

Impact of Reports of Hepatitis B Vaccination on Hepatitis A Vaccination Reports¹

Lisa R. Carley-Baxter¹, Doug Passaro², Susan Twiddy¹, Ron Hershow³, Rodney K. Baxter¹, and Paul S. Levy¹
RTI International¹
Posthumous²
University of Illinois at Chicago³

Abstract

Hepatitis A and hepatitis B are both viral diseases affecting the liver; however they are generally transmitted via different means and often result in different spectra of health effects once infected. Vaccinations are available for each of these diseases. It is hypothesized that many lay people are not familiar with differences between hepatitis A and hepatitis B and may confuse them owing to the similarity of their names. For this paper, we report the results of a randomized experiment that was conducted in the fall of 2004, embedded within a retrospective survey of parents concerning childhood vaccination followed by a record check from the children's health care providers. The objective of the embedded randomized experiment was to determine whether reports of hepatitis A vaccination were influenced by the inclusion of questions about hepatitis B vaccination. We further investigated whether these vaccination reports differ by demographic characteristics, the number and age of children, presence of shot records, and the number of vaccination providers. Finally, we investigated the accuracy of the reports of hepatitis A vaccinations from parents who were also asked the hepatitis B questions by comparing parent and provider reports of hepatitis A vaccinations.

Keywords: Telephone survey, Hepatitis A immunization, two-phase survey

1. Introduction

Hepatitis A and B are both vaccine-preventable viral diseases affecting the liver. Serologic testing is required to distinguish hepatitis A from hepatitis B. Hepatitis A is a self-limited illness transmitted by the fecal-oral route through close personal contact or by contaminated food. There is no chronic infection with the hepatitis A virus. Hepatitis A vaccine was licensed in the United States in 1995; and routine vaccination of children in 17 states was

recommended in 1999. Hepatitis A vaccine is not licensed for children less than 24 months old.

Pediatric hepatitis A vaccine is given in a 2-dose series (a 3 dose series was available until 1997). The second dose is given 6 to 12 months after the first dose, making 30 months of age the youngest that a child can be fully vaccinated against Hepatitis A. Hepatitis A incidence rates have declined dramatically since the vaccine was introduced; however, vaccine coverage is unknown in most states. The National Immunization Survey, which is considered the best source of vaccine coverage estimates among young children, is only administered to 19-35 month olds; therefore this survey is not as useful for estimating hepatitis A vaccine coverage as it is for other vaccines.

Hepatitis B is transmitted through blood or blood-derived body fluids, not by contaminated food. Hepatitis B vaccine was licensed in the United States in 1981, and routine vaccination of all infants was recommended in 1991. The schedule is typically 3 or 4 doses, with the first and last doses separated by 6 or more months; a 2 dose schedule is also available for 11-15 year olds using one of the vaccine formulations. The vaccination series can be started immediately after birth. Data from the 2003 National Immunization Survey indicate that 3 or more dose coverage is approximately 92% among 19-35 month olds.

While hepatitis A and hepatitis B have different modes of transmission and are prevented using different vaccines, it is hypothesized that many lay people are not familiar with differences between hepatitis A and hepatitis B and may confuse them owing to the similarity of their names. For this paper, we report the results of an experiment to determine whether reports of hepatitis A vaccination were influenced by the inclusion of questions about hepatitis B vaccination. We further investigate whether these vaccination reports differ by

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demographic characteristics, the number and age of children, presence of shot records, and the number of vaccination providers. The data were derived from a telephone survey of hepatitis A vaccination rates among children that was conducted in the fall of 2004.

