



Improving Timeliness of Communicable Disease Reporting in Arizona: Program Evaluation Perspective

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BACKGROUND

Arizona Department of Health Services' (ADHS) Bureau of Epidemiology and Disease Control has recently focused more attention on program evaluation, in part prompted by the CDC's Epidemiology and Laboratory Capacity cooperative agreement.

Program evaluation is a well-known practice, using various types of data to understand a program's performance and improve its outcomes, yet it is under-utilized within public health communicable disease programs. One evaluation focus has been on evaluating outcomes of implementing electronic laboratory reporting (ELR), which is anticipated to improve timeliness of disease reporting.

Electronic Laboratory Reporting (ELR)

- Timely and accurate reporting of case information to public health authorities is key to effectively and quickly initiating case investigations; detecting aberrations, clusters, and outbreaks; and ultimately more expeditiously enacting any necessary disease control measures. Laboratory reporting is central to this process.
- Technological changes over the last decade have allowed for a transition from traditional methods of laboratory reporting (mail, fax, and telephone) to electronic laboratory reporting (ELR).
- Various public health agencies have in fact shown ELR to be timelier than traditional reporting.¹⁻⁴
- National efforts, including federal funding to public health agencies and incentive programs for hospital laboratories demonstrating meaningful use of certified technology, have helped increase ELR utilization. As of mid-2014, ELR accounted for approximately 2/3 of the laboratory reports received annually in the U.S. for notifiable conditions, from 1/3 of the reporting laboratories.⁵

PROGRAM EVALUATION FRAMEWORK

- We used CDC's program evaluation framework,⁶ which includes the steps of engaging stakeholders, describing the program, focusing the evaluation design, gathering credible evidence, justifying conclusions, and ensuring use and dissemination of lessons learned (Figure 1).
- During the program description phase, we created a logic model to illustrate the many inputs, activities and intended results of the Bureau's Health Information Systems programs (Figure 2).
- We determined that one major program outcome is reduction in time to report a disease.
- Measurable indicators for this outcome are a lower mean reporting time and a higher proportion of cases received within required timeframes, by ELR compared to traditional reporting methods.
- We identified how we would gather credible evidence by using data already being collected as part of Arizona's surveillance system (MEDSIS) and justify conclusions by using appropriate methods to analyze and interpret these data.
- Plans have been developed to ensure use of these results and share the lessons learned with stakeholders.

EVALUATION QUESTION:

Is ELR helping achieve more timely communicable disease reporting within Arizona?

Justification for the selection of this evaluation question:

- The transition from traditional lab reporting to ELR does not occur easily, and requires significant work, expense, and expertise.
- Although ELR "went live" for the first reporting laboratory in Arizona in 2009, as of mid-2015, approximately 55% of lab reports are received via ELR, from 10 reporting laboratories.
- Thus, the Arizona Department of Health Services chose to evaluate the outcome of these efforts by answering the question of whether ELR improves the timeliness of reporting compared to traditional methods.
- An affirmative answer will help to provide validation and stimulus for the continued extensive efforts and investment needed for ELR implementation and maintenance.

