Post-partum influenza vaccination (cocooning) strategy to protect young infants

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Cocoon: definition

(verb) **to wrap or envelop tightly for protection**

to protect someone or something from an unpleasant situation

edicine and Public Health

cocooning = vaccination strategy implemented against vaccine-preventable diseases

- **that affect infants disproportionately**
- **high morbidity and mortality**
- **are caused by pathogens that are transmitted and spread easily within families**

of the cocooning strategy

➞ **indirectly protect neonates and young infants from infections by vaccinating their household contacts**

- **mother, father**
- **siblings**
- **grandparents**
- **nanny**

herd immunity = family immunity

al influenza

significant morbidity and mortality

elderly

persons with underlying conditions

infants < 6 months old

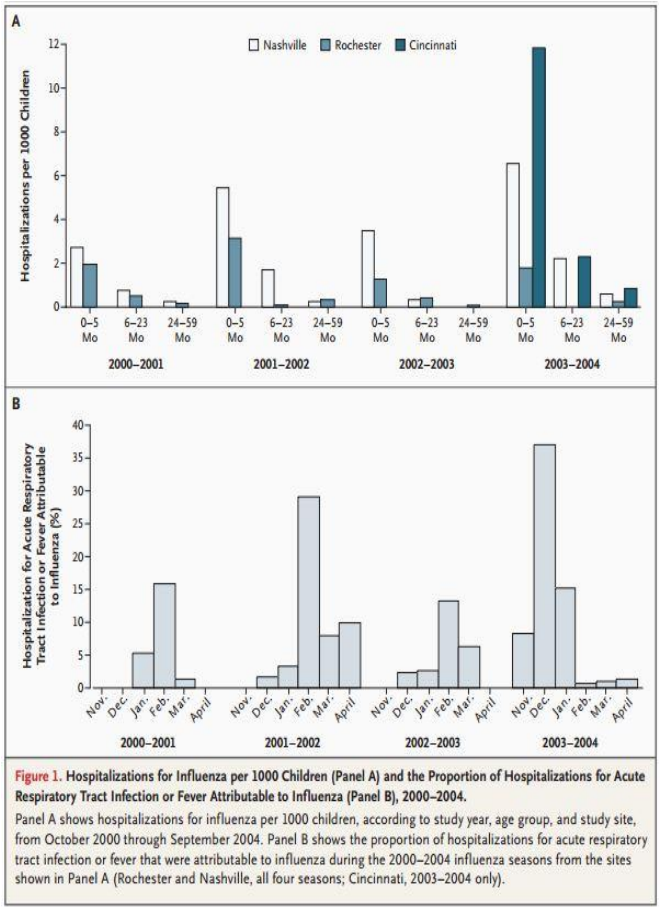


Figure 1. **Hospitalizations for Influenza per 1000 Children (Panel A) and the Proportion of Hospitalizations for Acute Respiratory Tract Infection or Fever Attributable to Influenza (Panel B), 2000–2004.**
Panel A shows hospitalizations for influenza per 1000 children, according to study year, age group, and study site, from October 2000 through September 2004. Panel B shows the proportion of hospitalizations for acute respiratory tract infection or fever that were attributable to influenza during the 2000–2004 influenza seasons from the sites shown in Panel A (Rochester and Nashville, all four seasons; Cincinnati, 2003–2004 only).

1. Neuzil et al. The effect of influenza on hospitalizations, outpatient visits and courses of antibiotics in children. *The New England Journal of Medicine* 2000;185:147-152

2. Dawood et al. Influenza - associated pneumonia in children hospitalized with laboratory - confirmed influenza, 2003 - 2008. *Pediatric Infectious Disease Journal* 2010;29:585-590

OF INFLUENZA ON HOSPITALIZATIONS, OUTPATIENT VISITS, AND COURSES OF ANTIBIOTICS IN CHILDREN

MALETIC NEUZIL, M.D., M.P.H., BEVERLY G. MELLEN, PH.D., PETER F. WRIGHT, M.D., EDWARD F. MITCHEL, JR., M.S., AND MARIE R. GRIFFIN, M.D., M.P.H.

N Engl J Med. 2000 Jan 27; 342(4):225-31.

