

# Cost Savings Associated With Using Immunization Information Systems for Vaccines for Children Administrative Tasks

Diana L. Bartlett, Michael L. Washington, Amanda Bryant, Norman Thurston, and Christine A. Perfili

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Our objective was to investigate the potential cost savings of immunization information systems (IIS) in performing some administrative tasks associated with the federal Vaccines for Children (VFC) program at the state and practice levels. VFC is an entitlement program providing free vaccine to eligible children. We timed the staff of the Utah Department of Health (UDOH) and 72 private VFC practices for administrative VFC-related tasks from September 2003 through March 2004. Time measurements included time for practices to produce VFC reports and for UDOH staff to assess practice coverage levels and process VFC reports manually or via the Utah Statewide Immunization Information System (USIIS). Median cost savings to the state health department could be as much as \$11 740 annually. Utah VFC practices could save up to a maximum of \$446 annually per practice by using USIIS for VFC tasks. If applied to the 218 enrolled private practices statewide, this would result in a median total cost savings of \$17 615 (\$15 519 for reports and \$2 096 for pulling medical charts).

**KEY WORDS:** health services, immunization, registries, time study, vaccination

Immunization information systems (IIS) or registries are confidential, population-based, computerized information systems that collect vaccination data about persons, especially children, within a geographic area.<sup>1</sup> These systems have the potential to streamline administrative tasks required of health departments and private practices that are associated with a large entitlement program, such as Vaccines for Children (VFC). Some IIS benefits include documentation of doses administered, tracking underimmunized children, consolidating vaccination records from multiple providers, generating

recall vaccination notices for each child, and providing official vaccination forms and vaccination coverage assessments. Some IIS can also capture VFC eligibility status and perform vaccine inventory management functions.

In 1994, the VFC program was created in an effort to remove financial barriers to immunization and improve immunization services.<sup>2</sup> It provides federally purchased vaccine to participating private providers for administration to children who meet VFC eligibility criteria: Medicaid-eligible, uninsured, Native American, or Native Alaskan.<sup>3</sup> Studies have shown a resulting increase in the number of children receiving immunizations from private sector providers.<sup>4-6</sup> A recent study also determined that VFC-eligible children were less likely to have a medical home and be up-to-date for vaccinations.<sup>7</sup> This places greater demands on

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The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the CDC.

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private practices who serve this population to consolidate scattered records and raise immunization coverage levels.

Implementing the VFC program adds administrative tasks to both state immunization programs and participating providers related to VFC inventory management, collection and processing of doses-administered reports, and the performance of annual quality assurance audits for enrolled private providers. A satisfaction survey conducted in 1999 showed that while participating providers are satisfied with the VFC program in general, they were least satisfied with tracking, documenting, and reporting doses administered than with any other individual component of the program.<sup>6</sup>

The objectives of this study were to evaluate the potential time and cost savings an IIS can provide to both a state immunization program and VFC-participating private physicians in performing the administrative tasks required of the VFC program. Using the Utah Statewide Immunization Information System (USIIS) as the model, we measured the time spent by VFC-enrolled private practice staff for producing VFC-related reports and pulling charts for vaccination coverage assessments during quality assurance visits by the Utah Department of Health (UDOH), time spent by the UDOH to process these reports, and time spent by the UDOH to assess vaccination coverage at the clinic level with and without using USIIS.

## ● Methods

### VFC data collection by private providers

During the summer of 2003, we identified all private practices in Utah participating in the VFC program. VFC-participating practices were selected for inclusion in the study if they met the following criteria:

1. Located along the extended Wasatch Front (Salt Lake, Utah, Davis, and Weber counties and the cities of Brigham City, Tooele, Park City, Heber City, and Nephi).
2. Placed an order with the UDOH VFC program for five vaccines recommended by the Advisory Committee on Immunization Practices for children through age 2 years (diphtheria, tetanus, and acellular pertussis (DTaP); inactivated poliovirus, *Haemophilus influenzae* type b; hepatitis B; and measles, mumps, and rubella).
3. Were a "high volume" practice, having ordered at least 120 doses of the DTaP vaccine from the UDOH VFC program in the 12 months prior to data collection (October 2002–September 2003).
4. Participated as a VFC provider for at least 1 year at the time of observation.

