Perspectives on Vaccine Hesitancy

Gary S. Marshall, M.D.
Professor of Pediatrics
Chief, Division of Pediatric Infectious Diseases
Director, Pediatric Clinical Trials Unit
University of Louisville School of Medicine
Louisville, Kentucky
## Disclosures

**Ad hoc consultant**
- GlaxoSmithKline
- Merck
- Novartis
- Pfizer
- Sanofi Pasteur
- Seqirus

** Principal investigator**
Objectives

After completion of this activity, participants should be able to…

- Explain why people accept anecdotal experiences as indicative of causal relationships
- Counteract thought patterns that lead to vaccine refusal
- Maintain high immunization rates despite pervasive vaccine hesitancy
Vaccinology Through the Ages

- Pestilence and Disease
- Era of Discovery
- Golden Age
- Era of Second Thought
Era of Discovery: 1796–1953

Jenner inoculates James Phipps with cowpox

Pasteur vaccinates animals with attenuated *B. anthracis*
Era of Discovery: 1796–1953

Pasteur inoculates Joseph Meister against rabies

von Behring discovers the protective effect of anti-toxins
Era of Discovery: 1796–1953

Ehrlich develops the concept of antibodies

Metchnikoff develops the concept of cellular immunity
Era of Discovery: 1796–1953

Goodpasture propagates viruses in eggs

Enders propagates viruses in cell culture
1954: The Shot Heard ’Round the World

Salk vaccine is effective against polio


Technological advances

Capsular polysaccharides
Protein-polysaccharide conjugation
Cold adaptation
Reassortment
Purified protein antigens
Recombinant-expressed protein antigens
Virus-like particles
Engineered attenuation
Reverse vaccinology
Adjuvants
Delivery methods
Manufacturing
Quality control


Programmatic advances

Disease surveillance
Economic analysis
Safety monitoring
Refinement in clinical trials
Effectiveness studies
Correlates of protection
Recommendations

Last case of smallpox anywhere on Earth—1977

Last case of type 2 polio anywhere on Earth—1999

http://www.who.int/iris/handle/10665/155528

Last endemic case of measles in the Americas—2002

Last endemic case of rubella in the Americas—2009

Impact of Routine Childhood Immunizations

US, 1994–2013

Cases prevented: 322 million
Hospitalizations prevented: 21 million
Deaths prevented: 732,000
Net societal costs saved: $1.38 trillion

Whitney. MMWR 2014;63:352-55
Cohort=78.6 million children. Analysis includes all vaccines except influenza and HepA. Costs adjusted to 2013 dollars; future disease costs discounted 3% annually.
Public Health Impact of Vaccines

- Childhood immunizations
- Cervical cancer
- Colorectal cancer
- Breast cancer
- Adolescent tobacco
- Physical activity
- Newborn screening
- Alcohol and drugs
- Diet
- Folic acid
- Childhood safety
- Infant feeding

QALYs saved x 1000


Science-mindedness

Science-mindedness
Era of Second Thought: 1998–Present

Early report

Ileal-lymphoid-nodular hyperplasia, non-specific colitis, and pervasive developmental disorder in children

A J Wakefield, S H Murch, A Anthony, J Linnell, D M Casson, M Malik, M Berelowitz, A P Dhillon, M A Thomson, P Harvey, A Valentine, S E Davies, J A Walker-Smith

Summary

Background We investigated a consecutive series of children with chronic enterocolitis and regressive developmental disorder.

Methods 12 children (mean age 6 years [range 3–10]; 11 boys) were referred to a paediatric gastroenterology unit with a history of normal development followed by loss of acquired skills, including language, together with diarrhoea and abdominal pain. Children underwent gastroenterological, neurological, and developmental assessment and review of developmental records. Ileocolonoscopy and biopsy sampling, magnetic-resonance imaging (MRI), electroencephalography (EEG), and lumbar puncture were done under sedation. Barium follow-through radiography was done where possible. Biochemical, haematological, and immunological profiles were examined.

Introduction

We saw several children who, after a period of apparent normality, lost acquired skills, including communication. They all had gastrointestinal symptoms, including abdominal pain, diarrhoea, and bloating and, in some cases, food intolerance. We describe the clinical findings, and gastrointestinal features of these children.