10 outpatient visits

5 antibiotic prescriptions

1 admission in hospital

per 100 healthy infants <6 months because of influenza-like illness

TABLE 1. RATES OF HOSPITALIZATION FOR ACUTE CARDIOPULMONARY CONDITIONS ATTRIBUTABLE TO INFLUENZA.

AGE	NO. OF PERSON-YEARS	NO. OF HOSPITALIZATIONS FOR ACUTE CARDIOPULMONARY CONDITIONS PER 10,000 PERSON-YEARS				NO. OF INFLUENZA-ATTRIBUTABLE HOSPITALIZATIONS PER 10,000 PERSON-YEARS*		AVERAGE EXCESS NO. OF HOSPITALIZATIONS PER 10,000 CHILDREN PER YEAR (95% CI)†
		INFLUENZA SEASON	PERI-INFLUENZA SEASON	SUMMER	TOTAL	CRUDE	STANDARDIZED‡	
<6 mo	117,205	1964	1497	608	1146	467	449	103.8 (89.0–118.6)
6 to <12 mo	82,997	1117	854	403	675	263	233	49.6 (35.3–63.8)
1 to <3 yr	324,900	464	387	233	325	77	79	18.6 (14.2–23.0)
3 to <5 yr	302,344	232	193	138	173	39	43	8.6 (4.9–12.3)
5 to <15 yr	1,207,697	120	105	86	98	15	22	4.1 (2.8–5.5)

*Values are differences in rates between the influenza season and the peri-influenza season (the base-line values).

†Values are weighted averages of annual excess hospitalizations for a population of 10,000 persons within the specified age group. The excess hospitalizations were calculated for each stratum by multiplying the stratum-specific difference in hospitalization rate by the proportion of the study year covered by the influenza season. CI denotes confidence interval.

‡The weighted average differences in rate between the influenza season and the peri-influenza season were calculated with stratum-specific person-years in all seasons as weights; strata were defined by age group, study year, race, and residence.

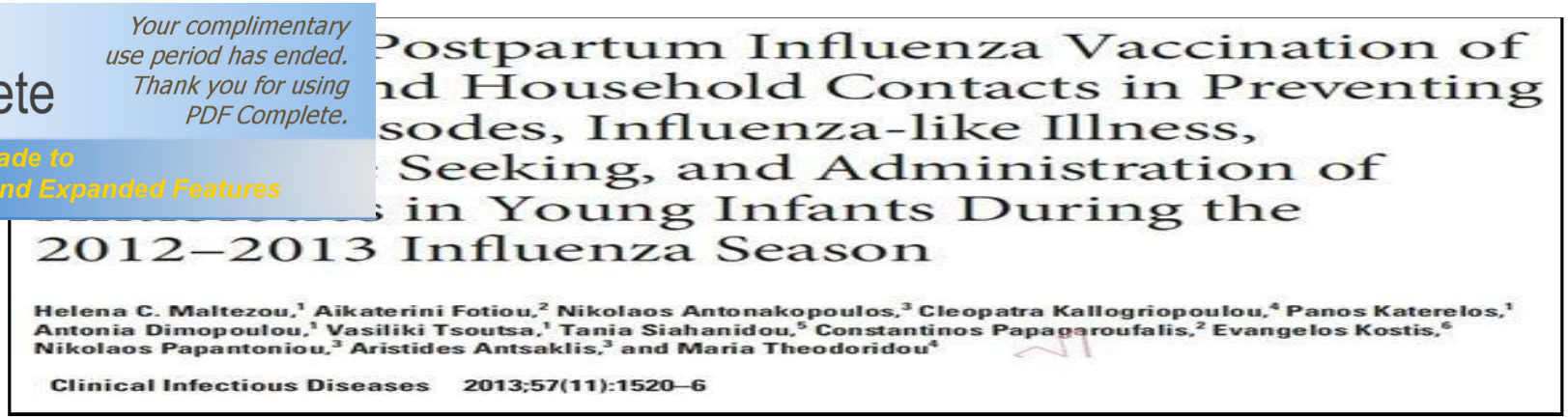
opportunities for preventing among infants < 6 months

