Evaluation of the Novel Respiratory Virus Surveillance Program: Pediatric Early Warning Sentinel Surveillance (PEWSS)

Patricia A. Armour, MPA, MT(ASCP)[a]
Linh M. Nguyen, PhD, MPH[b]
Michelle L. Lutman, MPH[b]
John P. Middaugh, MD[b]

ABSTRACT

Objectives. Infections caused by respiratory viruses are associated with recurrent epidemics and widespread morbidity and mortality. Routine surveillance of these pathogens is necessary to determine virus activity, monitor for changes in circulating strains, and plan for public health preparedness. The Southern Nevada Health District in Las Vegas, Nevada, recruited five pediatric medical practices to serve as sentinel sites for the Pediatric Early Warning Sentinel Surveillance (PEWSS) program.

Methods. Sentinel staff collected specimens throughout the year from ill children who met the influenza-like illness case definition and submitted specimens to the Southern Nevada Public Health Laboratory for molecular testing for influenza and six non-influenza viruses.

Results. Laboratory results were analyzed and reported to the medical and general communities in weekly bulletins year-round. PEWSS data were also used to establish viral respiratory seasonal baselines and in influenza vaccination campaigns. The surveillance program was evaluated using the Centers for Disease Control and Prevention's (CDC's) Updated Guidelines for Evaluating Public Health Surveillance Systems. PEWSS met three of six program usefulness criteria and seven of nine surveillance system attributes, which exceeded the CDC Guidelines evaluation criteria for a useful and complete public health surveillance program.

Conclusion. We found that PEWSS is a useful and complete public health surveillance system that is simple, flexible, accessible, and stable.

[a]Southern Nevada Public Health Laboratory, Las Vegas, NV

[b]Southern Nevada Health District, Las Vegas, NV

Address correspondence to: Patricia A. Armour, MPA, MT(ASCP), Southern Nevada Public Health Laboratory, PO Box 3902, Las Vegas, NV 89127; tel. 702-759-0842; fax 702-759-1444; e-mail <armour@snhdmail.org>.

Influenza infections are associated with recurrent epidemics and the associated widespread morbidity and mortality.[1,2] Monitoring and surveillance of the seasonal circulation of respiratory illness is necessary for community preparedness, public health management, and minimizing community impact.[3,4] In response to the influenza A (H1N1) 2009 pandemic, the Southern Nevada Public Health Laboratory (SNPHL) collaborated with the Southern Nevada Health District (SNHD) to develop a medical practice and laboratory-based influenza surveillance system to identify the occurrence of influenza virus in the Southern Nevada community.

Our surveillance program focused on collecting samples from ill children, followed by molecular laboratory testing. This approach differed from passive surveillance systems for laboratory-confirmed cases of influenza, which are often dependent on the health-care provider's decision to test and the type of test ordered.[5] Thus, a surveillance system more robust than passive surveillance is necessary to provide the clear and consistent reporting that forms the basis for evidence-based public health and medical practice.

The Enhanced Pediatric Influenza Surveillance (EPIS) program started in June 2009 and enlisted local pediatric practices as sentinel sites to provide nasal swab samples for influenza testing. The surveillance system was based on the assumption that pediatric patients, due to their susceptibility to respiratory diseases[6] and increased visits to health-care providers,[7] would provide early indications of influenza activity and trends in the broader community. Test results data were analyzed and reported back to the community in the form of weekly bulletins.

The results of the EPIS pilot project from 2009–2010 were highly encouraging. The participating pediatricians fully supported the project and collected appropriate specimens from children who presented with acute upper respiratory illness. The information obtained from analysis of the EPIS data proved valuable in creating public messaging during the influenza A (H1N1) 2009 pandemic, and in SNHD efforts to encourage the public to receive the annual influenza vaccine.

In 2010, an Association of Public Health Laboratories (APHL) Innovations in Quality Public Health Laboratory Practice grant enabled the SNPHL to partially fund the expansion of the EPIS program. With the addition of six non-influenza viruses[6] (human metapneumovirus [HMPV], adenovirus, respiratory syncytial virus [RSV], and parainfluenza 1, 2, and 3), the name was changed to Pediatric Early Warning Sentinel Surveillance (PEWSS), and it was established as a year-round program. Because the program used the EPIS project design, the pediatricians who participated in the EPIS project also consented to participate in PEWSS.