Patients and methods

12 children, consecutively referred to the department of paediatric gastroenterology with a history of a pervasive developmental disorder with loss of acquired skills and intestinal symptoms (diarrhoea, abdominal pain, bloating and food intolerance), were investigated. All children were admitted to the ward for 1 week, accompanied by their parents.

Clinical investigations

We took histories, including details of immunisations and exposure to infectious diseases, and assessed the children. In 11 cases the history was obtained by the senior clinician (TW-S).
Era of Second Thought: 1998–Present
Era of Second Thought: 1998–Present

Vaccine Junkies

Mass immunization campaigns are provoking unprecedented criticism
Era of Second Thought: 1998–Present
Era of Second Thought: 1998–Present
Era of Second Thought: 1998–Present
Pervasiveness of Vaccine Hesitancy

United States

54% of parents are concerned about adverse events
25% of young infants are following an “alternative” schedule
74% of physicians are willing to spread vaccines out

Freed. Pediatrics 2010;125:654 (N=1552 parental respondents)
Nadeau. J Pediatr 2015;166:151 (N=222,628 children ≤9 mo of age)
Pervasiveness of Vaccine Hesitancy

United States

Data from AAP Periodic Surveys (N=852 respondents in 2006 and 854 in 2013)

Hough-Telford. Pediatrics 2016;138:e20162127
Pervasiveness of Vaccine Hesitancy

United States

Hough-Telford. Pediatrics 2016;138:e20162127
Data from AAP Periodic Surveys (N=852 respondents in 2006 and 854 in 2013)
Pervasiveness of Vaccine Hesitancy

United States

Pervasiveness of Vaccine Hesitancy

Worldwide

Percent

Important
Safe
Effective
Compatible with religion

Africa
Americas
Eastern Med
Europe
South-East Asia
Western Pacific

Strongly disagree
Tend to disagree
Tend to agree
Strongly agree

Pervasiveness of Vaccine Hesitancy

Worldwide

Percent disagreeing that vaccines are safe

Pervasiveness of Vaccine Hesitancy

Worldwide

Vaccines Medications National health authorities Manufacturers Alternative medicine

Level of trust (%)

Global

Mexico United Kingdom United States Canada France

Imperial College, London (unpublished data)
Individual countries, N=837–848; Global, N=4178
Pervasiveness of Vaccine Hesitancy

Worldwide
Vaccine Hesitancy—a Threat to Public Health

Pertussis in England and Wales

Cherry. Curr Prob Pediatr 1984;14:1
Vaccine Hesitancy—a Threat to Public Health

Measles outbreaks in the United States

Phadke. JAMA 2016;315:1149
Cumulative epidemic curve of 18 outbreaks, 2000–2015
Vaccine Hesitancy—a Threat to Public Health

Measles cases in the United Kingdom

Vaccine uptake (%)

Vaccine uptake (N)

Measles cases (N)

Vaccine Hesitancy—a Threat to Public Health

*Measles among Somali immigrants in Minnesota*

The young woman started getting advice early on from friends in the close-knit Somali immigrant community. She told them not to let your children get the vaccine for measles, mumps, and rubella — it causes autism, they said.

Suxado Salah listened. And this spring, her 3-year-old boy and 18-month-old girl contracted measles in Minnesota’s largest outbreak of the highly infectious and potentially deadly disease in nearly three decades. Her daughter, who had a rash, high
Vaccine Hesitancy—a Threat to Public Health

Measles among Somali immigrants in Minnesota

Hall. MMWR 2017;66:713
# Vaccine Hesitancy—a Threat to Public Health

## Measles among Somali immigrants in Minnesota

### Humanitarian Health Action

**WHO Grade 3 emergency**

**WHO and the Federal Ministry of Health of Somalia call for urgent support to scale up response and address measles outbreak**


As millions of people in Somalia remain trapped in a devastating cycle of hunger and disease, WHO and health partners are working with national health authorities to save lives and reach the most vulnerable with essential health services.

[Read the full story from the Regional Office website](http://www.who.int/hac/crises/som/en/)
Vaccine Hesitancy—a Threat to Public Health

Polio vaccine boycott in Nigeria

Muslim officials have rejected assurances that the polio vaccine is safe—leaving Africa on the brink of reinfection.