Figure 1. Steps in the public health program evaluation framework⁶

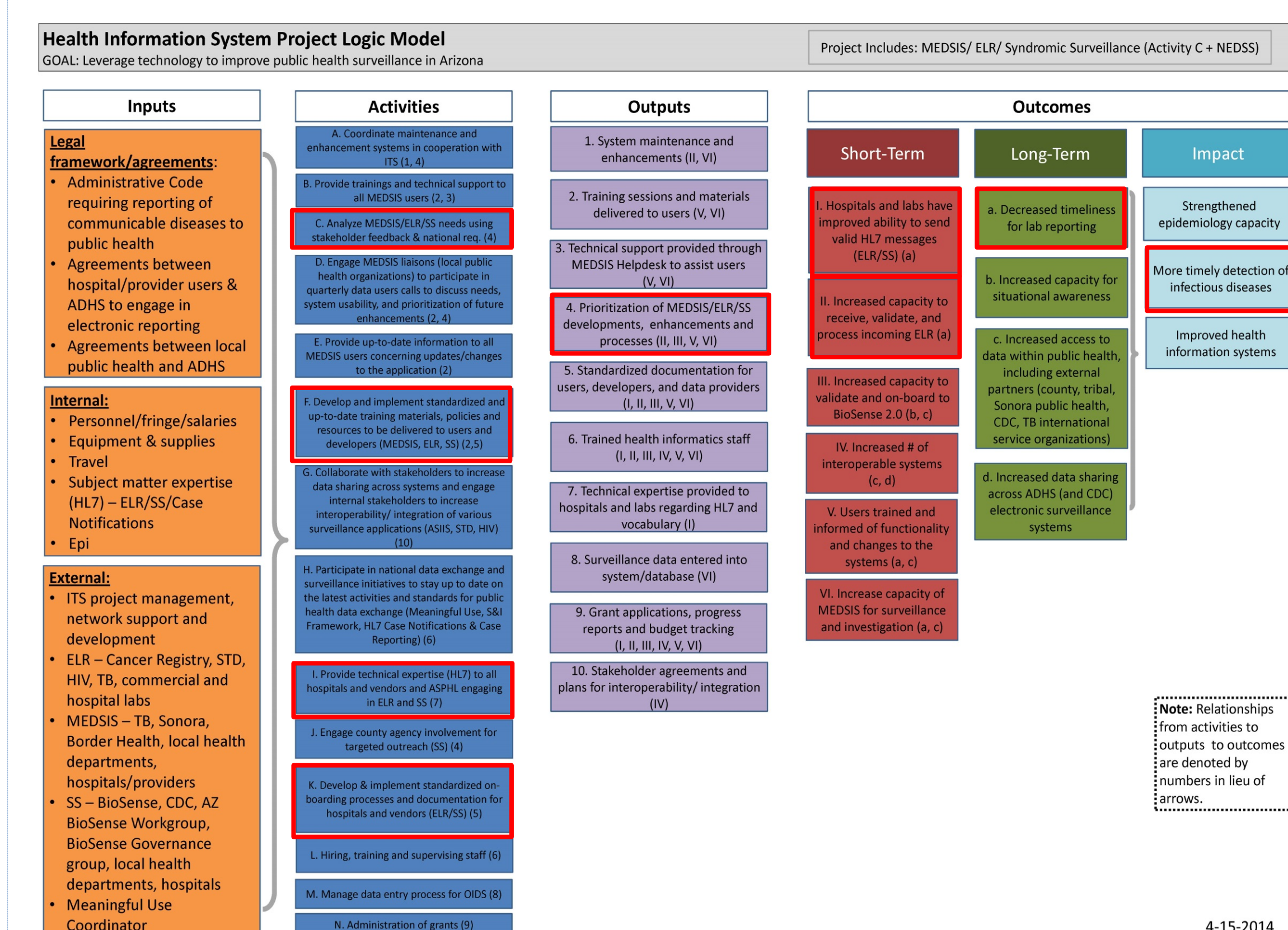


Figure 2. Logic model for ADHS Health Information System programs

GATHERING CREDIBLE EVIDENCE and JUSTIFYING CONCLUSIONS

Data analysis methodology:

- Confirmed and probable cases for laboratory-reportable conditions (Arizona Administration Code R9-6-2047), reported to public health agencies during the 2014 surveillance year, were analyzed.
- Cases of tuberculosis, hepatitis C and sexually-transmitted diseases were excluded, as they are managed by different ADHS programs.
- See **Table 1** for additional details on case exclusions and rationale.
- Urgent and non-urgent conditions were analyzed separately.

