BRIEF REPORT

Vaccination Data When the Outbreak Happens: A Qualitative Evaluation of Oregon's Rapid Response Tool

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ABSTRACT

Objective: Immunization data are vital to support responses to vaccine-preventable disease outbreaks. The Oregon Immunization Program developed a unique prototype instrument—the Rapid Response Tool (RRT)—that provides population data to local responders within 2 hours of a request. Data outputs include vaccination coverage by age group and zip code; percentages of students with nonmedical exemptions to vaccination requirements, by school; and current, comprehensive lists of local vaccination providers.

Methods: The RRT was demonstrated to staff at 7 Oregon counties and feedback was solicited via comments and a structured survey.

Results: The RRT received strong support. Attendees identified several uses for RRT data, including outbreak response and ongoing intervention efforts, and they pointed to areas for further development.

Conclusions: The success of the RRT demonstrations illustrates that a well-populated immunization information system can contribute to preparedness work well beyond current standards.
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Keywords: vaccination, preparedness, outbreak, response

Vaccine-preventable disease (VPD) remains a concern for emergency preparedness, and linking vaccination activities to disaster management remains a cornerstone of preparedness planning.[1] In Oregon in 2016, 828 cases of VPD were reported (neither varicella nor influenza are reportable in Oregon).[2]

The Oregon Immunization Program (OIP) supports local VPD outbreak response, in part through the provision of data from Oregon's Immunization Information System (IIS), ALERT IIS. IIS are confidential, population-based databases that record all immunization administration by participating providers to persons residing within a geopolitical area. ALERT IIS data support local response in 2 primary ways: by confirming immunization status among persons exposed to VPD and by measuring vaccination uptake after intervention. Because these services require that the exposed population be defined or an intervention be undertaken, they can take days or even weeks to accomplish.

The OIP seeks to improve outbreak response support through development of a new data tool. However, public health resources are constrained,[3] and infrastructure created for a response may be dismantled once an outbreak is over.[4] Therefore, 3 goals for a new tool were identified: (1) make greater use of data, (2) ensure sustainability by using only available resources, and (3) deliver useful data to local responders within 2 hours of notification of an outbreak to complement the longer-term support already provided.

To our knowledge, no models exist for such a product. We developed the Oregon Rapid Response Tool (RRT) to respond to a local measles scenario developed to illustrate its features. We describe the RRT and the results of an evaluation of its utility in 7 Oregon county health agencies.

METHODS

Data for the RRT were extracted largely from ALERT IIS. Compared to Oregon clinic records, ALERT IIS child immunization histories are more than 97% complete.[5] Additionally, OIP houses data for Oregon schools and children's facilities (preschools, Head Start, and certified childcare programs), including annual site-level population counts, vaccination information, and counts of students exempt from vaccination requirements. In Oregon, nonmedical exemptions (NME) can be granted for any immunization required for attendance. Sites maintain lists of exempted students (and from what vaccines they are exempted) in case of a site-specific VPD report, so susceptibles can be excluded.[6]

The RRT consists of code to extract ALERT IIS data (for clients under age 19 [ie, children]) that are readily available, can be formatted automatically, and may be of value to local responders. Data include up-to-date

vaccination coverage estimates, identification of comparatively underimmunized populations, and lists of vaccination providers who may be able to assist with intervention efforts.

Estimates were needed for population counts and coverage rates by age. Although ALERT IIS is an excellent source of vaccination data, challenges exist when using ALERT IIS data for rate denominators or population estimates. ALERT IIS is populated from birth records, including birth certificate number. From birth through age 3, counts of records containing a birth certificate number reasonably estimate the population. Over time, some children move out of Oregon, which is not reported to ALERT IIS. Simultaneously, children move into Oregon, and as they receive vaccinations and are thereby incorporated into ALERT IIS, client counts grow. Over time, age-specific counts in ALERT IIS can exceed the number residing in Oregon, particularly for older children.[7]