Tens of thousands of volunteers embarked on an emergency campaign on Feb 23 to immunise 63 million children against the polio virus in Nigeria. Muslim officials have rejected assurances that the polio vaccine is safe—leaving Africa on the brink of reinfection.

The polio vaccine is a safe and essential protection for children. We must not allow these unfounded rumours to come reports indicated that the uptake of immunisation was patchy, with many locals turning away volunteers. The state of Zamfara continued its boycott.

The standoff in Nigeria has left the international public health community frustrated, especially in view of the widespread belief that polio is eradicated. In addition to Nigeria, the vaccination drive will target neighbouring countries that had previously been declared polio free.

In addition to Nigeria, the vaccination drive will target neighbouring countries that had previously been declared polio free.

Nigerian states again boycott polio-vaccination drive

Kapp. Lancet 2004;363:709
Vaccine Hesitancy—a Threat to Public Health

Annual attributable cancers in the US, 2008–2012

Viens. MMWR 2016;65:661
## Vaccine Hesitancy—a Threat to Public Health

### Cost-effectiveness

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Cost per QALY saved ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPV4 for boys and girls, versus no vaccination</td>
<td>5500</td>
</tr>
<tr>
<td>HPV9 for boys and girls, versus HPV4</td>
<td>Cost-saving</td>
</tr>
<tr>
<td>Colorectal cancer screening</td>
<td>12,000</td>
</tr>
<tr>
<td>Breast cancer screening</td>
<td>20,000</td>
</tr>
<tr>
<td>Cholesterol screening</td>
<td>30,000</td>
</tr>
<tr>
<td>Td booster</td>
<td>170,000</td>
</tr>
<tr>
<td>MenACWY (2 doses)</td>
<td>212,000</td>
</tr>
</tbody>
</table>

Cohn. MMWR 2013;62:RR-2*
Vaccine Hesitancy—a Threat to Public Health

Coverage rates, ages 13–17 years

CDC. MMWR 2016;65:850
It is easy to scare people...
It is much harder to unscare them.

—Paul A. Offit, M.D.
Vaccine Hesitancy Cascade

Initial conditions

External factors

Internal factors

LEVEL–I

LEVEL–II

LEVEL–III
Vaccine Hesitancy Cascade

**Initial conditions**
- The Internet

**External factors**
- Culture of anti-science

**Internal factors**
- Anecdotal thinking
LEVEL–I: Initial Conditions

The Internet

Six Reasons to Say NO to Vaccination - The Healthy Home Economist
https://www.thehealthyhomeeconomist.com/six-reasons-to-say-no-to-vaccination/  
Jun 5, 2017 - You should neither assume shots are dangerous just because your friend down the street doesn't vaccinate her kids. The key here is education ...

Objective, science-based analysis of vaccine dangers vaccinepapers ...
vaccinepapers.org/about/  
Science shows that vaccines cause brain damage. VaccinePapers.org uses peer-reviewed science to report the truth about vaccine dangers.

Anti-Vaccine Scientific Support Arsenal – Scientific proof the media ...
https://avscientificsupportarsenal.wordpress.com/  
There is absolutely undeniable scientific proof that vaccines cause autism. ..... The website provides studies showing the dangers of mercury exposure and the ...

The Brilliance of Dr. Suzanne Humphries on The Dangers of Vaccines ...
https://www.youtube.com/watch?v=McfXd_Xuojs  
Oct 21, 2014 - Uploaded by PreventDiseaseTV  
http://preventdisease.com/vaccines There will come a day when all Doctors will understand that vaccination ...

Doctors-Scientists Warn about Dangers of Vaccination Immunisation
www.medicinekillingmillions.com/.../doctors-scientists-warn-dangers-of-vaccination-im...  
Quotes from Doctors & Scientists who warn against Dangers of Vaccination & Immunization.
Vaccine Hesitancy Cascade