Definition of terms used:

- Urgent and non-urgent conditions:** Reporting timeframes are defined in the reporting rules. Conditions to be reported within 24 hours or 1 working day are categorized here as urgent. (These two timeframes are combined because of the relatively small number of cases in each.) Conditions to be reported within 5 working days are categorized as non-urgent.
- ELR status, or Method of first report:** A case was considered to be "first received by ELR" if the earliest-received lab report in the case came through the ELR system.
- Time to report:** The difference, in days, between the earliest lab result date for a case and the date the result was received by a public health agency. Timeframes for "1 working day" or "5 working days" conditions were adjusted for weekends (though not holidays).
- Received within required timeframes:** Cases are "within" the required timeframe if the time to report was 0 or 1 day for urgent conditions, or 0 to 5 days for non-urgent conditions.

Outcome measurements:

- The time to report, in days, was compared between cases first received by ELR and non-ELR. Differences between the two groups were analyzed by ANOVA and by the Wilcoxon rank-sum test.
- The proportion of cases received within the required timeframes was compared using a chi-squared test for association.
- The measurements were also performed for two sub-categories to see if they differed from the overall outcomes:
 - Salmonella* and Shiga-toxin producing *E. coli* (STEC) cases only (both urgent conditions that warrant public health investigations)
 - Non-urgent conditions, *excluding* influenza and RSV, which account for a large proportion of cases and require no public health case investigations.

Results:

- 14,723 cases were included in the analysis. (Table 1)
- 53% of included cases were first received by ELR. A higher proportion of cases of urgent conditions were received by ELR (61%), compared to non-urgent conditions (52%). (Table 2)
- Of the 2,314 cases excluded because of merge status, problems with the time to report calculation, or extreme values, a disproportionate number were non-ELR (75%, p-value for chi-square test <0.0001) and urgent conditions (6%, p-value=0.002).

Table 1. Cases included in the analysis

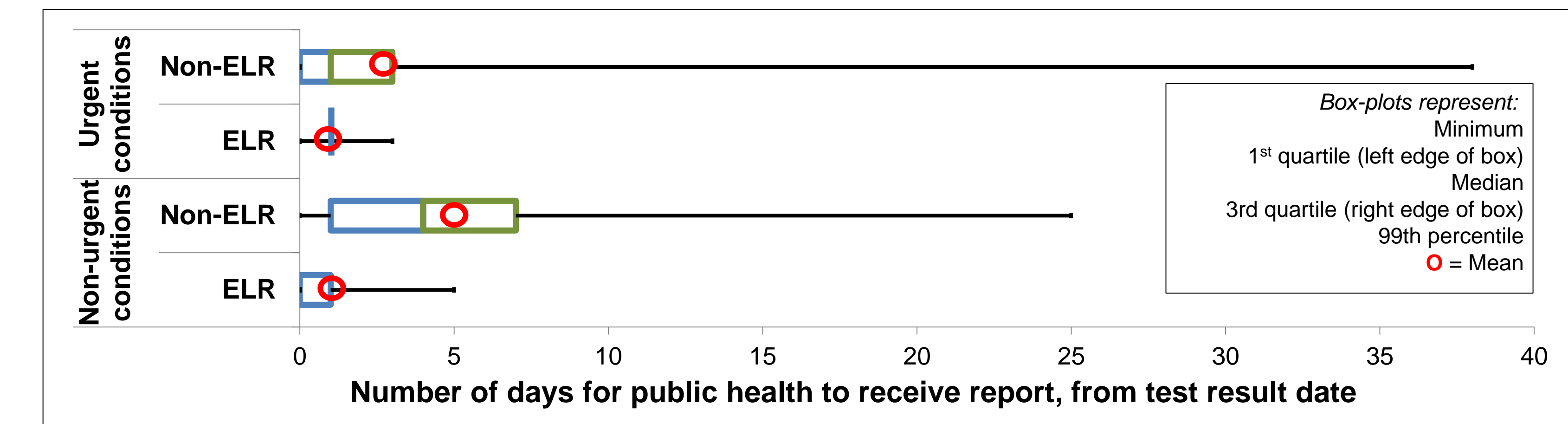
| | |
|---|---|
| Lab-reportable, confirmed or probable, Arizona residents, 2014 report dates (12/29/2013 - 1/3/2015) N = 29,250 | Most recent finalized data set. Classifications other than confirmed or probable may represent entry errors or non-reportable data. |
| ADHS-entered cases only N = 18,561 (63%) | Most ADHS-entered cases are lab reports; cases entered by others are more likely to be from providers. |
| Cases first reported by a lab other than the Arizona State Public Health Lab N = 17,037 (92%) | ASPHL reports may differ from reports from other labs. ADHS epidemiologists may be notified about the case before test results are available, and are involved in the reporting process from ASPHL. |
| Non-merged cases only N = 15,956 (94%) | Original entity that entered case cannot be determined for merged cases in 2014. |
| "Time to Report" can be calculated, and is ≥ 0. Extreme values (top 0.1% (n=16)) excluded. N = 14,723 (92%); 86% of all ADHS-entered, non-ASPHL cases | Negative or missing "time to report" is usually caused by missing result dates for the initial lab report. Extreme values excluded to reduce the effect of outliers. |

