

# Immunization Initiation among Infants in the Oregon Health Plan

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# Background

- Even though childhood immunization rates in the U.S. are at record highs, immunization disparities still remain—about one million children in the U.S. are insufficiently immunized, which puts them at risk for vaccine-preventable diseases.

# The Oregon Health Plan (OHP)

- A waived Medicaid program
  - Covers prevention services including immunizations
  - Note: no children were directly cut from OHP due to budget shortages
- In 2000 (study year), 25% of Oregon's children were covered by OHP
- OHP plays a valuable role in the immunization status of children at-risk

# Immunization Initiation: Why Is It Important?

- Oregon infants who did not have their initial immunization by three months of age were 4 to 5 times less likely to be up-to-date by 2 years of age
  - Hepatitis B shot was excluded when determining immunization initiation

# Study Objectives

1. To describe immunization-initiation patterns in a cohort of infants covered by the Oregon Health Plan
2. To identify demographic and health care system factors associated with immunization status among mothers and their infants at three months of age  
(Only administrative data was used in this study.)

# Methods

- Population: infants born 2000-2001 in OHP and their mothers
- Babies matched with Oregon ALERT registry
- Correlations between the outcome variable (initiation or non-initiation of immunization) and the independent variables were assessed
- Factors significantly associated with the outcome were entered into a logistic regression model to adjust for confounding and to determine odds ratios

# Results

- 84% of the 39,708 infants received their first immunization by three months of age
- However, 1-in-6 infants had not initiated immunization

Characteristic at time of birth ( <i>n</i> )	Infant Immunization Initiated by 3 Months of Age?		<i>p</i> *
	No (%)	Yes (%)	
<b>Birth Year</b>			.000**
2000 (21,011)	3,660 (17.4%)	17,351 (82.6%)	
2001 (18,697)	2,816 (15.1%)	15,881 (84.9%)	
<b>Total (39,708)</b>	<b>6,476 (16.3%)</b>	<b>33,232 (83.7%)</b>	
<b>Sex of Infant</b>			.341
Female (19,211)	3,098 (16.1%)	16,113 (83.9%)	
Male (20,497)	3,378 (16.5%)	17,119 (83.5%)	

Characteristic at time of birth ( <i>n</i> )	Infant Immunization Initiated by 3 Months of Age?		<i>p</i> *
	No (%)	Yes (%)	
<b>Infant Race/ethnicity</b>			.000**
Asian (909)	132 (14.5%)	777 (85.5%)	
Black (1,556)	305 (19.6%)	1,251 (80.4%)	
Hispanic (11,704)	1,666 (14.2%)	10,038 (85.8%)	
Native American (646)	122 (18.9%)	524 (81.1%)	
White (24,131)	4,085 (16.9%)	20,046 (83.1%)	
Other (376)	82 (21.8%)	294 (78.2%)	
Unknown (351)	78 (22.2%)	273 (77.8%)	

Characteristic at time of birth ( <i>n</i> )	Infant Immunization Initiated by 3 Months of Age?		<i>p</i> *
	No (%)	Yes (%)	
<b>Place of birth</b>			.730
Urban (21,819)	3,545 (16.2%)	18,274 (83.8%)	
Suburban (6,032)	1,004 (16.6%)	5,028 (83.4)	
Rural (11,815)	1,916 (16.2%)	9,899 (83.8%)	

Characteristic at time of birth ( <i>n</i> )	Infant Immunization Initiated by 3 Months of Age?		<i>p</i> *
	No (%)	Yes (%)	
<b>OHP program</b>			.000**
TANF (11,286)	2,249 (19.9%)	9,037 (80.1%)	
Foster/SubAdoptive Care (721)	162 (22.5%)	559 (77.5%)	
PLM/CHIP/OHP (27,319)	3,964 (14.5%)	23,355 (85.5%)	
Blind/Disabled (270)	70 (25.9%)	200 (74.1%)	