We evaluated PEWSS in 2011 using the Centers for Disease Control and Prevention (CDC) Updated Guidelines for Evaluating Public Health Surveillance Systems (hereafter, Guidelines).[8] In this article, we describe the PEWSS program design and implementation and show the results of the evaluation.

METHODS

Program design

The design of the PEWSS program was based on the following assumptions:

- The laboratory-based surveillance system will detect respiratory viral pathogens (RVPs) more quickly and accurately than passive surveillance systems.
- Early detection of these viruses could provide important information to clinicians about locally circulating viral pathogens to enhance clinical treatment decisions.
- Detecting RVPs among children is a valid indicator of virus activity in the community.
- Knowledge of respiratory virus activity in the community provides valuable information for public health prevention and education.
- Molecular testing is consistently superior to rapid testing in both sensitivity and specificity.
- Educating program participants on appropriate specimen collection and storage will enhance the laboratory's ability to detect viral pathogens.
- Sentinel sites will follow program protocols and provide sufficient samples that will allow the surveillance system to succeed in its objectives.
- Simple enumeration of influenza cases has little potential to impact patient outcomes, public health, or medical decisions.

Sample collection

Each week, sentinel site staff collected nasal swab samples from the first 10 children who presented at the facility with acute respiratory illness characterized by a fever (≥100˚F) and one or both of two symptoms, cough and/or sore throat. We used a flocked nasal swab for sample collection due to its comparability with nasopharyngeal swabs[9] and superior yield of epithelial cells for viral testing.[10] To ensure that SNPHL testing capacity was not exceeded, 10 individual sample col-

lection kits were provided to each PEWSS site every week. The standard kits included flocked nasal swab, viral transport media (VTM), and an SNPHL test requisition. If needed, SNPHL provided the sentinel site with a small refrigerator to store collection kits prior to and after sample collection. During initial site visits, we instructed clinic staff on proper nasal swab collection techniques. Following sample collection, the flocked swab was placed in the VTM and mixed. The entire sample was refrigerated until pickup by the SNPHL courier, which occurred three times per week. A designated person coordinated sample collection and test reports at each sentinel site.

There was no charge to the physician, the patient, or the patient's insurance for sample collection and testing performed for the PEWSS program.

Sample analysis

At the SNPHL, 100 microliters (μL) of each VTM sample were extracted on the Roche Compact analyzer using the Roche MagNA Pure Compact Nucleic Acid Isolation Kit 1 with external lysis (Roche Applied Science, Indianapolis, Indiana). Each extracted nucleic acid sample was analyzed on the Applied Biosystems® 7500 Fast DX Real-Time PCR Instrument (Life Technologies Corporation, Carlsbad, California) using the CDC[11] and APHL real-time reverse transcriptase polymerase chain reaction protocols for influenza, HMPV, adenovirus, RSV, and parainfluenza 1, 2, and 3.

Results reporting

Each PEWSS site received a written report for the samples submitted from its site. The SNHD prepared a weekly aggregate report of the samples analyzed from the previous week and distributed these weekly PEWSS bulletins to local health-care providers and the general public by fax, e-mail, and website.

The results of the weekly molecular testing were also submitted to the CDC National Respiratory and Enteric Virus Surveillance System using a Web-based reporting system.

Influenza viral resistance and surveillance testing

As one of 85 U.S. World Health Organization collaborating laboratories participating in virologic surveillance for influenza, the SNPHL submitted a subset of influenza-positive samples to CDC for further characterization, including genetic analysis (sequencing), antiviral resistance testing, and antigenic characterization. The results of the additional CDC testing performed on the samples submitted by the participating laboratories were used to identify the influenza strains to include in the 2011–2012 influenza vaccine. SNPHL did not report the results of the CDC testing back to the submitting facility.