Provider reports of vaccinations are considered the “gold standard” of vaccination reports since they record the vaccination at the time of administration. However, following up with providers to obtain vaccination records can be time consuming and costly. In addition, many health care providers interpret the 2003 Health Insurance Portability and Accountability Act (HIPAA) regulations as requiring written parental consent before health care providers can provide medical records to researchers (Ness, 2005). Providers may not realize that HIPAA applies to covered entities and many research organizations do not meet the definition of a covered entity under the HIPAA regulations; therefore the HIPAA regulations do not apply to research organizations. Despite this, research organizations are faced with the reality of conducting studies that utilize medical records and therefore must respond to the beliefs held by providers if their research is to be a success. In response to this concern, in this study we first obtained verbal parental consent during the telephone interview and then mailed parents written consent forms to sign and return. While 82% of parents in this study (532 cases, representing 1027 children) gave verbal permission to contact their children’s healthcare providers to obtain shot records, only 58% of those (306 cases, representing 560 children) returned signed consent forms. If we had not proactively responded to provider concerns regarding the release of medical records without written consent, we could have followed up on 42% more of our completed cases (226 cases, representing 467 children) which likely would have resulted in nearly doubling the final number of parent-provider matches we obtained.

In this study, we obtained parents’ reports of vaccinations and compared those to provider reports. Determining whether parents’ reports of vaccination status are comparable to those obtained from healthcare providers is important, because if parent reports were found to be as accurate (or nearly as accurate) as provider reports, immunization coverage surveys could be conducted for less cost. We also compare parents’ reports of hepatitis A vaccinations with those obtained from providers, and investigate whether the addition of questions about hepatitis B influences these matches. Future papers from this study will focus on the concordance between parent

and provider reports of vaccinations, while this paper focuses only on results from the embedded methodological experiment.

2. Methodology

In the fall of 2004, a list assisted random-digit-dial (RDD) survey was conducted with parents of children between 2.5 and 15 years of age in Arizona and Oregon. Since the earliest that a full series of vaccinations can be complete is 2.5 years of age, this determined the eligibility criteria for this study.

Parents or guardians were asked for reports of childhood vaccinations, permission to contact healthcare providers to obtain data on these vaccinations, and the demographic characteristics of the household. All cases received questions about hepatitis A and varicella (chicken pox) vaccinations. In addition, half of the cases were randomly assigned to receive the hepatitis B vaccination questions.

Interviews were completed with 650 households, representing approximately 1,266 children, in Arizona and Oregon. These states were chosen because of their high occurrence rates of hepatitis A. Since 1999, the Advisory Committee on Immunization Practices (ACIP) has recommended routine childhood vaccinations in areas where incidence has been twice the national average, meaning 20 cases per 100,000 individuals. Both Arizona and Oregon met these criteria at the time the study was designed.

Of the 650 completed interviews, 532 (82%, representing 1027 children) gave verbal permission to contact their children’s healthcare providers to obtain shot records. These parents were then mailed a consent form to complete and return to RTI. Parent non-respondents (those who didn’t return consent form) were followed-up via mail and telephone. These efforts resulted in a 58 percent return rate with 306 cases (representing 560 children) returning written consent forms.

For cases where written parental consent was obtained, medical providers were contacted to obtain vaccination records for the children. Parents may have given contact information for multiple healthcare providers during the telephone interview and on the written consent form, but owing to budgetary constraints only one of these providers was contacted initially for each child. Providers were contacted both via mail and by telephone. Providers were asked to return the Immunization History Questionnaires by either mailing in a postage-paid

envelope, or faxing the forms to a project-specific fax machine monitored by a project staff member. Of the 306 cases (representing 560 children) mailed to providers, 274 cases (90%, representing 493 children) returned shot records or completed surveys.

3. Results

Provider follow-up was completed in late March, 2005, and the data became available in early April, 2005. All results presented here are preliminary, although we are confident that the general findings of this embedded experiment will not change significantly upon further analysis.

The focus of this research is a methodological test of impact of questions about hepatitis B vaccination on reports of hepatitis A vaccination. Ideally, the hepatitis A reports would not be affected by the receipt of additional questions. Because we are interested in both significant results (for differences) and non-significant results (to show that the reports are not different based on the receipt of additional questions), the analysis below discusses both significant and, more hypothetically, non-significant findings and the impact of those results for future vaccination reporting surveys.