Characteristic at time of birth ( <i>n</i> )	Infant Immunization Initiated by 3 Months of Age?		<i>p</i> *
	No (%)	Yes (%)	
<b>Date OHP coverage began by infant age</b>			.000**
Coverage began DOB (32,047)	4,519 (14.1%)	27,528 (86.9%)	
Coverage began 1 week-1 month (874)	129 (14.4%)	745 (86.6%)	
Coverage began 1-2 months (780)	174 (22.4%)	606 (78.6%)	
Coverage began after 2 months (6,007)	1,772 (29.5%)	4,235 (71.5%)	

Characteristic at time of birth ( <i>n</i> )	Infant Immunization Initiated by 3 Months of Age?		<i>p</i> *
	No (%)	Yes (%)	
<b>Mother's OHP status on birth of infant</b>			.000**
Mom in OHP on infant DOB (34,743)	5,416 (15.6%)	29,327 (84.4%)	
Mom not in OHP on infant DOB (4,965)	1,060 (21.3%)	3,905 (78.7%)	

Characteristic at time of birth ( <i>n</i> )	Infant Immunization Initiated by 3 Months of Age?		<i>p</i> *
	No (%)	Yes (%)	
<b>Mother's Age at time of birth of infant</b>			.005**
11-17 years old (1,507)	220 (14.6%)	1,287 (85.4%)	
18-20 years old (7,509)	1,104 (14.7%)	6,405 (85.3%)	
21-25 years old (12,222)	1,881 (15.4%)	10,341 (84.6%)	
26-35 years old (10,325)	1,605 (15.5%)	8,720 (84.5%)	
36 years and older (2,154)	388 (18.0%)	1,766 (82.0%)	

Characteristic at time of birth ( <i>n</i> )	Infant Immunization Initiated by 3 Months of Age?		<i>p</i> *
	No (%)	Yes (%)	
<b>Mother's Language</b>			.000**
English (25,621)	4,086 (15.9%)	21,535 (84.1%)	
Spanish (7,120)	904 (12.7%)	6,216 (87.3%)	
Russian (475)	135 (28.4%)	340 (71.6%)	
Vietnamese (130)	8 (6.2%)	122 (93.8%)	
Other/Unknown (1,424)	294 (20.6%)	1,130 (79.4%)	

Characteristic at time of birth ( <i>n</i> )	Infant Immunization Initiated by 3 Months of Age?		<i>p</i> *
	No (%)	Yes (%)	
<b>Mother's number of OHP births in 2000-2001</b>			.000**
1 (31,790)	4,876 (15.3%)	26,914 (84.7%)	
2 (2,876)	532 (18.5%)	2,344 (81.5%)	
3 (96)	17 (17.7%)	79 (82.3%)	
4 (8)	2 (25%)	6 (75%)	

# Predictors of Immunization Initiation

**1. Age of infant when OHP coverage began**

(OR = 2.1; 95% CI = 1.7, 2.5)

**2. Mother covered by OHP**

(OR = 1.5; 95% CI = 1.4, 1.6)

**3. OHP eligibility category**

(OR = 1.2; 95% CI = 1.1, 1.3)

**4. Race/ethnicity of infant**

(OR = .94; 95% CI = .92, .96)

**5. Mothers' number of births**

(OR = .83; 95% CI = .74, .95)

# Recommendations

The gap between immunization rates in the Medicaid population and the general population can be reduced by assuring the mother's coverage during pregnancy and the infant's coverage beginning at birth.

# Conclusions

- Not only do infants benefit from early Medicaid coverage, but infants will benefit if their mothers have Medicaid insurance as well
- Elimination of the cost barrier alone does not guarantee timely immunization initiation.
- There is much more to learn about what accounts for immunization disparities—even within the first three months of life.