Program implementation

Five pediatric sentinel sites participated in the PEWSS program. The sites were chosen based on their receptiveness to participating in the pilot project, the volume of clients, and the economic diversity of the clinic patients. Program enrollment was voluntary and physicians could choose to stop participating at any time. Active communication with each sentinel site occurred through weekly visits by SNPHL couriers, phone notifications of positive results, and quarterly site visits.

Program evaluation

The PEWSS program (Unpublished master's thesis, Lutman ML. Evaluation of the pilot program, Pediatric Early Warning Sentinel Surveillance (PEWSS) program, and its efficacy in monitoring pediatric illness in Clark County, Nevada. Las Vegas: University of Nevada, Las Vegas; 2011) was evaluated in 2011 using the CDC Guidelines.[8] We examined the program's operational period from June 1, 2010, to May 31, 2011. The CDC Guidelines recommend using the following six tasks to evaluate a public health surveillance system, with a focus on how well the system operates to meet its purpose and objectives.

Task A: engage the stakeholders in the evaluation. PEWSS stakeholders were defined as those who receive the weekly information (the general public, which includes medical health professionals; the scientific community; and the lay population) and those who provide the data (sentinel site staff). We created two surveys—one for the general public (Task A.1) using SurveyMonkey®,[12] and the other for the sentinel sites (Task A.2). The electronic link to the general public survey was e-mailed or faxed along with two weekly PEWSS bulletins, and the sentinel site survey was in paper format. Participation in the survey was voluntary.

Task B: describe the surveillance system evaluated. A description of the PEWSS system, which included program objectives, resources, activities, outputs, and outcomes, was developed. The funding sources and cost analysis to run the program were also calculated.

Task C: focus the evaluation design. We identified our agency's priorities for evaluating the system. We determined whether the specific purpose of PEWSS was understood by all the stakeholders in the evaluation and whether stakeholders were committed to using the information generated from the program. We conducted a literature review to find sentinel-based surveillance programs similar to PEWSS.

Task D: gather credible evidence regarding surveillance system performance. According to the CDC Guidelines, a surveillance system might be considered useful if it satisfactorily addresses at least one of the following questions. Briefly, does the system:

1. Detect diseases, injuries, or adverse or protective exposures of public importance in a timely way?
2. Detect trends that signal changes in the occurrence of disease, including the detection of epidemics (or outbreaks)?
3. Lead to improved clinical, behavioral, social, policy, or environmental practices?
4. Provide estimates of the magnitude of morbidity and mortality, and the identification of factors, of the event under surveillance?
5. Permit assessment of the effect of prevention and control programs? or
6. Stimulate research intended to lead to prevention or control?

The Guidelines also define nine attributes that affect the usefulness and completeness of a public health surveillance system. We rated PEWSS against the following attributes on a scale of high, medium, low, or not applicable:

- Simplicity—ease of program operation
- Flexibility—adaptability to changing information needs
- Acceptability—willingness to participate in the program
- Stability—system reliability (i.e., the ability to collect, manage, and provide data properly without failure) and availability (ability to be operational when it is needed)
- Data quality—completeness and validity of the data
- Timeliness—speed between steps in a system
- Representativeness—the occurrence of a health-related event over time and its distribution in the population
- Sensitivity—proportion of cases of a disease detected by the system
- Predictive value positive—proportion of reported cases that actually have the health-related event under surveillance

Tasks E and F: justify and state conclusions and recommendations, and ensure the use of evaluation findings. We employed our ratings of PEWSS, along with the results of the stakeholder surveys, to help us determine if the system is addressing an important public health problem, meeting its objectives, and identifying how evaluation findings will be distributed.

RESULTS

Program implementation

The Table shows the molecular test results of the 872 total specimens provided by the five sentinel sites during the evaluation period of June 1, 2010, through May 31, 2011. Respiratory viruses were detected in 503 (57.7%) of the specimens. Of these specimens, the viruses detected most often were influenza A or B (n=196, 39.0%) and RSV (n=100, 19.9%). There were 29 (5.8%) coinfections, where multiple viruses were detected in a sample. These viruses were counted as positive results in their respective test categories.