We extend this analysis by reporting whether parents reports of hepatitis A vaccination match provider reports. If parent reports are found to match provider reports, this would strengthen the option of only using parent reports for vaccination rates. This would allow the gathering of these data to be more cost-effective, and at least somewhat easier to obtain.

Any parent or guardian of the children in the household age 2.5 to 15 years of age was eligible to participate. Since we are investigating the impact of demographic factors on reporting of hepatitis A vaccination, and demographic variables were collected only for mothers of the child (not for all respondents), our analysis only includes cases where the mother is the respondent.

We present both bivariate and multivariate results. Significance testing is based on an odds ratio from a random effects logistic regression controlling for the other variables. This procedure will estimate an odds ratio for each variable that controls for confounding by the other independent variables in the equation. It also controls for the cluster effect that is due to mothers with multiple children reporting for each child. A large number of the cases represent multiple children households and the resulting intra-cluster correlations turned out to be high (over 0.75).

3.1 Initial Reports of Hepatitis A Vaccination

Initial parent reports of hepatitis A vaccination are reported for both household/mother's demographics, as well as other variables (including number and age of children, presence of a shot record, and number of vaccination providers). *Table 1* illustrates the impact of asking the hepatitis B question, as well as demographic and other variables of interest on parent reports of hepatitis A vaccination. Percentages represent percent of children whose parents reported at least one hepatitis A vaccination. This table shows that children whose parents received the hepatitis B questions were no more likely to report hepatitis A vaccination than were children whose parents did not receive these questions ($p=.76$), even though the point estimates for cases that received the hepatitis B questions were slightly higher than for their hepatitis A question only counterparts.

Reports of Hepatitis A Vaccination by Household/Mother's Demographics. The likelihood of reporting a hepatitis A vaccination is significantly associated with the age of the children in the household and the presence of a shot record. Mothers² with children 9 to 11 years old were significantly less likely to report hepatitis A vaccination, as were mothers with children aged 12 to 15 years old than were mothers with children 5 years of age or younger. Unexpectedly, mothers who had a shot record while reporting vaccinations were significantly less likely to report hepatitis A vaccination.

No other demographic variables had a significant impact on the likelihood of reporting hepatitis A vaccination. Though not significant, several variables demonstrated lower reports of hepatitis A vaccination and may be risk factors for not getting the vaccination. These variables include lower income (\$7,500 to \$25,000), mother of hispanic or non-hispanic non-white ethnicity, and unmarried mothers.

Reports of Hepatitis A Vaccination by Other Variables. As discussed above, two of these other variables of interest (presence of a shot record and age of children) were shown to be significant predictors of hepatitis A vaccination reports. We

²While children are the reported unit of observation for this analysis, parents provided data on the child. Therefore when parents (or mothers) are referred to throughout the results section, the reference is the child of the parent who did the reporting for the survey.