# Actions Taken: Sharing the Study

## Poster Sessions

1. National Immunization Conference,  
Washington, D.C., March 2005
2. Western Maternal and Child Health  
Epidemiology Conference,  
Portland Oregon, May 2005
3. Oregon Public Health Association Annual  
Meeting and Conference,  
Corvallis Oregon, October 2005

# Actions Taken: Sharing the Study

## Publications

- *American Journal of Public Health*  
May 2006
- *DHS Staff News*
  - June 2006

# Actions Taken

- **Medical Card Messages** - quarterly, a message that reminds pregnant women to notify their case worker when their baby is born
- **Newborn Notification Forms** - regular reminders sent to all Oregon hospitals to use the form

# Actions Taken

## Handout developed for OHP Regional Meetings:

### 1. Outreach workers

- Facilitate eligible pregnant women to obtain OHP coverage

### 2. Case workers

- Reminder to add newborns to mothers case, as soon as possible, after delivery

### 3. Exceptional Needs Care Coordinators

- Attention needed for children blind or disabled, in foster or sub-adoptive care, Native American, African American, or mother's main language is Russian

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- Oregon Immunization Program for advice and the grant to fund the research
- Oregon ALERT Registry for providing advice and registry data

# Immunization Initiation Among Infants in the Oregon Health Plan

Jessica W. Henderson, PhD, Susan A. Arbor, MSW, MPA, Steven L. Broich, PhD, Judy Mohr Peterson, PhD, and Jean E. Hutchinson, PhD

Infants who start receiving immunizations on time are more likely to be up to date at age 2 years. Among 39708 infants aged 3 months covered by the Oregon Health Plan (expanded Medicaid), those who did not have health care coverage within the first month of life were less likely to start receiving immunizations on time. Also at risk were infants in foster care, in subadoptive care, who were blind or disabled, who were Native American or Black, or whose mothers were not covered by the Oregon Health Plan. (*Am J Public Health*. 2006;96:XXX-XXX. doi:10.2105/AJPH.2005.0687420)

A national objective of *Healthy People 2010: Understanding and Improving Health* is to increase vaccination levels to 90% of infants by their second birthday.<sup>1</sup> Studies have shown that infants who had not initiated the immunization series by 3 months of age were 4 to 10 times more likely to be inadequately immunized at 24 months.<sup>2,3</sup>

Oregon Health Plan is a comprehensive, expanded Medicaid system that covers immunization costs. We studied a large sample of infants in the Oregon Health Plan database. Our objectives were to describe immunization initiation patterns and to identify associated demographic and health care system factors.

## METHODS

The sample consisted of infants born in 2000 to 2001 who had records in both the Oregon Health Plan and the Alert Immunization Registry (100% of public clinics and 86% of private clinics are part of the independently validated registry). We used match-

ing procedures for names and birthdates to merge the 2 databases.

The outcome measure was defined as whether the infant had initiated immunization before 92 days of age. An infant was determined to have initiated immunization if she or he had received 1 of the following immunizations: diphtheria and tetanus toxoids and pertussis, *Haemophilus influenzae* type b, inactivated poliovirus, or pneumococcal conjugate.

Immunization histories from both databases were compared, and inconsistencies were corrected. Missing data among variables were low, ranging from 0% to 2%. No missing data patterns were identified. Cases with missing values were deleted from analysis.

Associations between the outcome variable (initiation or noninitiation of immunization) and the independent variables were assessed in bivariate analysis. Significant factors ( $P < .10$ ) were entered into a logistic regression model to adjust for confounding.

## RESULTS

We were able to match 81% of the infants in the Oregon Health Plan database with the Alert Immunization Registry for a cohort of 39708 infants. The infants who were not matched were excluded from the study.

Table 1 shows the percentage of infants with immunization initiation by characteristic. Overall, 83.7% of the infants had initiated immunization by age 3 months and 16.3% had not. The infants born in 2001 had a higher immunization initiation rate than did those born in 2000, indicating a positive trend (82.6% to 84.9%). There was no significant difference in immunization initiation by gender of the infant or by place of birth (urban, suburban, or rural).

Seven factors were associated with immunization initiation: race/ethnicity, eligibility category, date Oregon Health Plan coverage began, birth mother coverage, and mother's age, language, and number of births.

