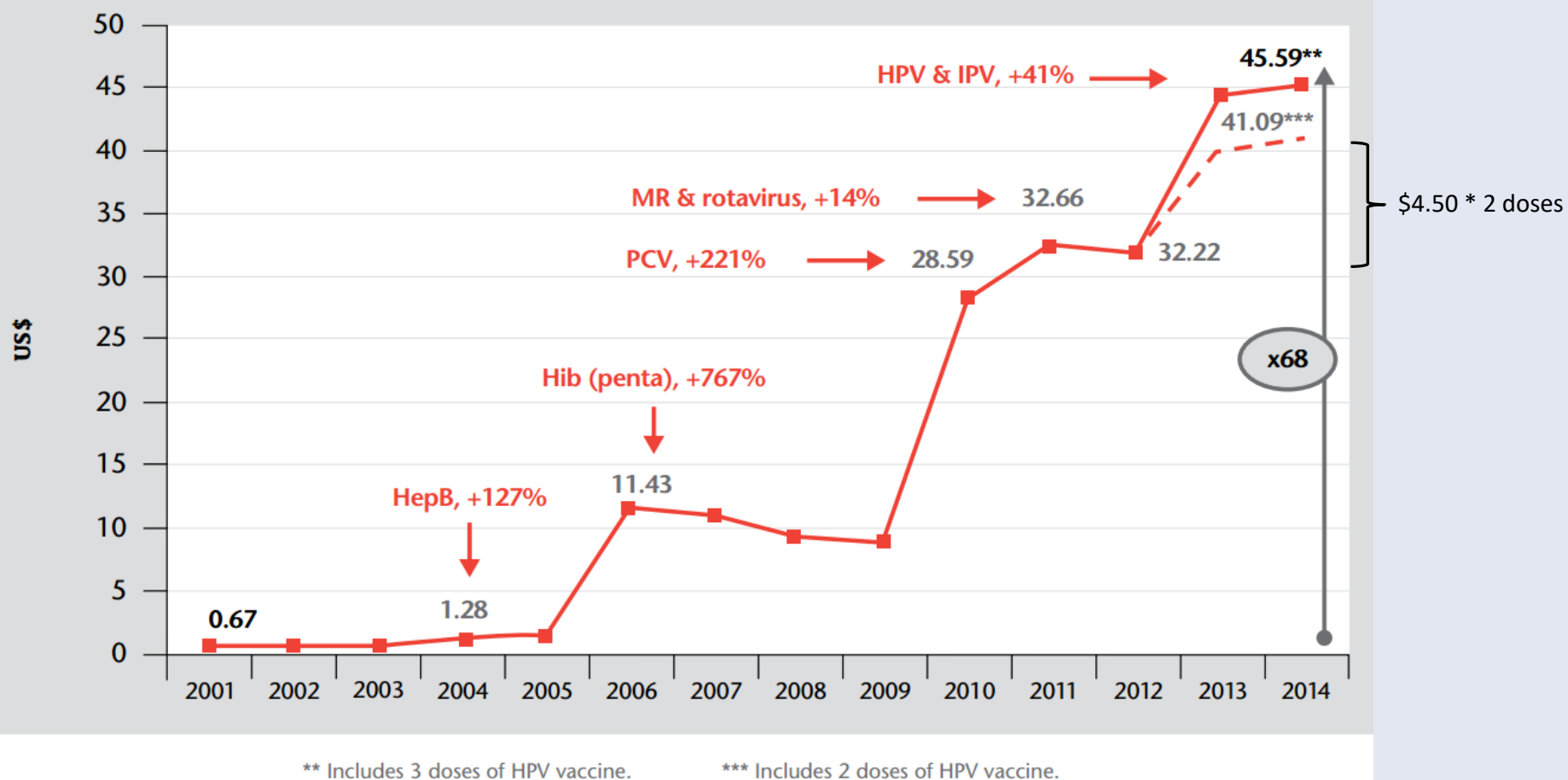


Source: International Agency for Research on Cancer

“Médecins Sans Frontières/Doctors Without Borders (MSF) ... showed that in the poorest countries, **the price to vaccinate a child is now a colossal 68 times more expensive than it was in 2001...**”

