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Immunization Initiation Among Infants in the Oregon Health Plan

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Infants who start receiving immunizations on time are more likely to be up to date at age 2 years. Among 39 708 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.[1] 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.[2,3]

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 matching 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 39 708 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.[2,4–7] 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? No (%)	Yes (%)	P^a
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			
Mother in Oregon Health Plan on infant date of birth (34 743)	5416 (15.6)	29 327 (84.4)	.000*
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)	

[a]*P* value for association with immunization initiation calculated by χ^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*
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 birthsin 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. ■

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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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