The 5 factors independently predictive of immunization initiation in a logistic regression model, summarized in Table 2, are: age of infant when Oregon Health Plan coverage began (odds ratio [OR]=2.1; 95% confidence

interval [CI]=1.7, 2.5); mother covered by Oregon Health Plan (OR=1.5; 95% CI=1.4, 1.6); eligibility category (OR=1.2; 95% CI=1.1, 1.3); race/ethnicity of infant (OR=0.94; 95% CI=0.92, 0.96); and mother's number of Oregon Health Plan births (OR=0.83; 95% CI=0.74, 0.95).

## DISCUSSION

The majority of infants (84%) in the Oregon Health Plan had received their first immunization by 3 months of age. However, 1 in 6 infants had not initiated immunization.

Results suggested that infants were more likely to have initiated immunization if they and their mothers were covered by the Oregon Health Plan within the first month of life. Infants were less likely to have initiated immunization if they were in blind or disabled or foster or subadoptive care eligibility categories. We are not aware of any published studies that have examined immunization initiation by eligibility category.

Race and ethnicity of the mother and infant have various immunization outcomes in published research.<sup>2,4-7</sup> In our study, immunization initiation varied by mother's language, with a range from 94% for Vietnamese-speaking mothers to 72% for Russian-speaking mothers. Our study showed that Hispanic and Asian infants had higher immunization initiation rates than did White infants, but Black infants had rates lower than did White infants; thus, simple White and non-White categorization misses the complexity of the race/ethnicity outcome.

A limitation of this study was that the sample was limited to 81% of the infants in the Oregon Health Plan who were matched with the Alert Immunization Registry. However, we have no reason to believe that the infants excluded from the analysis were significantly different from the study sample.

As a result of our study, several policy changes were made to enhance earlier access into the system and reduce disparities among Oregon Health Plan recipients:

- A message (3–4 times a year) on the Medical Care Identification Card that reminds pregnant women to enroll their newborns in the Oregon Health Plan

**TABLE 1—Characteristics of 39 708 Infants in the Oregon Health Plan and Initiation of Immunization by 3 Months of Age: 2000–2001**

Infant Characteristic at Time of Birth (n)	Infant Immunization Initiated by 3 Months of Age?		P <sup>a</sup>
	No (%)	Yes (%)	
Birth Year			.000*
2000 (21 011)	3660 (17.4)	17 351 (82.6)	
2001 (18 697)	2816 (15.1)	15 881 (84.9)	
Total (39 708)	6476 (16.3)	33 232 (83.7)	
Gender			.341
Female (19 211)	3098 (16.1)	16 113 (83.9)	
Male (20 497)	3378 (16.5)	17 119 (83.5)	
Race/ethnicity			.000*
Asian (909)	132 (14.5)	777 (85.5)	
Black (1556)	305 (19.6)	1251 (80.4)	
Hispanic (11 704)	1666 (14.2)	10 038 (85.8)	
Native American (646)	122 (18.9)	524 (81.1)	
White (24 131)	4085 (16.9)	20 046 (83.1)	
Other (376)	82 (21.8)	294 (78.2)	
Unknown (351)	78 (22.2)	273 (77.8)	
Place of birth			.730
Urban (21 819)	3545 (16.2)	18 274 (83.8)	
Suburban (6032)	1004 (16.6)	5028 (83.4)	
Rural (11 815)	1916 (16.2)	9899 (83.8)	
Oregon Health Plan program			.000*
Temporary Assistance for Needy Families (11 286)	2249 (19.9)	9037 (80.1)	
Foster or subadoptive care (721)	162 (22.5)	559 (77.5)	
Poverty Level Medical, pregnant women and their newborns/Children's Health Insurance Program/Oregon Health Plan (27 319)	3964 (14.5)	23 355 (85.5)	
Blind or disabled (270)	70 (25.9)	200 (74.1)	
Date Oregon Health Plan coverage began by infant age			.000*
Date of birth (32 047)	4519 (14.1)	27 528 (85.9)	
1 wk–1 mo (874)	129 (14.8)	745 (85.2)	
1–2 mo (780)	174 (22.3)	606 (77.7)	
after 2 mo (6007)	1772 (29.5)	4235 (70.5)	
Mother's Oregon Health Plan status at birth of infant			.000*
Mother in Oregon Health Plan on infant date of birth (34 743)	5416 (15.6)	29 327 (84.4)	
Mother not in Oregon Health Plan on infant date of birth (4965)	1060 (21.3)	3905 (78.7)	
Mother's age, y, at time of birth of infant			.005*
11–17 (1507)	220 (14.6)	1287 (85.4)	
18–20 (7509)	1104 (14.7)	6405 (85.3)	
21–25 (12 222)	1881 (15.4)	10 341 (84.6)	
26–35 (10 325)	1605 (15.5)	8720 (84.5)	
≥ 36 (2154)	388 (18.0)	1766 (82.0)	
Mother's language			.000*
English (25 621)	4086 (15.9)	21 535 (84.1)	
Spanish (7120)	904 (12.7)	6216 (87.3)	
Russian (475)	135 (28.4)	340 (71.6)	
Vietnamese (130)	8 (6.2)	122 (93.8)	
Other or unknown (1424)	294 (20.6)	1130 (79.4)	
Mother's number of Oregon Health Plan births in 2000–2001			.000*
1 (31 790)	4876 (15.3)	26 914 (84.7)	
2 (2876)	532 (18.5)	2344 (81.5)	
3 (96)	17 (17.7)	79 (82.3)	
4 (8)	2 (25)	6 (75)	