- ☒ vaccination
- ☒ antiviral prophylaxis
- ☑ vaccination during pregnancy
- ☑ cocooning strategy

Rationale for the cocooning strategy

- young infants contract influenza almost exclusively from their household members

- indirect protection of infants < 6 months old through vaccination of their close contacts



Postpartum Influenza Vaccination of
nd Household Contacts in Preventing
sodes, Influenza-like Illness,
Seeking, and Administration of
in Young Infants During the
2012–2013 Influenza Season

Helena C. Maltezou,[1] Aikaterini Fotiou,[2] Nikolaos Antonakopoulos,[3] Cleopatra Kallogriopoulou,[4] Panos Katerelos,[1] Antonia Dimopoulou,[1] Vasiliki Tsoutsa,[1] Tania Siahanidou,[5] Constantinos Papagaroufalis,[2] Evangelos Kostis,[6] Nikolaos Papantoniou,[3] Aristides Antsaklis,[3] and Maria Theodoridou[4]

Clinical Infectious Diseases 2013;57(11):1520–6

Aim of the study

to estimate the effectiveness of the postpartum influenza vaccination (cocooning) strategy in young infants

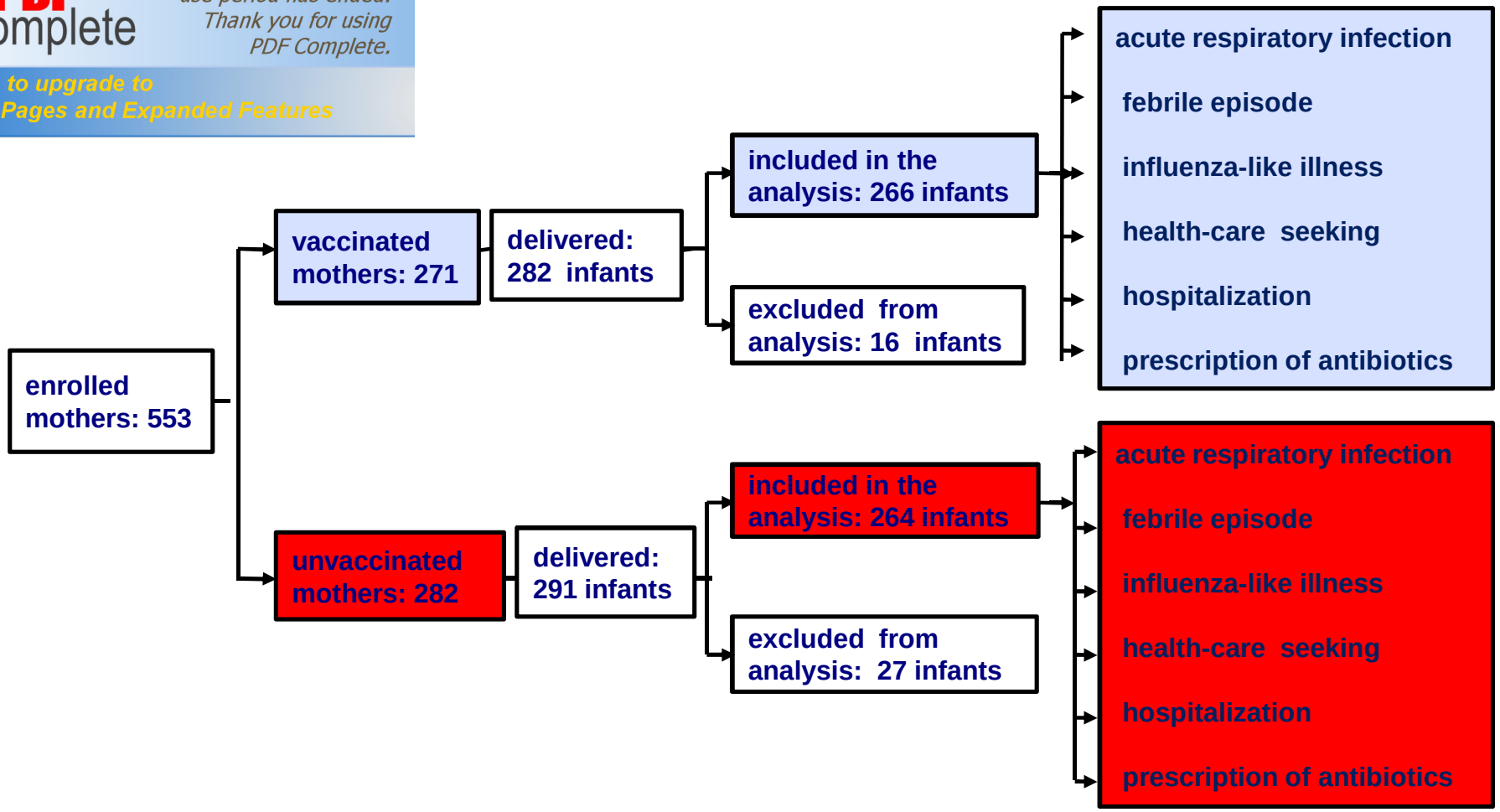
Methods

- prospective study
- Alexandra Maternity Hospital; Elena Venizelou Maternity Hospital; NICU, Aghia Sophia Childrenôs Hospital, Athens, Greece
- 2012ï2013 influenza season
- influenza vaccination of mothers and other household contacts of neonates delivered or hospitalized from 1 Oct 2012 to 5 Jan 2013
- data collection through personal interviews & chart review

Follow ï up of infants

(by telephone every 2 weeks during the influenza season)

- **fever and / or respiratory symptoms**
- **healthcare seeking**
- **hospitalization**
- **acute otitis media, bronchiolitis and / or pneumonia**
- **prescription of antibiotics**
- **breastfeeding, passive smoking, pneumococcal immunization**



Structure of the early post-partum maternal influenza vaccination (cocooning) strategy