Table 1. Parent (Mother’s) Reports of Hepatitis A Vaccination

Characteristic	Not Asked Hep B Questions % ^{a, b} (n)	Asked Hep B Questions % (n)	Odds Ratio (Confidence Interval)	P
Reported Hepatitis A Vaccination				
No	52.48 (265)	47.52 (240)	Referent	
Yes	47.96 (223)	52.04 (252)	1.14 (0.49, 2.63)	0.76
Family Income				
\$7,500 - \$25,000	11.96 (25)	8.89 (20)	Referent	
\$26,000 - \$50,000	26.32 (55)	23.56 (53)	0.67 (0.14, 3.12)	0.61
\$51,000 - \$75,000	23.44 (49)	26.67 (60)	0.62 (0.15, 2.67)	0.52
> \$75,000	38.28 (80)	40.89 (92)	2.64 (0.50, 13.98)	0.26
Mother’s Race				
Hispanic	8.56 (19)	8.68 (21)	Referent	
Non-Hispanic White	87.84 (195)	85.54 (207)	0.60 (0.08, 4.40)	0.62
Non-Hispanic Non-White	3.60 (8)	5.79 (14)	8.40 (0.34, 210.31)	0.20
Mother’s Marital Status				
Not Married	14.41 (32)	4.13 (10)	Referent	
Married	85.59 (190)	95.87 (232)	1.19 (0.28, 4.97)	0.81
Number of Children				
One	17.49 (39)	14.88 (75)	Referent	
Two or More	82.51 (184)	85.12 (390)	0.75 (0.27, 2.11)	0.59
Age of Children				
5 years old or Younger	39.01 (87)	30.58 (74)	Referent	
6 to 8 years old	25.11 (56)	30.58 (74)	0.85 (0.41, 1.74)	0.65
9 to 11 years old	17.49 (39)	19.83 (48)	0.20 (0.09, 0.48)	0.00
12 to 15 years old	18.39 (41)	19.01 (46)	0.09 (0.04, 0.23)	0.00
Shot Record				
Yes	51.12 (114)	63.64 (154)	Referent	
No	48.88 (109)	36.36 (88)	0.11 (0.04, 0.28)	0.00
Number of Vaccination Providers				
None	1.38 (3)	1.32 (107)	Referent	
One	57.34 (125)	46.93 (118)	2.21 (0.29, 16.96)	0.45
Two or More	41.28 (90)	51.75 (228)	3.21 (0.42, 24.48)	0.26

^a Indicates percent report of hepatitis A vaccination.
^b Results are reported only for cases where the mother was the respondent.

hypothesized that parents with multiple children and multiple vaccination providers would report higher levels of hepatitis A vaccinations. While none of these variables showed a significant impact on hepatitis A vaccination reports, households with only one child and those with no reported vaccinations providers may be risk factors for not getting a hepatitis A vaccination.

3.2 Parent and Provider Reports of Hepatitis A Vaccination

Comparison of Parent and Provider Reports. **Table 2** shows parent and provider reports of hepatitis A vaccination. In cases where providers reported no hepatitis A vaccination, approximately 86% of parents also reported no vaccination, compared to

47% of parents in cases where providers reported 1 shot and 83% of parents for cases where providers reported 2 or more shots. This represents a fairly high match rate for children receiving either no vaccinations or the complete hepatitis A vaccination series (2 shots).

Matches Between Parent-Provider Reports of Hepatitis A Vaccination. The random effect logistic regression analysis showed two variables to be significantly associated with the likelihood of a match between parent and provider reports of hepatitis A vaccination (**Table 3**). The likelihood of a match between parent and provider report is significantly associated with use of a shot card and number of providers. **Figure 1** shows the prevalence