**Initial conditions – LEVEL I**
I read that vaccines cause autism

**External factors – LEVEL II**
Culture of anti-science

**Internal factors – LEVEL III**
Anecdotal thinking
Vaccine Hesitancy Cascade

Initial conditions
I read that vaccines cause autism

External factors
Culture of anti-science

Internal factors
Anecdotal thinking
LEVEL–II: External Factors

Culture of anti-science

Kyettrak Glacier, Cho Oyu Region, Himalayan mountains
Vaccine Hesitancy Cascade

**Initial conditions**
I read that vaccines cause autism

**External factors**
Science isn’t always right

**Internal factors**
Anecdotal thinking
Vaccine Hesitancy Cascade

**Initial conditions**
I read that vaccines cause autism

**External factors**
Science isn’t always right

**Internal factors**
Anecdotal thinking
LEVEL–III: Internal Factors

Anecdotal thinking

<table>
<thead>
<tr>
<th>Exposure</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>
Vaccine Hesitancy Cascade

Initial conditions
- I read that vaccines cause autism

External factors
- Science isn’t always right

Internal factors
- One case is enough to convince me
Vaccine Hesitancy Cascade

Initial conditions

External factors

Internal factors
Vaccine Hesitancy Cascade

Initial conditions
Vaccine successes

External factors
Medical training paradigm

Internal factors
Distorted risk perception
LEVEL–I: Initial Conditions

Vaccine successes

- **Haemophilus influenzae type b**
- **Mumps**
- **Hepatitis**
- **Varicella**

Groseclose. MMWR 2003;50:1 (U.S. data)
Vaccine Hesitancy Cascade

**Initial conditions**
I’ve never seen a case

**External factors**
Medical training paradigm

**Internal factors**
Distorted risk perception
Vaccine Hesitancy Cascade

Initial conditions
I've never seen a case

External factors
Medical training paradigm

Internal factors
Distorted risk perception
LEVEL–II: External Factors

Medical training paradigm

Marcus Welby

Kumbaya Medicine
LEVEL–II: External Factors

Medical training paradigm

VACCINE EFFICACY CONSTRUCT (OVERALL)

VACCINE SAFETY CONSTRUCT (OVERALL)

Health Professional Graduation Year

Mergler. Vaccines 2013;1:154 (N=551)
Vaccine Hesitancy Cascade

**Initial conditions**
- LEVEL-I
  - I’ve never seen a case

**External factors**
- LEVEL-II
  - I need to partner with the parent

**Internal factors**
- LEVEL-III
  - Distorted risk perception
Vaccine Hesitancy Cascade

**Initial conditions**  
LEVEL-I  
I’ve never seen a case

**External factors**  
LEVEL-II  
I need to partner with the parent

**Internal factors**  
LEVEL-III  
Distorted risk perception
### LEVEL–III: Internal Factors

**Distorted risk perception**

<table>
<thead>
<tr>
<th>What we’re afraid of</th>
<th>What the real risk is</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shark attacks (28)</td>
<td>Dog bites (4.5 million)</td>
</tr>
<tr>
<td>Murder (14,180)</td>
<td>Suicide (33,289)</td>
</tr>
<tr>
<td>Death by peanut allergy (50)</td>
<td>Death by poisoning (27,531)</td>
</tr>
<tr>
<td>Death by plane crash (321)</td>
<td>Death by car crash (34,017)</td>
</tr>
</tbody>
</table>

LEVEL–III: Internal Factors

Distorted risk perception

<table>
<thead>
<tr>
<th>What we’re afraid of</th>
<th>What the real risk is</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shark attacks (28)</td>
<td>Dog bites (4.5 million)</td>
</tr>
<tr>
<td>Murder (14,180)</td>
<td>Suicide (33,289)</td>
</tr>
<tr>
<td>Death by peanut allergy (50)</td>
<td>Death by poisoning (27,531)</td>
</tr>
<tr>
<td>Death by plane crash (321)</td>
<td>Death by car crash (34,017)</td>
</tr>
</tbody>
</table>

Deaths from…

- the 9/11 attacks: 2,976
- automobile accidents attributable to the 9/11 effect: 350-1,200

Vaccine Hesitancy Cascade

Initial conditions
I’ve never seen a case

External factors
I need to partner with the parent

Internal factors
The vaccine is riskier than the disease
Vaccine Hesitancy Cascade

- Initial conditions (LEVEL-I)
- External factors (LEVEL-II)
- Internal factors (LEVEL-III)
Vaccine Hesitancy Cascade