Results

553 mothers (families) - 1844 household members

vaccination rate: 45,6% (841/1844)

complete cocooning in 183 (33,1%) families

nd residencies by maternal influenza

Characteristic	Vaccinated mothers n=271 (%)	Unvaccinated mothers n=282 (%)
Mean age, years (range) (n=548)	30.5 (15-46)	30.9 (15-45)
Roma population (n=553)	13 (4.8)	10 (3.5)
Immigrants (n=553)	64 (23.6)	62 (21.9)
Area of residence (n=547)		
urban	237 (87.4)	242 (85.8)
rural	31 (11.4)	37 (13.1)
Other cohabitants[a] (n=553)	269 (99.3)	268 (95.0)
Mean no. of cohabitants[a] (n=553)	2.5 (0-9)	2.2 (0-9)
Children <18 years in the house[b] (n=553)	124 (45.7)	136 (48.2)
Mean no. of children <18 years[b] (range) (n=553)	0.6 (0-4)	0.7 (0-5)
Mean no. of residential rooms (range) (n=537)	3.1 (1-5)	3.1 (1-7)
Mean no. of cohabitants/rooms ratio (range) (n=537)		
	1.6 (0.5-9)	1.5 (0.5-7)
Mean no. of parities (range)[c] (n=547)	0.6 (0-5)	0.6 (0-5)
Mean gestational age, weeks (range) (n=534)	37 (23-43)	37.7 (25-41)
Caesarian section (n=553)	157 (57.9)	162 (57.4)
Mean neonatal birth weight, g (range) (n=548)	2925 (670-4630)	3073 (600-4910)

[a] Excluding the mother and the neonate

[b] Excluding the neonate

[c] Excluding the current pregnancy

n: number of participants who whom an answer was available; no: number

Increased likelihood* for influenza vaccination uptake by mothers:

- **larger households**
- **lower gestational age**
- **younger infants at the onset of the influenza season**

*** Multiple logistic regression analysis results with a p-value <0.05**

ne 530 infants during the 2012 ï 2013 influenza season

- acute respiratory infection episodes: 227
- febrile episodes: 91
- episodes of influenza - like illness: 81
- episodes of healthcare seeking: 201
- hospitalizations: 59
- episodes of antibiotics prescription: 74