Program evaluation

Task A: engage the stakeholder in the evaluation.

Task A.1: survey of the general public stakeholders. Weekly PEWSS bulletins were well received by the general public stakeholders, and their regard for the program was high. Respondents to the public survey included physicians, nurses, laboratory staff, educators, administration staff, and day care providers. The public stakeholders were located in different areas of practice settings, such as hospitals, clinics, private offices, and small and large group practices. Of the 19 public stakeholder survey respondents, 17 (89.5%) replied that they frequently read the weekly PEWSS report. Of these respondents, 12 (70.6%) and five (29.4%) respondents reported reading the reports weekly and frequently, respectively.

Table. Respiratory virus distribution (n=872) in Clark County, Nevada, determined through PEWSS testing from June 1, 2010, through May 31, 2011

Testing results	N *(percent)*
Negative	369 (42.3)
Total positive	503 (57.7)
Adenovirus	59 (11.7)
Human metapneumovirus	29 (5.8)
Human parainfluenza 1	16 (3.2)
Human parainfluenza 2	26 (5.2)
Human parainfluenza 3	77 (15.3)
Influenza A	117 (23.3)
Influenza B	79 (15.7)
Respiratory syncytial virus	100 (19.9)
Coinfections[a]	29 (5.8)

[a]Multiple viruses detected in a sample. These viruses were counted as positive results in their respective test categories.

PEWSS = Pediatric Early Warning Sentinel Surveillance

More than 80% (range 82%–88%) of the public survey respondents rated the information within the PEWSS bulletins as very timely, accurate, relevant, and useful. All public respondents reported that they use the PEWSS bulletin for general information on circulating viruses in the community.

Among the 17 public respondents who answered regarding PEWSS bulletin usage, six (35.3%) said they never use the information to guide clinical diagnosis, nine (52.9%) said they never use the information to guide empirical treatment, and 11 (64.7%) said they never use it to guide laboratory testing. These high percentages were likely due to the number of public respondents who were not physicians and did not diagnose or treat patient illness.

The public stakeholders reported that the most useful information provided by the PEWSS bulletins was the weekly update on the current viral pathogens circulating in the community. Their suggested changes to the weekly report included adding more sentinel sites, changing graph displays, and adding national influenza data or more technical information regarding the surveyed pathogens. Changes were made to the weekly PEWSS bulletin to accommodate some of these suggestions (data not shown).

Task A.2: survey of sentinel site stakeholders. Nineteen responses were received among the five sentinel sites. Eight of the sentinel respondents (42.1%) were physicians. Almost all sentinel respondents reported that they strongly agreed or agreed that they received prompt responses from surveillance program administrators, test requisition forms were easy to complete, automatic courier transport of specimens was convenient, patient reports and the weekly PEWSS bulletins were easy to understand, sentinel site workers felt competent in collecting the specimens, and they would recommend their colleagues to partner with the SNPHL and the SNHD (data not shown).

Sentinel sites primarily received their weekly PEWSS bulletins by fax and e-mail, with eight (42.1%) and four (21.1%) respondents indicating they read them every week or frequently but not every week, respectively. The majority of sentinel respondents (n=15, 78.9%) said they use the PEWSS bulletins for general information, and eight (42.1%) said they use the information to guide their clinical diagnoses. Nearly all sentinel respondents thought the information in the weekly PEWSS bulletins was timely, accurate, relevant, useful, and easy to read and understand. Sentinel staff members who collected the PEWSS specimens were physicians, nurses, or medical assistants. Sentinel staff also reported they used the weekly bulletins to show their patients the viruses circulating in the community and to reinforce the idea of not using antibiotics when viruses were circulating widely (data not shown).

Task B: describe the surveillance system evaluated. We created a logic model (Figure 1) to explain the program objectives, resources, activities, outputs, and outcomes. The PEWSS program was funded through a combination of federal grant and local property tax revenues. Personnel costs per year included $50,220 and $14,961 for laboratory and epidemiology support, respectively, for a total annual personnel cost of $65,181. The laboratory calculated the average cost of sample analysis, including reagents and supplies, as $55 per sample. A total of 872 samples were tested during the evaluation period. The total testing cost was $47,960 ($55 × 872 samples/year). The total annual operating cost (personnel and supplies) for the program was $113,141 (data not shown).