**Initial conditions**  
LEVEL–I  
Vaccine side effects

**External factors**  
LEVEL–II  
Poor science and math education

**Internal factors**  
LEVEL–III  
Heuristics
LEVEL–I: Initial Conditions

Vaccine side effects

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Event</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any</td>
<td>Anaphylaxis</td>
<td>1 in 1,000,000</td>
</tr>
<tr>
<td>MMR</td>
<td>ITP</td>
<td>1 in 40,000</td>
</tr>
<tr>
<td>RRV-TV</td>
<td>Intussusception</td>
<td>1 in 11,000</td>
</tr>
<tr>
<td>MMRV</td>
<td>Febrile seizures</td>
<td>1 in 2,300</td>
</tr>
<tr>
<td>RV1 and RV5</td>
<td>Intussusception</td>
<td>1 in 20,000–100,000</td>
</tr>
</tbody>
</table>

Vaccine Hesitancy Cascade

**Initial conditions**

- LEVEL I
  - Vaccines can have serious side effects

**External factors**

- LEVEL II
  - Poor science and math education

**Internal factors**

- LEVEL III
  - Heuristics
Vaccine Hesitancy Cascade

Initial conditions
Vaccines can have serious side effects

External factors
Poor science and math education

Internal factors
Heuristics
LEVEL–II: External Factors

Poor science education

Program for International Student Assessment Science Literacy Scale, 15-year-olds (2015)
LEVEL–II: External Factors

Poor math education

Program for International Student Assessment Mathematics Literacy Scale, 15-year-olds (2015)
LEVEL–II: External Factors

Failure to understand science

Failure to reject $H_0$ vs. Reject $H_0$
Vaccine Hesitancy Cascade

**Initial conditions**
- LEVEL I
  - Vaccines can have serious side effects

**External factors**
- LEVEL II
  - They can’t prove the vaccines are safe

**Internal factors**
- LEVEL III
  - Heuristics
Vaccine Hesitancy Cascade

Initial conditions
Vaccines can have serious side effects

External factors
They can’t prove the vaccines are safe

Internal factors
Heuristics
## LEVEL–III: Internal Factors

### Heuristics

<table>
<thead>
<tr>
<th>Availability</th>
<th>The perceived probability of an event correlates with how easily similar events are remembered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do no harm</td>
<td>A bad outcome seems more tolerable if it occurs because of inaction rather than action</td>
</tr>
<tr>
<td>Ambiguity</td>
<td>A known risk is more acceptable than an unknown risk</td>
</tr>
<tr>
<td>Compression</td>
<td>Rare risks are overestimated and common risks are underestimated</td>
</tr>
</tbody>
</table>

Vaccine Hesitancy Cascade

**Initial conditions**
- LEVEL-I
  - Vaccines can have serious side effects

**External factors**
- LEVEL-II
  - They can’t prove the vaccines are safe

**Internal factors**
- LEVEL-III
  - This kid down the street got sick after getting a vaccine, so it must be common
Other Things About Being Human

Folk numeracy

Shermer. Sci Amer 2008;Sep;40
Middle World
Folk Numeracy

10,000,000 pregnant women get a shot

6 weeks later

16,684 have a spontaneous abortion

Shermer. Sci Amer 2008;Sep;40; Black. Lancet 2009;374:2115
Folk Numeracy

10,000,000 pregnant women get a shot

6 weeks later

16,684 have a spontaneous abortion

If the shot is a placebo!

Shermer. Sci Amer 2008;Sep;40; Black. Lancet 2009;374:2115
Sample Size Needed to Detect Adverse Event

<table>
<thead>
<tr>
<th>Background rate in general population</th>
<th>Rate in vaccinated population</th>
<th>2-fold higher</th>
<th>10-fold higher</th>
<th>100-fold higher</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 in 10,000</td>
<td></td>
<td>141,000</td>
<td>5,500</td>
<td>500</td>
</tr>
<tr>
<td>1 in 100,000</td>
<td></td>
<td><strong>1,238,000</strong></td>
<td><strong>53,500</strong></td>
<td><strong>2,500</strong></td>
</tr>
<tr>
<td>1 in 1,000,000</td>
<td></td>
<td>12,951,500</td>
<td>532,500</td>
<td>23,500</td>
</tr>
</tbody>
</table>

Assumes 5% risk of Type I error and power of 90%
Other Things About Being Human

Folk numeracy

Patternicity

Shermer. Sci Amer 2008;Sep;40
Patternicity

Grilled cheese sandwich sold on eBay in 2004 for $28,000
THE POPE TOASTER

2015 COMMEMORATIVE

Toast the Pope!