...idity in Infants by Maternal Influenza Vaccination Status

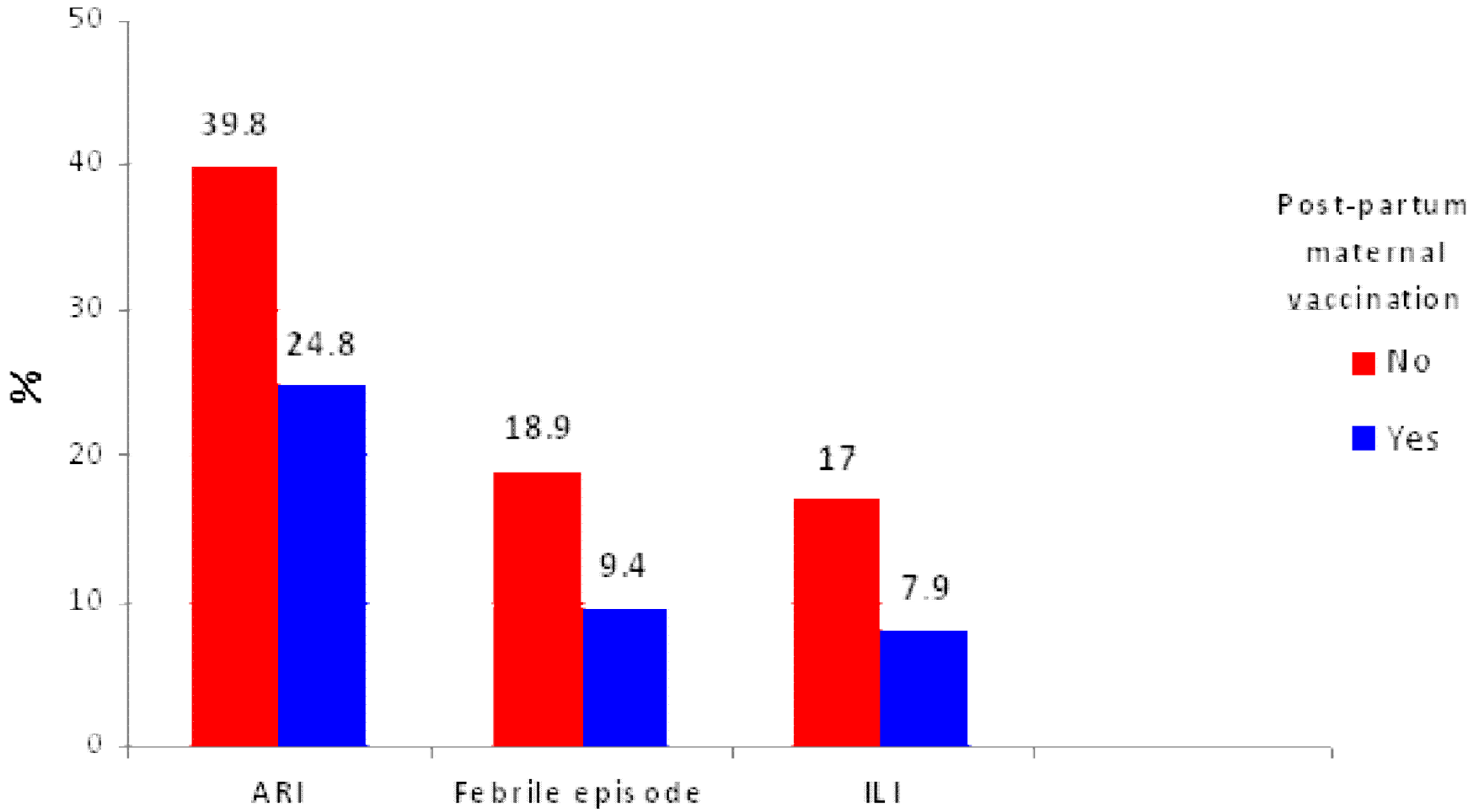
	Unvaccinated Mothers (n = 264)		Vaccinated Mothers (n = 266)		
Type of Illness	No. (%)	95% CI	No. (%)	95% CI	*P* Value
ARI	105 (39.8)	33.8–45.7	66 (24.8)	19.6–30.0	<.001
Febrile episode	50 (18.9)	14.2–32.7	25 (9.4)	5.9–12.9	.002
ILI	45 (17.0)	12.5–21.6	21 (7.9)	4.6–11.2	.001
Acute otitis media[a]	9 (3.4)	1.2–5.6	4 (1.5)	.0–3.0	.156
Bronchiolitis[a]	40 (15.2)	10.8–19.5	26 (9.8)	6.2–13.4	.061
Pneumonia[a]	2 (0.8)	.3–1.8	2 (0.8)	.0–1.8	.994
Healthcare seeking	99 (37.5)	31.6–43.4	58 (21.8)	16.8–26.8	<.001
Admission to hospital	26 (9.8)	6.2–13.5	23 (8.6)	5.2–12.0	.633
Administration of antibiotics	40 (15.2)	10.8–19.5	22 (8.3)	4.9–11.6	.014