Table 2. Parent Reports of Hepatitis A Vaccination Compared to Provider Reports

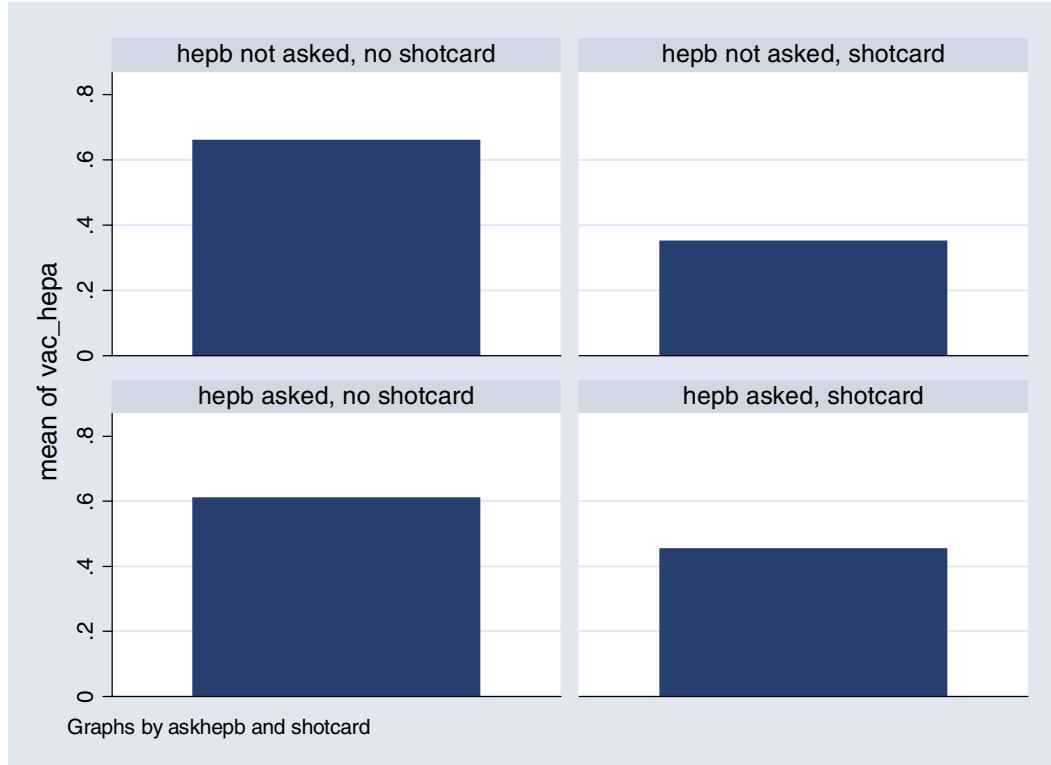
Parent Report	Provider Report: 0 shots		Provider Report: 1 shot		Provider Report: 2 or more shots		Total	
	N	Percent	N	Percent	N	Percent	N	Percent
0 shots	161	85.64	7	23.33	5	3.94	173	50.10
1 shot	10	5.32	14	46.67	17	13.39	41	11.90
2 shots	17	9.04	9	30.80	105	82.69	131	37.97
Total	188	54.49	30	8.70	127	36.81	345	100.00

Table 3. Matches Between Parent (Mother's) and Provider Reports of Hepatitis A Vaccination^a

Characteristic	Not Asked Hep B Questions % ^{b,c} (n)	Asked Hep B Questions % (n)	Odds Ratio (Confidence Interval)	P
Parent-Provider Match				
Not Match	29.81 (62)	42.92 (94)	Referent	
Match	70.19 (146)	57.08 (125)	0.44 (0.11, 1.75)	.24
Family Income				
\$7,500 - \$25,000	5.63 (8)	13.11 (16)	Referent	
\$26,000 - \$50,000	23.24 (33)	25.41 (31)	0.29 (0.13, 6.47)	0.43
\$51,000 - \$75,000	21.13 (30)	22.13 (27)	0.14 (0.01, 2.90)	0.20
> \$75,000	50.00 (71)	39.34 (48)	0.93 (0.05, 17.12)	0.96
Mother's Race				
Hispanic	2.74 (4)	8.80 (11)	Referent	
Non-Hispanic White	95.89 (140)	89.60 (112)	6.94 (0.57, 84.35)	0.13
Non-Hispanic Non-White	1.37 (2)	1.60 (7)	0.60 (0.01, 48.97)	0.82
Mother's Marital Status				
Not Married	2.05 (3)	14.40 (18)	Referent	
Married	97.95 (143)	85.60 (107)	1.23 (0.09, 17.28)	0.88
Number of Children				
One	20.55 (30)	25.60 (32)	Referent	
Two or More	79.45 (116)	74.40 (93)	0.62 (0.99, 11.83)	0.54
Age of Children				
5 years old or Younger	29.45 (43)	29.60 (37)	Referent	
6 to 8 years old	20.55 (30)	29.60 (37)	2.84 (0.78, 10.27)	0.11
9 to 11 years old	26.71 (39)	18.40 (23)	1.79 (0.43, 7.37)	0.42
12 to 15 years old	23.29 (34)	22.40 (28)	0.97 (0.22, 4.24)	0.97
Shot Record				
No	6.85 (10)	6.40 (8)	Referent	
Yes	93.15 (136)	93.60 (117)	3017.21 (75.53, 120531.70)	.000
Number of Vaccination Providers				
One	58.90 (86)	54.40 (68)	Referent	
Two or More	41.10 (60)	45.60 (57)	3.43 (0.99, 11.83)	.05

^a Only cases with both parent and provider data are reported.
^b Indicates percent report of hepatitis A vaccination.
^c Results are reported only for cases where the mother was the respondent.