<sup>a</sup>P value for association with immunization initiation calculated by  $\chi^2$  test for categorical variables, *t* test for continuous variables, and Spearman correlation coefficient for ordinal variables.

\*\*Denotes  $P \geq .10$ ; inclusion into regression model.

**TABLE 2—Predictors of Immunization Initiation by 3 Months of Age: Results of Logistic Regression**

	Odds Ratio	95% Confidence Interval		P
		Lower	Upper	
Age of infant when Oregon Health Plan coverage began	2.1	1.7	2.5	.000
Mother covered by Oregon Health Plan	1.5	1.4	1.6	.000
Oregon Health Plan eligibility category (Children's Health Insurance Program; Poverty Level Medical, pregnant women and their newborns; Temporary Assistance for Needy Families; foster care; blind or disabled)	1.2	1.1	1.3	.000
Race/ethnicity of infant	0.94	0.92	0.96	.000
Mother's number of Oregon Health Plan births in 2000–2001	0.83	0.74	0.95	.006

- Regular reminders to all birthing hospitals to prompt staff to send a newborn notification form whenever an infant is born to a mother covered by the Oregon Health Plan
- Training and informational handouts for case management nurses, Mothers Care Outreach workers, and Exceptional Needs care coordinators

Our study found that we may be able to achieve the *Healthy People 2010* immunization objective by providing earlier health care coverage for both mothers and infants and offering additional support services for mothers caring for infants in foster care or subadoptive care and for blind or disabled infants and infants of all races/ethnicities. In addition, Oregon Health Plan medical and encounter data can be used to guide decisions on public health funding and targeted interventions that ensure this immunization objective. ■

### About the Authors

Jessica W. Henderson is with Western Oregon University, Monmouth. Susan A. Arbor, Steven L. Broich, Judy Mohr Peterson, and Jean E. Hutchinson are with the Oregon Department of Human Services, Salem.

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### Contributors

J.W. Henderson analyzed the data and led the writing of the brief. S.A. Arbor wrote the grant proposal and assisted with the study. S.L. Broich created the database and provided advice on the study design. J. Mohr Peterson contributed to the conceptualization of the study and interpretation of the data. J.E. Hutchinson helped to interpret findings. All authors reviewed and edited drafts of the article.

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### Human Participant Protection

No protocol approval was needed for this study.

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# Immunizations for Children on the Oregon Health Plan

**Immunizations protect children** from becoming infected with diseases that can cause lifelong disabilities and even death. The Oregon Health Plan covers immunizations.

## **Children need their immunizations soon after birth.**

Babies are *more likely* to develop complications or die from vaccine-preventable diseases than older children.