Celebrate Pope Francis's first visit to America with The Pope Toaster—the best thing since sliced bread! The Pope Toaster brands the pope's picture and other images onto your toast.

The 2015 commemorative, one-of-a-kind, 2-slice toaster comes with two impression inserts: the pope's picture and the words "Spread the Love." Just pop in some bread and enjoy your pope on toast.

Spread the Love

Only $48.95
BUY NOW!

Included:
White toaster with two pope inserts and two Spread the Love inserts

Spread the Love inserts

Additional impression inserts available for all occasions.

Inserts are removable and interchangeable. For wholesale orders, email us at info@frostydesign.com.
Other Things About Being Human

Folk numeracy
Patternicity
Confirmation bias

Shermer. Sci Amer 2008;Sep;40
Confirmation Bias

2500 scientists say we've caused global warming

I'd like a second opinion
Vaccines are prepared at Area 51 by reverse-engineered alien technology on orders from the Trilateral Commission, then delivered in black helicopters under the U.N.’s ‘Agenda 21’ mandates...

...but that’s just my personal belief.
Vaccination Against Fear and Misinformation

- Anecdotal thinking → Scientific thinking
- Heuristic thinking → Deductive reasoning
- Folk numeracy → Statistical numeracy
- Patternicity → Hypothesis testing
- Perception of risk → Risk:benefit analysis
- The tragedy of the commons → The common good
The Tragedy of the Commons

Rational self-interest leads to herd expansion
Negative shared consequences are predictable

Hardin. Science 1968;162:1243
https://ideas4sustainability.wordpress.com
Strategies: Begin Discussion Early

Tdap and IIIV for pregnant women
Prenatal meetings
HepB in the nursery
Strategies: Have a Plan

Outline scheduled vaccines for each visit
Give VIS
Explain importance of each vaccine
Screen for contraindications
Anticipate common side effects
Strategies: Take a Strong Position

Presumptive

“We’ve got some shots due today.”

Participatory

“What do you want to do about shots today?”
Strategies: Take a Strong Position

Presumptive

“We’ve got some shots due today.”

Participatory

“What do you want to do about shots today?”

Be persistent—

“These shots are really important.”

“If he were my kid, I’d definitely do it.”
Strategies: Take a Strong Position

“My child does not need a vaccine against a sexually transmitted disease.” —This vaccine will protect your child from cancer.

Modified from Immunization Action Coalition. Needle Tips; Nov 2013
Strategies: Take a Strong Position

“My child does not need a vaccine against a sexually transmitted disease.”
—This vaccine will protect your child from cancer.

“My child is too young to be getting this vaccine.”
—The vaccine works best at younger ages, and I want your child protected long before there is any exposure.

Modified from Immunization Action Coalition. Needle Tips; Nov 2013
Strategies: Take a Strong Position

“My child does not need a vaccine against a sexually transmitted disease.”
—This vaccine will protect your child from cancer.

“My child is too young to be getting this vaccine.”
—The vaccine works best at younger ages, and I want your child protected long before there is any exposure.

“Being vaccinated will open the door to sexual activity.”
—That’s like saying, “Good thing I’ve had the typhoid vaccine. Now I can drink the sewer water in Mumbai!”

Modified from Immunization Action Coalition. Needle Tips; Nov 2013
Strategies: Use a Team Approach

“Good news—protection from measles today!”

“Can I answer any questions?”
Strategies: Be Consistent
Strategies: Organize Visits Efficiently

- Preparatory phone call
- Screening questionnaire
- Printed brochures
- Take-home materials
- Off-peak scheduling
- Maximize face-to-face time
Strategies: Layer Information Appropriately
Strategies: Emphasize Disease Risks

Horne. Proc Natl Acad Sci 2015;112:10321
Strategies: Normalize Vaccination

SOCIAL NORMS
Vaccine Hesitancy

Pervasive
Threat to public health
Complex phenomenon with deep roots
Imperative to implement strategies to increase vaccine confidence
Vaccine Confidence
The good thing about science is that it’s true, whether or not you believe in it.

—Neil deGrasse Tyson