Figure 1. Mean of Hepatitis A Vaccination Reports by Hepatitis A Only Questions/Hepatitis B Questions and Presence of Shot Record.



of a reported hepatitis A immunization according to the four possible combinations of whether the respondent was asked the hepatitis B questions and whether a shot card was present at the time of reports; while *Figure 2* shows the prevalence of a match for each of the same 4 categories. These graphs are based on raw proportions and are not related to the significance levels that should be obtained from the regressions. Note the obvious strength of the shot card in the accuracy of the report. Presence of a shot card is associated with a lower prevalence of immunization reports but with a higher prevalence of a match (it seems that there are fewer spurious positive reports if information comes from a shot card).

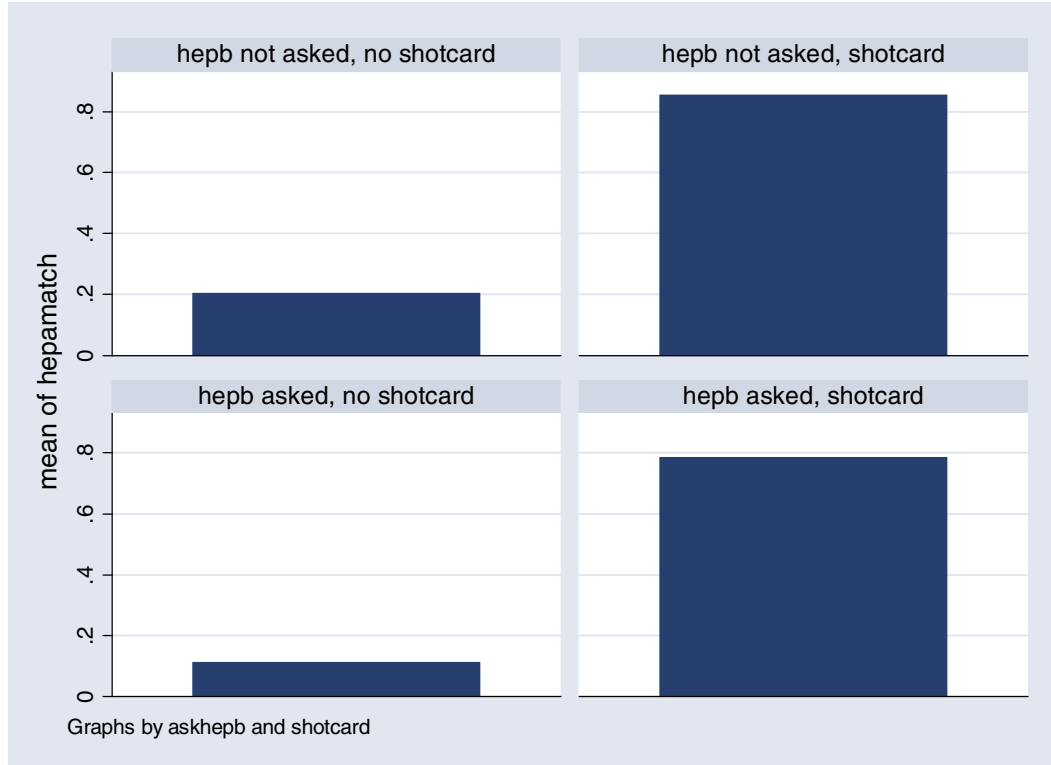
Similar to the findings for reports of hepatitis A vaccination, the likelihood of a parent-provider match in reports of hepatitis A vaccination was not significantly impacted by the presence (or absence) of the additional hepatitis B vaccination questions. While none of the other variables was shown to be a significant predictor of parent-provider matches in reports of hepatitis A vaccinations, several of them demonstrated lower reports and therefore may be risk factors for not matching provider reports of hepatitis A vaccinations. Five out of six of these variables are