The extended Wasatch Front is a geographic area where 75% of the private VFC-participating providers practiced during our project period of September 2003–March 2004. This area also is where nearly 80% of Utah's children less than 5 years of age reside.<sup>8</sup> Including "high volume" practices in the study would ensure that observers could time a few VFC doses administered weekly. Of the 163 VFC private provider practices along the extended Wasatch front, 81 met our eligibility criteria, and 72 practices agreed to participate. Of the 72 practices, the median number of DTaP doses ordered was 290 (range 120–2 250) per year.

Practices were stratified into those that use USIIS to produce VFC doses-administered reports ( $N = 23$ ) and those that did not ( $N = 49$ ). Of the practices that did not submit their reports through USIIS, 30 used UDOH paper tally sheets to keep track of information needed to complete the quarterly doses-administered (QDA) report. In 19 practices, the information needed to complete the QDA reports was derived from existing data in billing or other automated systems.

For the practices using paper tally sheets, UDOH hired and trained observers in the clinics to collect VFC-related time data. These observers made at least five observations at 23 practices of the time spent to record the child's eligibility category, age group, and quantity of VFC vaccines administered. The observers did not interfere with normal clinic operations. Non-tally sheet users were not observed for time because doses-administered data were already collected for other non-VFC purposes (ie, billing, data consolidation in USIIS).

We collected data on these activities for both groups as well as the time required to prepare and submit the report. Clinical staff were instructed to log the amount of time that they spent collecting, organizing, tabulating, and submitting quarterly reports to the state VFC program on a self-reporting data collection instrument. We also asked each of the practices using USIIS for VFC reporting to self-report the time required to prepare and submit the quarterly report. Forty-three (88%) of the non-USIIS practices and 22 (96%) of the practices using USIIS completed and submitted the self-reported time form. Data collection occurred over two quarters with practices submitting time to produce QDA reports at least once. Practices submitting timed data for two quarters had their average time analyzed with the other practices.

During the study time period, UDOH staff conducted provider quality assurance visits at 20 private VFC practices. The staff at 18 of these practices provided a self-report of the time required to retrieve medical charts for the UDOH vaccination coverage assessments conducted during these visits, to provide charts to UDOH staff, and to return the chart to the file.

Time data were linked with the job titles of persons performing the timed tasks. The median 2003 salary

data for clinical staff by job title and practice location (ie, metropolitan areas of the clinic's address) were obtained from the Bureau of Labor and Statistics and were used to estimate costs for the clinic staff to perform tasks. When estimating statewide costs for private practices, we used the median salary per job title for Utah.<sup>9,10</sup> Costs are described in 2003 dollars.

## UDOH staff time

### VFC reports

UDOH VFC staff received 253 QDA reports submitted by public and private VFC providers statewide during the project period for each quarter via mail, e-mail, or fax. Eighteen additional reports were downloaded electronically through USIIS. Staff entered the paper-based data into an electronic format and reviewed the USIIS-based reports. Staff provided a self-report of the time required to complete these tasks. Estimates were also obtained of the costs for VFC state staff to process all QDA reports into a summary report for submission to the CDC, and costs and time to produce a summary QDA report using the IIS were also estimated.

### Clinic vaccination coverage assessments

The UDOH VFC staff also completed a self-report of the time required to review charts, enter data into the CDC's Clinical Assessment Software Application (CASA) and complete a CASA report for each of the 20 private VFC practices seen during the project period for provider quality assurance visits. A simulation of the time required to produce CASA reports using electronic data (such as could be provided by USIIS) was conducted using the same UDOH staff for comparability. When estimating costs for the UDOH staff, we used reported state staff salaries from the 2003 and 2004 state applications for federal immunization funding.