- The mean number of days for a report to be received after the results were completed was significantly shorter for ELR than for non-ELR reports, for both urgent (0.9 vs. 2.7) and non-urgent (0.9 vs. 5.0) conditions (p-values for ANOVA both <0.0001). (Table 2 and Figure 3)
- Two-sided Wilcoxon rank-sum tests also indicated statistically significant differences (p-value = 0.02 for urgent and <0.0001 for non-urgent conditions).

Table 2. Descriptive statistics for the time to report, in days, for urgent and non-urgent conditions, by method of first report

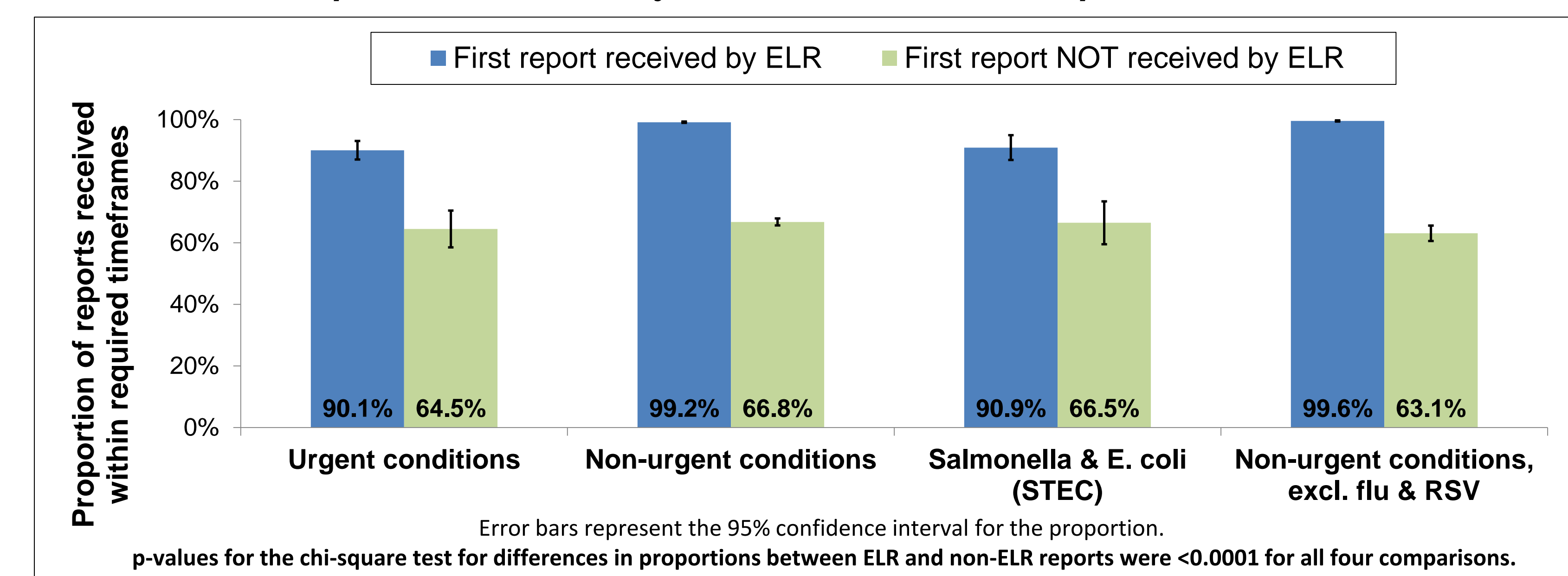
| | First report received by... | N | Time to report, in days | | | |
|---------------------------------------|-----------------------------|------------|-------------------------|--------|--------------------------|--------------------------|
| | | | Mean | Median | 1 st quartile | 3 rd quartile |
| Urgent conditions (n=674, 5%) | Non-ELR | 262 (39%) | 2.7 | 1 | 0 | 3 |
| | ELR | 412 (61%) | 0.9 | 1 | 1 | 1 |
| Non-urgent conditions (n=14,049, 95%) | Non-ELR | 6724 (48%) | 5.0 | 4 | 1 | 7 |
| | ELR | 7325 (52%) | 0.9 | 1 | 0 | 1 |