Task C: focus the evaluation design. The priority system attributes identified by our agency for evaluating the PEWSS system were simplicity, flexibility, acceptability, and stability. These attributes were based on our main program objectives (Figure 1), which included reporting respiratory virus test results data to the community and participating in the CDC national influenza surveillance program. Additionally, the CDC Guidelines proposed that meeting these four specific attributes may indicate that a surveillance system will likely be more useful and complete for public health action. Our rating of these four priority attributes as "high" was in agreement with the stakeholders' ratings of the program. Stakeholders were committed to using the information generated from the system. The majority of stakeholders read the PEWSS bulletins every week to update themselves on circulating respiratory pathogen trends, and some also incorporated the PEWSS data to care for patients at their medical practices.

We did not identify any program similar to PEWSS in the literature review, particularly ones that employed similar objectives and test menus. PEWSS appeared to be a unique public health surveillance program.

Task D: gather credible evidence regarding surveillance system performance. As presented in the CDC Guidelines, a surveillance system may be considered useful if it satisfactorily addresses at least one of six questions. The following results show that PEWSS exceeded this program usefulness criterion by satisfactorily answering three of six program usefulness questions in the Guidelines. The PEWSS program:

1. Detected current circulating respiratory pathogens, which may help to increase the awareness of prevention measures to limit the spread of these pathogens.

Figure 1. Program logic model showing program objectives, resources, activities, and outputs: PEWSS program, Clark County, Nevada, June 1, 2010–May 31, 2011

Objectives	• Provide laboratory surveillance data to track respiratory diseases within the community. • Provide early detection of seasonal RVPs. • Report findings to the health-care community, public health partners, and general public. • Participate in the CDC national influenza surveillance systems.
Resources	• Funding to support program • Clinical laboratory scientists • Epidemiologists • Administrative support staff • Courier services • Short- and long-term sample storage • Pediatrician sentinel sites • Laboratory supplies and reagents • Laboratory equipment • Validated testing methods • Trained and competent sentinel site and laboratory staff
Activities	• Secure funding. • Recruit sentinel sites. • Train sentinel sites on program procedures, specimen collection, and storage. • Encourage program compliance through direct contact with sentinel site staff. • Collect patient samples per protocol. • Supply sentinel site with specimen collection kits. • Transport nasal swab samples to SNPHL three times per week. • Access, extract, and analyze samples at SNPHL. • Store samples at SNPHL for possible future testing. • Review individual patient results and investigate cases if indicated. • Analyze data and generate reports. • Provide selected samples to CDC for additional characterization and resistance testing. • Perform periodic evaluation of sentinel sites and surveillance system (by OOE and SNPHL).
Outputs	• OOE analyzes results for public health planning, decision making, and communication of others (i.e., incidence, epi curves, and risk factor analysis). • Sentinel site receives individual patient laboratory results for clinical decision making and analysis. • Other agencies (CDC, state) and the medical community receive weekly summary data and other analyses as needed. • The public receives news and advice via SNHD website, public service announcements, and technical bulletins about RVP activity.
Short-term outcomes	• Early detection of emergence of seasonally expected RVPs • Early detection of RVPs not often detected, including novel influenza viruses • Understanding trends of common RVPs, including prevalence, severity, and mutation • Availability of samples for additional characterization at CDC
Middle-term outcomes	• Understanding trends of less common RVPs (besides influenza and RSV) • Identification and impact of viral coinfections
Long-term outcomes	• Better understanding of seasonality of RVPs, including influenza and RSV • Potential to identify emerging or novel respiratory viruses • Potential to strengthen community partnerships • Potential to develop a standardized process for laboratory-based surveillance of infectious diseases in the community • Collection of molecular data for long-term trend analyses