## Ethics

This study was reviewed by the Human Subjects Coordinator at the Centers for Disease Control and Prevention's National Immunization Program and was determined to be a nonsensitive evaluation of public health practice exempt from Institutional Review Board review.<sup>11</sup>

## Analysis

Summary statistics were generated using Microsoft Excel (version 2002, Microsoft Corporation, Redman, WA) spreadsheets. All results were analyzed per practice per year unless otherwise indicated. Total state costs for 1 year were also estimated. Estimated costs for private practices were limited to the 218 private VFC practices

in the state, while UDOH VFC staff time assumes participation of all 253 public and private VFC clinics in the state unless otherwise indicated. Costs were calculated assuming that the IIS functions operated normally, its data were complete and reliable, and that data quality standards were high. We report the median and range in the results; the data are skewed and the range of time and cost from clinics vary widely.

## ● Results

### Costs and time for a private practice to perform VFC-related reporting per year

The median time for a private practice to document on a paper tally sheet that they vaccinated VFC-eligible children in their practice was 106 minutes per year (range: 26.29–777.20) (Table 1). The median cost for this activity was \$22.10 (range: \$7.46–\$145.17). The median time per practice to manually tabulate and submit their QDA report for the year was about 360 minutes (range: 36.00–2 446.00) versus 80 minutes (range: 4.00–1 010.00) for those that used USIIS, equating to a yearly median cost of \$63.12 and \$14.03, respectively.

When USIIS users and nonusers were compared, there was more variation in the report times of nonusers than USIIS users (Figure 1). Doses-administered report times were affected by the number of VFC patients seen in a practice (proxy measured by VFC DTaP doses ordered), but more noticeably in practices that produce reports manually rather than with USIIS.

The annual median time for private practice staff to retrieve charts for a CASA assessment was about 53 minutes (range 15–270) with a median cost of about \$10 (Table 1). Practice staff do not need to manually retrieve charts for CASA assessments if an IIS is used. Manual chart retrieval may be necessary for other aspects of an annual VFC provider quality assurance visit, but were not measured here.

Utah VFC private practices could save up to a maximum of \$446 annually per practice by using USIIS for vaccination coverage assessments and reporting VFC doses administered. If applied to the 218 private practices statewide, this would result in an annual median total cost savings of \$17 615, (\$15 519 for reports and \$2 096 for retrieving medical charts).

### UDOH time and costs for doses-administered and vaccination assessments

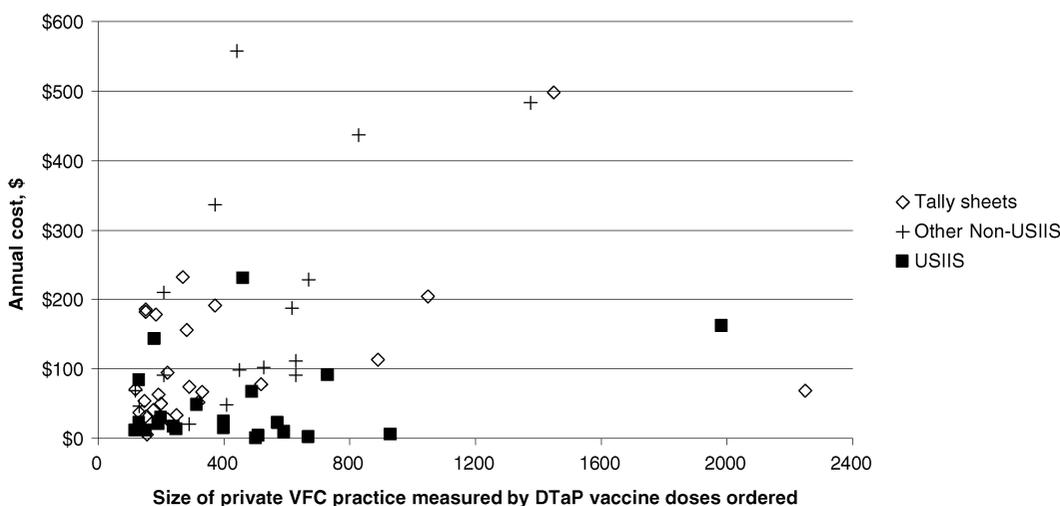
When practices submit their quarterly report by mail, e-mail, or fax, a UDOH employee organizes and enters these data into a database. As seen in Table 2, this equates to a median annual time and cost of 4 800 minutes (~80 hours) and \$1 400, respectively. When