**A recent study\*** found that babies on the Oregon Health Plan are *less likely* to start their immunizations early if:

- Babies do not have OHP coverage on the day of their birth or within the first month of life.
- Mothers are not on OHP when their baby is born.
- Babies are in foster care, sub-adoptive care, blind, disabled, Native American, African-American or their mother's primary language is Russian.

\* Jessica Henderson, Susan Arbor, Steven Broich, Judy Mohr-Peterson and Jean Hutchinson, "Immunization Initiation among Infants in the Oregon Health Plan," *American Journal of Public Health*, in press 2005.

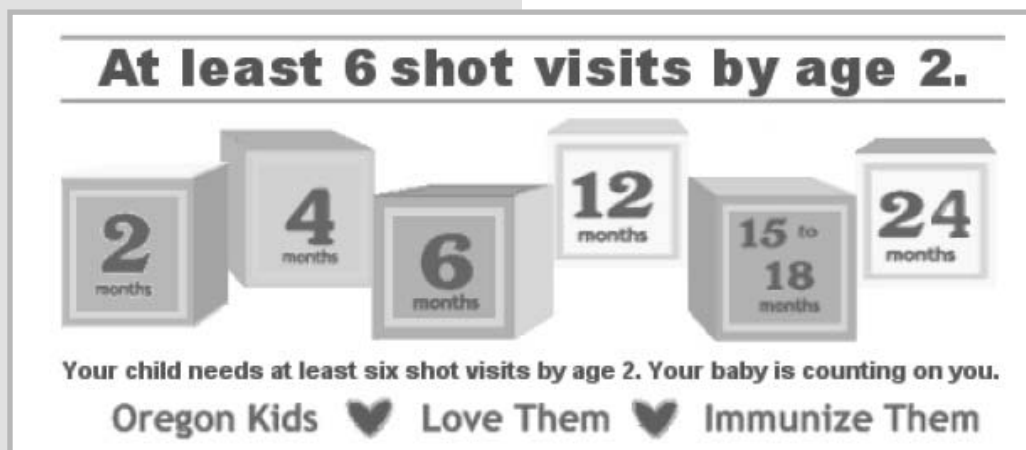
## **Here's how you can help:**

**CASE WORKERS:** Add newborns to the mother's case as soon as possible so that OHP benefits are available early in baby's life.

**OUTREACH WORKERS:** Help eligible pregnant women obtain OHP coverage as soon as possible.

**MANAGED CARE ENCCs:** Focus on timely immunizations for infants with special needs, in foster care, Native American, African-American or babies whose mother's primary language is Russian.

**More information about vaccines is available on the Oregon Public Health Web site:**



<http://www.oregon.gov/DHS/ph/imm/aboutvac.shtml>

**QUESTIONS?** Call the child's OHP managed care plan or health care provider.



# Immunizations for Children on the Oregon Health Plan

**Vaccines work!** The fact we no longer see certain diseases doesn't mean they no longer exist. It simply means the vaccines are at work protecting our children. However, they can only continue to do their work if we continue to immunize children.

**Immunizations are given in a regular series.** The schedule recommends the shot series start at birth and continue through 24 months of age. Boosters begin at age four. For more scheduling information see <http://www.cdc.gov/nip/recs/child-schedule.htm>.

Children who start their immunizations on time and stay on schedule are more likely to be up-to-date with their immunizations by the time they are two years old.

**If a child falls behind** in the immunization schedule, the provider should use the CDC's catch-up immunization schedule to bring the child up-to-date. See <http://www.cdc.gov/nip/recs/child-catchup.pdf>.



Color copies of this handout are available at [http://www.oregon.gov/DHS/healthplan/tools\\_staff/reftools.shtml](http://www.oregon.gov/DHS/healthplan/tools_staff/reftools.shtml)

## Vaccines protect children against:

Chickenpox	Diphtheria
Hepatitis A	Hepatitis B
Flu	Measles
Meningitis	Mumps
Pneumonia	Polio
Rubella	Tetanus
Whooping cough	

## These diseases can spread from child to child

at school . . .

at the grocery store . . .

on the playground . . .

at church . . .

*ANYWHERE!*