Three data sources were used to estimate county-level populations by age. The Oregon Department of Education (ODE) publishes annual counts of students attending ODE schools by county and grade (K–12).[8] ODE students account for approximately 91% of school-aged children annually in Oregon (personal correspondence, Stacy de Assis Matthews, MPH, OIP School Law Coordinator, September 5, 2017). For denominators, we used ODE data for grades 1 through 12 from school year 2014-2015 and assigned a year of age to each grade level: grade 1 equaled age 6, grade 2 equaled age 7, etc. We used data reported to OIP for the same school year to adjust counts for non-ODE children. For example, for school year 2014-2015, the total school population for Clatsop County reported to OIP was 3.2% higher than that reported by ODE. Each grade/age count in Clatsop County was therefore increased by 3.2%. Also, many kindergarten and preschool facilities are not administered by ODE, so counts of kindergarten students (age 5) came exclusively from OIP data. Counts for children age 4 were adjusted by one-half the percentage difference between ODE and OIP figures. For children under age 4, counts of ALERT IIS records with a birth certificate number were used. Table 1 illustrates population calculations.

A child's latest reported zip code in ALERT IIS determined county of residence. Methods to maintain zip code–level population differences are described in the Online Supplement.

For RRT development, a measles scenario was used because any report would constitute a serious public health threat and because of the ease of defining coverage. We referenced the Advisory Committee on Immunization Practices (ACIP) recommendations for vaccination timing by age.[9] All children aged 2 or older receiving 2 or more measles-containing vaccines were considered fully immunized, a more conservative requirement than the ACIP recommendation because during an outbreak, caution would be exercised to ensure full vaccination for exposed persons. Correct vaccination spacing was assumed for convenience. Table 2 illustrates how RRT vaccination data were presented during demonstrations.

The age groups shown in Table 2 are commonly used by OIP to segment populations. Measles vaccination is not required for individuals younger than age 1, yet tables included these counts for completeness. Data for vaccination providers, schools, and children's facilities included site name; address; zip code; telephone; and, for schools, NME rates. Rates were not shown for children's facilities because for some, rates aren't available. All providers reporting a vaccine administration to ALERT IIS in the prior year were included.

The RRT was demonstrated in local public health agencies, which were selected on the basis of response capacity, size of public health infrastructure, recent outbreak experience, presence of a vaccine-hesitant community, or sharing populations

TABLE 1

Determination of Population Estimates by Age and County

Age (years)[a]	Formula for Deriving County by Age	Corresponding Grade
>1	BCN[b]	N/A
1>2	BCN	N/A
2>3	BCN	N/A
3>4	BCN	N/A
4>5	BCN × 0.5(OIP %)[c,d]	N/A
5>6	OIP	K
6>7	ODE[e] × OIP %	1
7>8	ODE × OIP %	2
Etc…	ODE × OIP %	3…

[a]Calculated as age-in-days at date of a request for rapid response data.
[b]BCN: count of ALERT IIS records with a birth certificate number by age by county.
[c]OIP: count of kindergarten students reported to the Oregon Immunization Program by county.
[d]OIP %: percent difference between county school population and Oregon Department of Education figures.
[e]ODE: Oregon Department of Education.

TABLE 2

Presentation of Vaccination Data to Counties

Age Group	Vaccination Status by Age Group (Zero, Partial, Full) Population Estimates			Coverage Rate		
	Zero Doses	One Dose	> One Dose	Zero Doses	One Dose	> One Dose
0<1	n	N/A	N/A	%	N/A	N/A
1<2	n	n	n	%	%	%
2<4	n	n	n	%	%	%
4<6	n	n	n	%	%	%
6-10	n	n	n	%	%	%
11-18	n	n	n	%	%	%

n = count, % = percent

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with bordering counties or states. RRT data were presented in printed tables for convenience; mapping options are not currently automated in OIP. Following demonstrations, evaluation surveys were distributed (see Online Supplement). Attendees could also make comments throughout demonstrations.

Because audiences were public health responders, a higher level of analytical comprehension was assumed. The measles scenario gave contagious individuals maximum mobility throughout the county to stimulate zip code–level coverage comparisons. Each county's data were modified so coverage in 1 zip code was low. School data were modified so that the NME rate of 1 school was high. To contrast data layers, the high-NME school was located in a zip code with high vaccination coverage. Provider data were presented unmodified. Presentation staff included a presenter and a note-taker. Following demonstrations, each wrote summaries independently, then compared notes. Where discrepancies existed, the note-taker's observations took priority.