**TABLE 1 • Annual time and costs to private practices to produce quarterly Vaccine for Children–related reports by reporting method**

Clinic activities	Unit of measure	Non-USIS reporting <sup>a</sup>			USIS reporting <sup>a</sup>			Cost difference between non-USIS and USIS reporting method
		N	Median time in minutes (range)	Median cost (range)	N	Median time in minutes (range)	Median cost (range)	
1) Doses-administered reports								
a) Dose documentation <sup>b</sup>	Clinic	24	106.33 (26.29–777.20)	\$22.10 (\$7.46–\$145.17)	Not applicable <sup>c</sup>			
	Estimated state total	218	23180.67 (5731.95–169429.60)	\$4816.72 (\$1625.74–\$31647.84)				
b) Report production <sup>d</sup>	Clinic	43	360.00 (36.00–2446.00)	\$63.12 (\$6.31–\$428.87)	22	80.00 (4.00–1010.00)	\$14.03 (\$0.70–\$177.09)	
	Estimated state total	218	78480.00 (7848.00–533228.00)	\$13760.16 (\$1376.02–\$93492.64)	218	17440.00 (872.00–220180.00)	\$3057.81 (\$152.89–\$38604.89)	
Totals for report tasks	Clinic	e	466.33 (62.29–3223.20)	\$85.22 (\$13.77–\$574.04)	22	80.00 (4.00–1010.00)	\$14.03 (\$0.70–\$177.09)	
	Estimated state total	218	101660.67 (13579.95–702657.60)	\$18576.88 (\$3001.75–\$125140.48)	218	17440.00 (872.00–220180.00)	\$3057.81 (\$152.89–\$38604.89)	
2) Annual chart retrieval for CASA vaccination assessments								
	Clinic	18	52.50 (15.00–270.00)	\$9.62 (\$2.75–\$49.46)	Not applicable <sup>b</sup>			
	Estimated state total	218	11445.00 (3270.00–58860.00)	\$2096.34 (\$598.96–\$10781.19)				
Total costs	Clinic	e	518.83 (77.29–3493.20)	\$94.83 (\$16.52–\$623.49)	22	80.00 (4.00–1010.00)	\$14.03 (\$0.70–\$177.09)	\$80.80 (\$15.82–\$446.41)
	Estimated state total <sup>e</sup>	218	113105.67 (16849.95–761517.60)	\$20673.22 (\$3600.71–\$135921.67)	218	17440.00 (872.00–220180.00)	\$3057.81 (\$152.89–\$38604.89)	\$17615.41 (\$3447.82–\$97316.78)