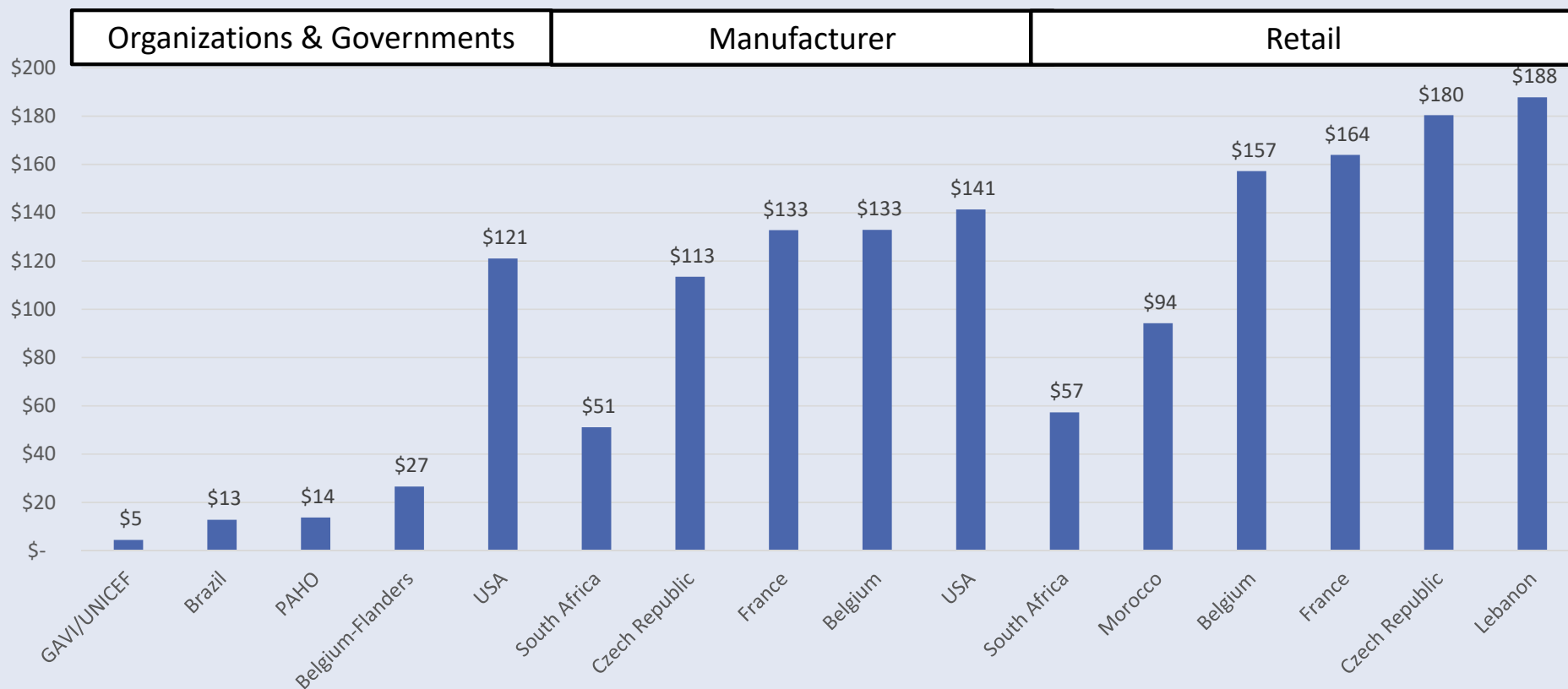
- Stephen Cornish in Huffington Post

**Graph 1: Price to immunise a child based on lowest price available to Gavi/UNICEF**



Source: Médecins Sans Frontières

# Gardasil price per dose as low as \$4.50



Source: Médecins Sans Frontières, 2014



# Low prices in low-income countries

Price	Maker	Drug	Disease
\$0	Merck	Ivermectin	River blindness
\$5	Merck	Gardasil	Human papillomavirus
License to generics	Gilead	Sovaldi	Hepatitis C