Figure 3. Timeliness of report of first laboratory report, by method of first report: ELR reporting is significantly faster than non-ELR reporting



- As shown in Figure 3, there was much more variability in the time to report for non-ELR compared to ELR reports.
- The proportion of reports received within the required timeframes was significantly greater for ELR reports for both urgent and non-urgent conditions. (Figure 4)
- The same holds true when looking at only *Salmonella* and STEC, and non-urgent conditions excluding flu and RSV. (Figure 4)

Figure 4. Proportion of reports received within the required timeframes, by method of first report: ELR reports are more likely to be received within required timeframes



LIMITATIONS

- This evaluation does not examine differences in timeliness for particular lab(s) when they switch to ELR reporting. It is possible that labs now using ELR are inherently faster reporters.
- Only the first report for each case is used to assign method of report, although multiple reports may be received for a single case.
- True times to report may be different for cases excluded because they were merged (6%) or a positive time to report could not be calculated (8%).

CONCLUSIONS and LESSONS LEARNED

Our evidence demonstrates:

- Significantly faster reporting from laboratories via ELR than by traditional methods, for both urgent and non-urgent communicable diseases;
- A much higher proportion of ELR reports received within the required timeframes; and
- Less overall variability in reporting timeframes for reports received by ELR.

This evaluation project has helped provided justification and incentive within our agency to continue the extensive work to transition lab reporting to ELR. Preliminary outcomes and interpretations have been shared with ADHS stakeholders. Other benefits, not examined here, include increased data quality and reduced staff time to enter data from each report. Integrating a formal evaluation process into routine program activities should continue to aid epidemiologists in monitoring, and demonstrating the effects of, our work.

Future activities include:

- Sharing these outcomes and lessons learned with external partners and stakeholders.
- The ongoing transition to ELR of reporting from hospital and commercial laboratories. This should continue to increase the overall timeliness of reporting; program resources spent on ELR implementation do appear to help achieve this desired outcome.
- Continuing to gather data prospectively, as more laboratories begin reporting via ELR.
- Regularly repeating this evaluation to ensure that these outcomes continue to be achieved and that reporting timeliness improves even more, with additional labs using ELR.

REFERENCES

¹Potential Effects of Electronic Laboratory Reporting on Improving Timeliness of Infectious Disease Notifications—Florida, 2002-2006. *MMWR*. 57(49): 1325-28

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³Nguyen TO, Thorpe L, Makki HA, and Mostashari F. 2007. Benefits and Barriers to Electronic Laboratory Results Reporting for Notifiable Diseases: The New York City Department of Health and Mental Hygiene Experience. *AJPH*. 97 Suppl 1: S142-5.

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⁶Framework for program evaluation in public health. 1999. *MMWR* Recomm Rep. 48(RR-11):1-40.

⁷Arizona Administration Code R9-6-2047 <http://www.azdhs.gov/phs/cids/pdf/labrptlist.pdf>