<sup>a</sup> USIS indicates the Utah Statewide Immunization Information System, non-USIS indicates practices producing doses-administered report by tabulating data from paper tally sheets or from other means (includes billing systems, clinic management systems, and other nonelectronic means).  
<sup>b</sup> Dose documentation only includes clinics using paper tally sheets to track VFC doses administered.  
<sup>c</sup> USIS data entry costs are not VFC-specific (ie, USIS data entry results in activities that benefit the state immunization program beyond VFC doses-administered reports).  
<sup>d</sup> In Utah, VFC providers produce reports every quarter; results reflect the median time and costs when reports are produced four times a year. Of the 43 non-USIS clinics, 26 used tally sheets to produce quarterly doses-administered reports for an annual median cost of \$52.48 (range: \$6.31–\$231.440) and 17 used other means (which could include billing and clinic management systems or nonelectronic methods) for an annual median cost of \$101.69 (\$15.43–\$428.87).  
<sup>e</sup> Not applicable. Total median time and costs for dose documentation and report production are estimated from the sum of tasks for each activity and not by clinic number.  
<sup>f</sup> Estimated totals for the state assume that providers are using paper-based tally sheets to document VFC doses administered. Estimates may be lower if more providers are using electronic systems (eg, billing systems) because there would be no cost to document doses administered; documenting all doses for all patients through the billing process would simultaneously document VFC doses administered for free.  
<sup>g</sup> Manual chart retrieval no longer necessary for CASA assessments. Costs related to CASA assessments transferred from provider to Utah Department of Health VFC program (see Table 2).

**FIGURE 1** ● Annual total costs associated with creating doses-administered reports by size of provider practice in Utah.<sup>a</sup>



<sup>a</sup>Provider practice size is estimated by the number of Diphtheria, Tetanus, and acellular Pertussis (DTaP) doses ordered from the Utah Department of Health's Vaccine for Children (VFC) program from October 2002 to September 2003. Graph depicts the annual cost associated with producing quarterly doses-administered reports (QDA) by using paper tally sheets, the Utah Statewide Immunization Information System (USIIS), or by some other means. Cost is in 2003 dollars.

practices produced QDA reports using USIIS, the estimated median cost for UDOH to generate a summary quarterly report for the practices were about \$14.47 annually.

The state VFC office took a median time of 87.5 minutes to do manual vaccination assessments (eg, review charts, enter data, and run CASA assessments) per private practice (range of 9–58 charts entered); estimated annual costs statewide were almost \$6 000. If the VFC staff used USIIS, the time to run CASA reports per clinic annually was 1.52 minutes with an estimated median total annual cost of \$124 for all clinics. Annual median cost savings to the UDOH could be as much as \$11 740 if USIIS were used to produce summary doses-administered reports for VFC providers and assess vaccination coverage in private practices statewide.

## ● Discussion

To the best of our knowledge, our study is the first published study to document the time and estimate the cost savings associated with completing VFC-related tasks at the state and local clinic level using an IIS. Potential time and cost savings vary, depending on conditions of data quality and provider participation. IIS data quality must be excellent and provider participation must be high for the full potential to be realized. Utah does not mandate USIIS participation for any of its vaccine providers and had 43 percent of its private provider

sites reporting to USIIS during the last 6 months of 2003 (Centers for Disease Control and Prevention internal data, Bobby Rasulnia, 11/11/2005). Since vaccine tracking and reporting doses administered have been reported as activities least liked by participating VFC providers, IIS can make the reporting process easier and may influence providers to more readily adhere to VFC administrative requirements<sup>5</sup> and participate in an IIS.

IIS can provide numerous benefits in addition to the automation of VFC reporting to private providers; however, perceptions exist that inhibit participation, such as that reporting to and retrieving information from the IIS will cost them precious time and resources.<sup>12</sup> Studies have demonstrated, however, that although there are initial costs upon participation, those costs were offset by increased efficiency as well as the functions that the IIS could perform in lieu of manual processes.<sup>13–15</sup> Support of VFC administration is therefore a small part of any cost savings that may be realized by a private provider upon implementing an IIS in their office, but cost savings measured in other scenarios would add to these savings.