PEWSS = Pediatric Early Warning Sentinel Surveillance

RVP = respiratory viral pathogen

CDC = Centers for Disease Control and Prevention

SNPHL = Southern Nevada Public Health Laboratory

OOE = Office of Epidemiology

SNHD = Southern Nevada Health District

RSV = respiratory syncytial virus

2. Developed trends for each pathogen under surveillance. Abnormal occurrences of surveyed pathogens were detected, and the information was relayed weekly to the community to notify people of increased seasonal cases or a potential outbreak.
3. Led to improved clinical, behavioral, social, policy, or environmental practices. We intended to use the surveillance data to inform health professionals about respiratory pathogens circulating in the community. This information may help clinicians inform their patients of the viral etiology of the diseases, which may reduce the demand for antibiotics to treat these infections. The weekly PEWSS bulletins also emphasize the need for public health prevention during peak pathogen circulation.

However, the PEWSS program did not provide estimates of the magnitude of morbidity and mortality related to circulating respiratory diseases, or identify factors associated with the event; permit assessment of the effect of prevention and control programs; or stimulate research intended to lead to prevention or control.

We rated the nine public health surveillance system attributes listed in the CDC Guidelines on a scale of low, medium, high, or not applicable. Six of the nine attributes were rated as high, one attribute was rated medium, and two attributes were not applicable to the program objectives. All four of our agency's priority attributes of simplicity, flexibility, acceptability, and stability were rated as high.

- Simplicity was rated high: Because of the ease of collection and transport of specimens, the training of sentinel site staff was minimal. The case definition was easily understood by the sentinel site staff. The weekly reports to the community were simple and easy to understand.
- Flexibility was rated high: The PEWSS program can easily expand to include additional sentinel sites and/or pathogens for surveillance.
- Acceptability was rated high: All sentinel sites expressed their eagerness to continue their participation in the program. Their enthusiasm and dedication earned each of the sites the 2011 SNHD Public Health Heroes Award. The partnership between the laboratory and epidemiology to develop and maintain the program was a significant factor in the program's acceptability.
- Stability was rated high: The systems that provide support to the PEWSS program were very stable. Laboratory delays were rare, courier pickup of specimens was consistent, and reports were always distributed weekly throughout the year.
- Data quality was rated high: The data quality of the PEWSS program was complete and valid. Minimal patient information was solicited, which helped to minimize clerical error.
- Timeliness was rated high: Specimens for analysis were collected three times a week. Laboratory testing was performed at least once a week. Results were analyzed and reports summarizing the surveillance results were distributed to the community once a week.
- Representativeness was rated medium: Samples from five sentinel sites were used to generate data. However, sentinel-based surveillance does not allow the results to be generalized to the entire population of pediatrics in the community.
- Sensitivity and predictive value positive attributes were not applicable to the PEWSS program.

Tasks E and F: justify and state conclusions and recommendations, and ensure the use of evaluation findings. We successfully established the PEWSS program, a sentinel surveillance system to monitor circulating respiratory diseases throughout the year in Clark County, Nevada. The CDC Guidelines were used to assess the usefulness and completeness of the surveillance system.

The CDC Guideline tasks, evaluation activity, and evaluation results are summarized in Figure 2. The results (Task D) showed that PEWSS was an effective system for accurately capturing and relaying information about the surveyed pathogens to the community, and stakeholders were committed to using the information provided by the program. PEWSS exceeded the CDC Guidelines minimum level of system usefulness (addressing one of six program usefulness questions) by satisfactorily addressing three questions. Results also revealed that the PEWSS public health surveillance system was simple, flexible, operationally stable, timely, and well accepted by stakeholders. As defined by the CDC Guidelines, these attributes indicate that the system will likely be more useful and complete for public health action.