RESULTS

Thirty-nine staff members from 7 (of Oregon's 34) local public health agencies attended demonstrations; group size ranged from 3 to 10. Demonstrations lasted 90 minutes, except for 1 that lasted 60 minutes. The RRT was operationalized separately for each demonstration, and data were ready for use within 2 hours using only existing resources.

Survey results and attendee feedback were broadly positive. Attendees said RRT output could help responders understand an outbreak's potential scope and allow comparison of data with what was believed to be true. Attendees said RRT output might improve response consistency across outbreaks, make investigations more thorough, guide information gathering, and align clients needing vaccinations with providers (eg, proximate or age-related vaccinators). They felt RRT data could help prioritize areas for investigation and deliver interventions faster to vulnerable areas. Long-term benefits could include contributing to data-use standards for outbreak response. Attendees noted the RRT might also assist with interventions in vulnerable communities by measuring outcomes before and after an intervention.

Conversely, some noted that the primary goal of an outbreak investigation is to identify individuals exposed to infection, and contextual information—such as that from the RRT—may not assist this effort. Outbreaks may not conform to age or geographic categories. The RRT may occupy a "middle ground" of response, between a contained and a widespread outbreak, diminishing its broader utility.

Some attendees lacked experience in outbreak response, making it difficult for them to assess the RRT's impact. Others noted that some aspects—such as working with schools—were already in place, albeit in different forms. The RRT data format was unfamiliar to attendees, although it was noted that without the RRT, much of its data would still be sought.

Some attendees found the tables overwhelming. A need for analytical support was raised for counties lacking such resources or if other duties took precedence for staff. Adding information for providers (eg, total vaccinations administered) and for schools and children's facilities (eg, population counts) was suggested, along with improvements for data sorting and visualization and the inclusion of adult data.

DISCUSSION

The RRT was developed to assist local public health agencies in disease-control efforts. Events such as the H1N1 pandemic[10] illustrate the value of an IIS collaborating in emergency preparedness. This evaluation demonstrates that to be employed with good effect, such support need not wait for the next outbreak but could be incorporated into routine disease-control activities. Overall response to RRT demonstrations was favorable; in every demonstration immediate uses for RRT data were identified. As responders become more familiar with RRT—and as it improves—comfort and therefore use should increase. Future benefits may exceed expectations if it is used for work such as targeted interventions.

Outbreak responders did not possess greater analytic comprehension as was assumed. One potential benefit of RRT could be to maintain response continuity in light of staffing changes or lack of analytical expertise. Integrating RRT data analysis into state-level support should be considered.

Inclusion of adult data should also be considered. Resources such as data mapping, if available, should improve the RRT. The RRT could serve as a focal point for dialogues about which data and data formats would best aid county preparedness efforts.

Limitations

Not all local public health agencies in Oregon participated. Results may be specific to a measles scenario. The potential for researcher bias was addressed as described in the methods. Each county recruited attendees, so selection bias may have affected results. RRT output was shared via paper copies, which may have affected responses.

CONCLUSION

All goals in developing the RRT were met, though with caveats. Greater data use was achieved sustainably and delivered to demonstration attendees within 2 hours. While the precise, immediate role of RRT output in outbreak response didn't crystalize, this evaluation demonstrates that a well-populated IIS such as Oregon's can identify vulnerable populations and utilize the rapid collection of vaccination data to produce effective, versatile products without event-specific funding. As the first known tool of this type,

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Oregon's RRT stretches the boundaries of IIS support capabilities and invites the pursuit of creative solutions to the challenges of identifying VPD vulnerability and responding effectively.

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Institutional Review Board Exemption

This paper was determined to be exempt from the Oregon Public Health Institutional Review Board process.

Supplementary Material

To view supplementary material for this article, please visit https://doi.org/10.1017/dmp.2018.130

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