This study has several limitations. First, although our sample of mainly urban clinics represented 75 percent of VFC private vaccine practices in the state, this limited generalization to the entire state because the rural, frontier clinics were not sampled for practice staff time. Median salary costs for the state were used in our extrapolation of state costs to reduce the effect of higher salaries in the urban areas sampled. Furthermore,

**TABLE 2 • Annual time and cost to state for Utah Department of Health Vaccines for Children doses-administered reports and assessments using Clinic Assessment Software Application**

Reporting method	Task <sup>a</sup>	N <sup>b</sup>	Annual median time in min/clinic (range)	Annual median cost/clinic (range)	Estimated annual median total time for the state in min (range)	Estimated annual median total cost for the state (range)
Manual	Doses-administered reports	253	19.04	\$5.62	4 816.00	\$1 421.28
	Vaccination assessments	20	87.50 (21.00–150.00)	\$27.49 (\$6.20–\$48.69)	19 075.00 (4 578.00–32 700.00)	\$5 993.26 (\$1 351.04–\$10 615.46) <sup>c</sup>
	Median total for all manual tasks		106.54 (40.04–169.04)	\$33.11 (\$11.82–\$54.31)	23 891.00 (9 394.00–37 516.00)	\$7 414.53 (2 772.31–12 036.73)
USIIS-assisted <sup>d</sup>	Doses-administered reports	83	0.17	\$0.06	42.67	\$14.47
	Vaccination assessments	<sup>b</sup>	1.52 (0.90–3.42)	\$0.49 (\$0.30–\$1.05)	384.25 (227.70–864.42)	\$124.05 (\$73.92–\$265.92)
	Median total for all USIIS-assisted tasks		1.69 (1.25–3.77)	\$0.55 (\$0.41–\$1.17)	426.93 (317.29–954.01)	\$138.53 (\$104.31–\$296.31)
Cost difference between median totals for manual and USIIS-assisted tasks				\$32.56 (\$11.40–\$53.14)		\$7 276 (\$2 668–\$11 740.42)

<sup>a</sup>tasks included completing a doses-administered report each quarter (QDA), but a vaccination assessment annually. Annual time and costs for all tasks are reported in this table. Manual doses-administered reports included reviewing incoming reports and data entry of report data. Manual vaccination assessments included Utah Department of Health Vaccines for Children (UDOH VFC) staff reviewing clinic charts, entering data into Clinic Assessment Software Application (CASA) software, and running CASA to produce a vaccination coverage report. Utah Statewide Immunization Information System (USIIS)-assisted vaccination assessments included preparing USIIS data for import into CASA, having UDOH VFC staff import a USIIS file into CASA at provider practices, and running a CASA report at the provider practice.

<sup>b</sup>twenty private VFC practices had manual CASA assessments conducted by UDOH VFC staff during the study time period; of the 253 public and private practices statewide, 83 practice entries were recorded in USIIS during the study time period and used to produce a state summary doses-administered report; 42 of the 218 private VFC practices had data in USIIS during the time period for USIIS-assisted CASA assessments; even though data were available for 42 clinics, UDOH VFC staff only visited 26 VFC private practices during the time period for CASA assessments using data files produced via USIIS. The USIIS-assisted vaccination assessments include time collected from these 42 clinics as well as the 26 clinics used in CASA assessments.

<sup>c</sup>State staff aim to perform practice vaccination coverage assessments during provider quality assurance visits at least once a year to all clinics participating in the UDOH VFC program. CASA is most often used. However, since our data collection included only private practices, the estimated statewide time and cost accounts for one visit per private clinic/year for the 218 private VFC clinics in the state. All other state estimates include costs to summarize data from 253 VFC ODAs from the private and public sector (253).

<sup>d</sup>Estimated state totals for tasks assisted by the USIIS assume time is equal for all 253 public and private VFC clinics in the state. VFC staff time to perform manual CASA assessments was noted only in private clinics; estimated state costs for these tasks are limited to the 218 private VFC clinics.

this study focused on the personnel time for VFC-related activities and did not include hardware/software costs (eg, electricity, maintenance, other infrastructure needs), input/output costs to run the USIIS, or time to input data into USIIS. Because IIS have multiple benefits to practices apart from VFC accountability, separating the VFC-related costs from the input/output costs to operate USIIS (including data entry) proved too resource intensive.