the same and in the same direction as for hepatitis A vaccination reports, including: families with lower incomes (\$7,500 to \$25,000), mother of Hispanic or non-hispanic non-white ethnicity, unmarried mothers, families with one child, and families with older children. Two or more vaccination providers showed a trend towards lower matching of parent-provider reports of hepatitis A vaccinations.

4. Conclusion

Overall, the methodological experiment on the impact of the addition of questions about hepatitis B to a random selection of cases has shown no differences in either hepatitis A vaccination reports or likelihood of parent-provider matches in hepatitis A vaccination reports. Further, few variables significantly impact reports of hepatitis A vaccination. Reports of hepatitis A vaccination were significantly impacted by the presence of a shot card and the age of the child. The presence of a shot card and the increasing age of the child resulted in a decreased likelihood that a vaccination will be reported by the parent (whether the vaccination actually happened or not). The impact of the shot record on the report of hepatitis A vaccination by parents is easily understandable since the data about

Figure 2. Mean of Parent-Provider Matches by Hepatitis A Only Questions/Hepatitis B Questions and Presence of Shot Record.



the shot is recorded. Similarly, since children usually undergo a series of vaccinations as an infant, getting vaccinations later in childhood may not stand out as much to parents. This may explain why parents of older children are less likely to report hepatitis A vaccinations.

Parent-provider matches are similarly affected by only a few key variables: presence of shot record and number of vaccination providers. The more providers reported, the less likely parents were to correctly match provider reports of hepatitis A vaccination. This may be due less to parent reporting skills than to the study methodology which focused on contacting only one medical provider, even if multiple medical providers were reported by parents³. If all providers had been contacted, then the match rate for parent-provider reports may have been different. Future research on the accuracy of parent-provider reports of any vaccination should follow-up

³ For cases where the initial provider reported having no vaccination records for the child, we contacted the second provider on the list to request vaccination records for the child.

with all medical providers to provide a complete evaluation of these factors.

The most significant finding from this research is the impact of the shot card and on both parent reports and accuracy of parental reports. The presence of a shot card is strongly related to the accuracy of the parental report. Presence of a shot card is associated with a lower prevalence of immunization reports but with a higher prevalence of a match (it seems that there are fewer spurious positive reports if information comes from a shot card). The shot record leads to fewer reports of hepatitis A vaccination, but an increase in the likelihood of a match between parent and provider reports. These results may be complementary since parents may be less likely to report hepatitis A vaccinations that did not actually happen if they have a shot record, and the occurrence of a shot may lead to more accurate matches with provider reports.

It is also important to note that the number of providers positively impacts the accuracy of parental reports of hepatitis A vaccination. This may be because parents who take their children to more than one provider are used to providing a snap shot of the child's medical history to the new provider. This

exercise may lead to parents remembering vaccinations more clearly in these situations.

The overall positive methodological finding from this analysis is that parent reports of hepatitis A vaccination and the likelihood of a match between parent and provider reports are not significantly impacted by receipt of hepatitis B questions. This may mean that parents can be asked about multiple vaccinations (even those with similar names) without concern for reporting of vaccinations impacted by the different questions. Future research on parent reporting of vaccinations for children beyond infancy may need to focus on asking about several types of vaccinations, and following up with all medical record providers listed by the parent to provide a more complete picture of vaccination reports and parent-provider matches.

Reference

Ness, Roberta B. (2005). "A Year is a Terrible Thing to Waste: Early Experience with HIPAA." *Annals of Epidemiology*, 15(2): 85-86.