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# 3 Conclusions

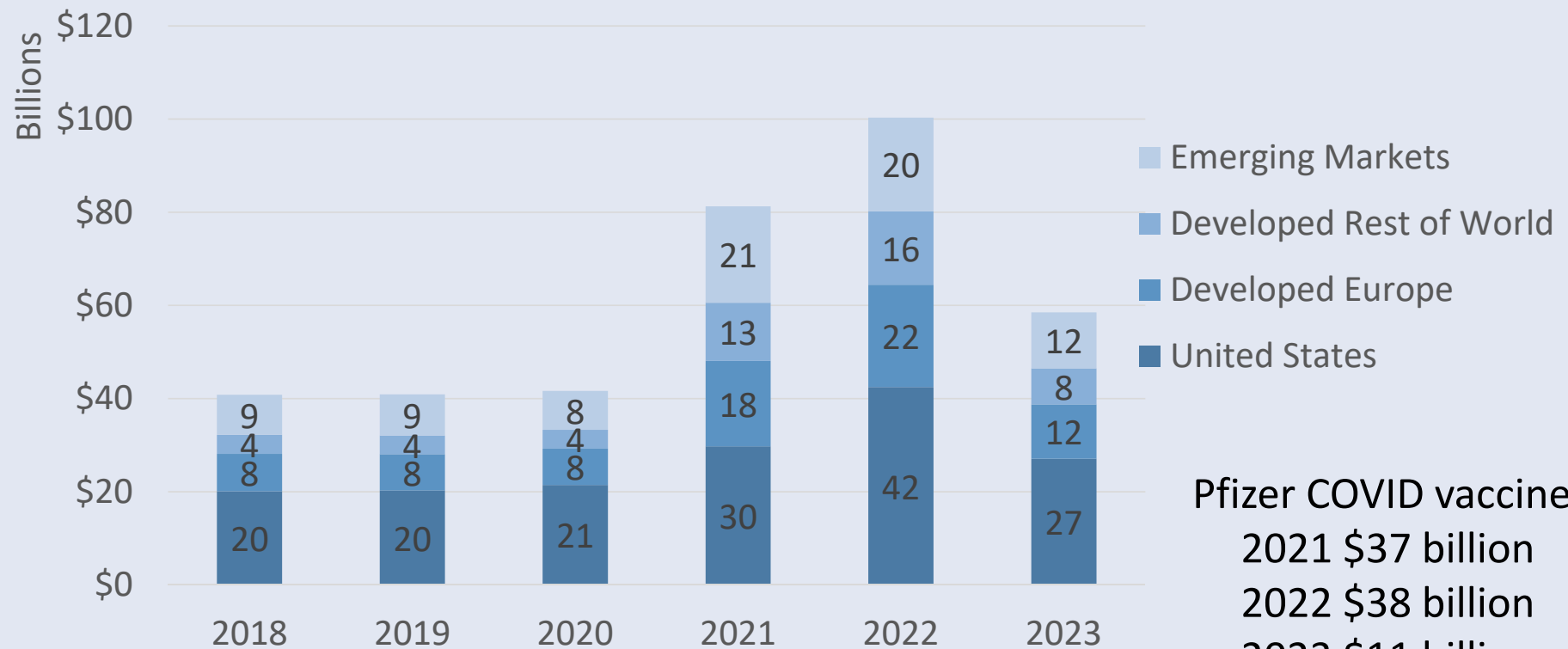
1. Choose price based on value, but also political and ethical considerations.
2. Charge low prices in low-income countries.
3. If you make an important product, you'll make money and get attention, including from Médecins Sans Frontières.

# Next

- Class photo
- Which should Teva make: innovators, generics, or biosimilars?
- What is the current state of the biosimilar market?



# Revenue



**Pfizer COVID vaccine:**  
2021 \$37 billion  
2022 \$38 billion  
2023 \$11 billion