Second, rather than collect timed observations for all activities, we collected self-reported time for state VFC staff activities and practice staff time to create the QDAs and retrieve patient charts for CASA assessments. Timed observations were collected for documenting doses administered in the private practices. Staff who self-timed their activities received instruction on how to time themselves and the activities to be timed. Their data collection sheets also had a checklist of activities to be timed. The results indicate a wide range of times for both the self-reported and timed observation activities. Although there is bias in self-reported data, the wide range of times could be largely due to the wide variety of office business practices and practice size.

Our study was limited in its scope of only assessing cost savings related to doses-administered reports and clinic vaccination coverage assessments. The USIIS vaccine inventory module was not fully operational during our project timeframe. Time and costs saved for documenting vaccine doses wasted and vaccine inventory administration manually versus using USIIS could not be measured and would potentially add to the cost savings already demonstrated with our study.

Lastly, limited data on provider characteristics also prevented further analysis and modeling using other statistical techniques, such as linear regression. Working from the assumption that USIIS data were complete and reliable also inhibits our study results from becoming applicable to all IIS because data quality varies between IIS.<sup>16</sup> Functional problems with USIIS further limited data analysis. After data collection was completed, USIIS technical staff found a problem with the USIIS's ability to produce quarterly doses-administered reports (eg, functions to produce reports would shut down and have to be restarted). This problem existed during data collection and may explain some of the longer times associated with using USIIS to produce reports. Yet even with these longer times, using USIIS rather than manual tabulation was a more time-efficient process for doses-administered report production.

The cost benefits of VFC task automation as measured in our study contribute more to the benefits realized by the immunization program rather than the participating provider. With an annual median cost savings

of \$7 276 (ie, doses-administered reports and CASA assessments), UDOH staff time devoted to data entry of QDAs at the state level could be redirected to provider quality assurance visits and other activities to improve vaccination coverage in the VFC-eligible population. Gathering vaccination coverage data for clinic assessment activities using USIIS data could minimize the impact of VFC visits on the workflow in a private practice. This would also eliminate the time burden to UDOH staff of entering patient vaccination data into CASA to assess vaccination coverage in a practice. Utah VFC-enrolled vaccine provider practices could save as much as \$446 per practice annually to meet state VFC reporting requirements by using USIIS's VFC reporting options. Clinics serving a larger volume of VFC patients could save the most in producing doses-administered reports if they used USIIS for these tasks. Practice staff could also save as much as 270 minutes (~4.5 hours) annually (Table 1) by not having to retrieve patient charts for CASA assessments. Although retrieving patient charts may still be necessary for other state requirements, the number of charts retrieved and frequency could be reduced.

There was wide variability in provider office procedures used to track VFC doses administered and create QDA reports, especially in clinics that do not use USIIS. These clinics tabulated doses administered throughout the day or waited until the end of the quarter. Some clinics obtain their quarterly report data via the billing system, IIS, tally sheet, or even patient charts. Figure 1 illustrates the variability in total costs to these clinics to complete QDA reports due to their varied methods despite their similar size. Staffing and other clinical practices contribute to this variability, but we did not try to examine best practices.

Additional evaluation of an IIS's role in VFC program management should be performed. The potential cost savings at the practice level, although small, still suggest that VFC providers should incorporate the use of an IIS in their clinic workflow to reduce the time associated with VFC accountability tasks and assessment activities. State immunization programs could benefit from further investigation into the cost savings associated with using an IIS to estimate VFC-eligible children's vaccination coverage, reduce vaccine wastage, and ensure VFC program accountability. Federal VFC funds are already available to develop VFC functionality in IIS. Future studies could evaluate how an IIS vaccine inventory module can assist in optimizing vaccine supply management for both the immunization program and the VFC-participating provider and how an IIS can reduce errors in vaccine documentation and dose administration. These studies may enable the expansion of the scope and availability of VFC funds for IIS use.

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