Although they also cause substantial illnesses,[6,13,14] non-influenza viruses (other than RSV[15]) under surveillance by the PEWSS program were not reportable illnesses. PEWSS was a unique system, as there was no comparable surveillance system that monitored as many circulating viruses and was as timely in delivering the information back to the community. We also implemented a hospital- and coroner-based sentinel system that followed the PEWSS model to monitor for

Figure 2. Summary of CDC Guidelines[a] tasks with related program evaluation activities and results: PEWSS program, Clark County, Nevada, June 1, 2010–May 31, 2011

Guidelines task	*Evaluation activity*	*Evaluation results*
Task A: Engage the stakeholders in the evaluation.	Conduct a general public survey. Conduct a sentinel site survey.	19 general public surveys 19 sentinel site surveys
Task B: Describe the surveillance system to be evaluated.	Develop logic model. Calculate annual costs.	Logic model developed Annual personnel and testing costs = $113,141
Task C: Focus the evaluation.	Identify SNHD priority attributes. Evaluate stakeholder understanding of objectives and acceptability. Perform a literature review.	SNHD priority system attributes are simplicity, flexibility, acceptability, and stability. Stakeholders understand program objectives with high acceptability. No comparable program was identified.
Task D: Gather credible evidence regarding the performance of the surveillance system.	Evaluate level of usefulness. Rate PEWSS program attributes.	Exceeded CDC Guidelines minimum usefulness questions (one of six questions) by answering three questions. Simplicity, flexibility, acceptability, stability data quality, and timeliness were rated high. Representativeness was rated medium. Sensitivity and PVP ratings were not applicable to the program.
Task E: Justify and state conclusions and make recommendations.	Evaluate and provide recommendations.	PEWSS met seven of nine CDC Guidelines public health surveillance system attributes, which met and exceeded the agency's four priority attributes. Recommendation to continue the program with possible test menu expansion.
Task F: Ensure the use of evaluation findings and share lessons learned.	Evaluate and provide lessons learned.	Survey findings resulted in revision of the weekly report. Program funding continued for the next two years. Quarterly site visits provide ability to share lessons learned with sites.

[a]German RR, Lee LM, Horan JM, Milstein RL, Pertowski CA, Waller MN. Updated guidelines for evaluating public health surveillance systems. MMWR Recomm Rep 2001;50(RR-13):1-35.

CDC = Centers for Disease Control and Prevention

PEWSS = Pediatric Early Warning Sentinel Surveillance

SNHD = Southern Nevada Health District

PVP = predictive value positive

viruses that cause severe respiratory illnesses. Future plans include expansion of the PEWSS test menu to survey rhinovirus,[16,17] coronavirus,[18,19] and pertussis, a reemerging public health threat.[20]

DISCUSSION

Public health surveillance systems are developed to address a specific public health need. The data collected from these systems have a wide variety of uses including implementing public health action, monitoring disease trends, and planning programs. Periodically, these systems should be evaluated to ensure that resources and personnel are efficiently used to meet the program objectives and that the system effectively monitors the specific public health issue.[8] Use of a standardized evaluation format ensures that the appropriate system attributes are assessed and that the results can be used for follow-up evaluations. The CDC Guidelines provided a standardized format for our evaluation of the PEWSS program. We successfully evaluated the program for all six tasks listed in the CDC Guidelines.

Limitations

This evaluation was subject to several limitations. The first limitation was that samples collected from sentinel surveillance were not representative of the general public.[5] Samples were obtained only from ill pediatric patients, and results were generalized among residents of the whole community. Although there are advantages to sentinel surveillance systems,[5] the program sensitivity and predictive value positive could not be calculated. However, these attributes were not the objectives of PEWSS, and we did not seek to measure the burden of diseases that were associated with the surveyed viruses.

Second, the cost of starting and maintaining a surveillance system may serve as a potential hurdle

for public health agencies that want to institute such programs. Although these expenses may have been comparatively high, grants were used to partially offset the program's cost. Because the results of this evaluation indicated that PEWSS was a valuable surveillance system that fostered relationships between public health agencies and the medical and general communities, the SNHD also committed funds toward the continuation of the program.

CONCLUSION

Our evaluation indicated that PEWSS met three of six program usefulness criteria and seven of nine surveillance system attributes, which exceeded the CDC Guidelines evaluation criteria for a useful and complete public health surveillance program. PEWSS monitored the respiratory viruses circulating in our community, was well accepted by the health-care and general community, and met its purpose and objectives.

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