Abbreviations: ARI, acute respiratory illness; CI, confidence interval; ILI, influenza-like illness.

[a] Diagnosed by a pediatrician.

*** The study power based on the Pearson x^2 test was 93%.**

ence rates of reported morbidity in infants by maternal nation status



ARI: acute respiratory illness; ILI: influenza-like illness

# of episodes of morbidity, healthcare seeking per infant by maternal vaccination status

	post-partum vaccination	
	no	yes
acute respiratory infection	0.5	0.3
febrile episode	0.3	0.1
influenza-like illness	0.2	0.1
healthcare seeking	0.5	0.3
prescription of antibiotics	0.2	0.1

*p-value < 0.001 for all comparisons

uenza vaccine effectiveness during the 2012 - 2013 influenza season in infants

against

- **acute respiratory infection: 37.7%**
- **febrile episode: 50.3%**
- **influenza-like illness: 53.5%**
- **healthcare seeking: 41.8%**
- **prescription of antibiotics: 45.4%**

for factors associated with reported morbidity and utilization of health-care services in infants during the 2012-2013 influenza season

End-point	Statistically significantly associated factors	Odds	95% CI	p-value
Febrile episode	**no post-partum maternal vaccination against influenza**	2.358	1.324-4.201	0.004
	large number of household contacts	1.301	1.087-1.556	0.004
ARI	increased number of parities	1.501	1.164-1.936	0.002
	no post-partum maternal vaccination against influenza	1.791	1.185-2.708	0.006
	no pneumococcal vaccination of infant	1.695	1.042-2.757	0.033
ILI	**no post-partum maternal vaccination against influenza**	2.718	1.460-5.061	0.002
	large number of household contacts	1.354	1.124-1.630	0.001
Health-care seeking	increased number of parities	1.484	1.154-1.909	0.002
	no post-partum maternal vaccination against influenza	3.122	1.479-6.590	0.003
	no breastfeeding or breastfeeding of short duration	1.103	1.018-1.194	0.016
Hospitalization	large number of household contacts	1.357	1.107-1.664	0.003
	Unvaccinated infants against pneumococcus	3.122	1.479-6.590	0.003
	older infant age at the onset of the influenza season	1.284	1.022-1.614	0.032
Administration of antibiotics	younger maternal age	1.110	1.053-1.169	<0.001
	Increased number of parities	1.997	1.418-2.811	<0.001
	no post-partum maternal vaccination against influenza	2.115	1.097-4.079	0.025
	older infant age at the onset of influenza season	1.340	1.073-1.673	0.010

ARI: acute respiratory illness; ILI: influenza-like illness; CI: confidence interval

...tion of the influenza cocooning strategy in NICUs and maternity clinics

Advantages

- ease approach of parents
- development of immunity around the neonates as early as 2 weeks old

Challenges

- vaccination of visitors (cost, legal issues)
- vaccination of siblings - outpatient office
- involvement of healthcare professionals not familiar with vaccines (obstetricians, midwifes) ï need to educate them
- flexible vaccine ï delivery systems

Conclusions

Maternal vaccination against influenza early post-partum reduces morbidity, healthcare seeking, and consumption of antibiotics in young infants during the influenza season.

Vaccination of fathers and other household contacts had no statistically significant impact on morbidity of their infants.

Our findings strongly support the recommendations for vaccinating the mothers against influenza early post-partum.

Thank you for your attention !