

Electronic Laboratory Reporting in the USA: 2004 National Snapshot Survey

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ABSTRACT

Objective: To capture an accurate picture of the current and planned future status of electronic laboratory reporting (ELR) in the USA during 2004.

Design: Survey questionnaire.

Setting: The survey was conducted on 50 state public health departments in the USA.

Methods: A 22-question survey was developed and distributed to state public health departments. Survey topics included aspects of electronic laboratory reporting such as supported formats, transmission modes, security, data quality control, commercial off-the-shelf applications and data usage. Returned surveys were analysed and compiled into meaningful output formats.

Results: 49 of the 50 states responded; of these 24 were currently implementing some degree of ELR and 24 were planning to implement ELR. At the time of the survey 45% of the states claimed to have laboratories reporting electronically, with one state having more than ten laboratories and one state having more than 100 laboratories. Only five states reported having an established quality control system in place. While a majority of states reported use of a state firewall, less than half of the states identified any other security measures as being utilised. More than half the respondents (57%) indicated that their ELR data were being utilised by state program areas. This figure was higher than the number of states who claimed to have ELR (45%).

Conclusions: The study demonstrated that during 2004 almost all states in the USA were either in the process of implementing or were planning to implement ELR. There were some discrepancies apparent in the reported data. These may be related to the nature of the questionnaire and will be addressed by improving the design of the questionnaire for the next annual survey.

INTRODUCTION

Laboratory reporting is a major source of data for public health surveillance activities and consequently one of the keystones of population health systems. In the United States, the move towards electronic reporting of laboratory (and other health-related) data is rapidly gaining momentum, enabled by brisk technological advances and championed by federal initiatives such as the Public Health Information Network (PHIN)¹ and National Electronic Disease Surveillance System

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(NEDSS)². The number of states able to electronically accept laboratory data in standardised format (Health Level 7 (HL7)) continues to increase³. Recent literature provides evidence that electronic reporting can improve timeliness and completeness of data^{4,5}, as well as reducing data transfer errors⁶.

In 2004, the Electronic Laboratory Reporting (ELR) National Snapshot Survey was conducted to capture a national picture of the current and future status of ELR in the US. This was done using a survey questionnaire that included related topics such as standards, security and public use of data.

METHOD

The survey questionnaire encompassed topics presumed to be of national interest. These topics included:

- Current ELR implementation
- Use of the Center for Disease Control (CDC) NEDSS Base System
- Information on reporting laboratories for each state (number, volume, local/regional/national)
- Supported formats for ELR (HL7, XML (extensible markup language), text, spreadsheet, etc.)
- Transmission modes
- Security
- Data quality control
- Commercial off-the-shelf (COTS) applications and in-house/contracted development
- Uses for ELR data (local, state and federal public health partners, analysis and visualisation, alerts, public use data)
- Integrated data store

A draft survey was created and volunteers were solicited to review the draft. Nine volunteers were located, representing five states and the CDC. The survey was designed in Microsoft (MS) Excel and included background coding to populate a master data table upon return to the author.

Identification of Respondents

Since the goal of the survey was to represent each of the fifty states in the US, a critical early step was to identify one respondent for each state. This task proved to be a challenging one. Beginning with the national call roster (containing representatives from <20 states at that time) and Internet research of state public health websites, a combined e-mail and telephone campaign was conducted that eventually produced one ELR contact per state.

Survey Distribution

The survey (see Appendix) was distributed and collected via e-mail attachments. The initial e-mail was sent on 11 March 2004 and contained advice on saving, opening and working with the file. Recipients were asked to choose the 'enable macros' option when opening the MS Excel file in order to enable the active checkboxes and background coding. A few states unable to comply with this request instead printed their survey, manually completed it and faxed/mailed the paper copy to the author for data input. The author also provided technical support to respondents during survey deployment and collection.

Survey recipients not returning their surveys in a timely manner were followed up by e-mails and telephone calls. The final survey was returned on 23 April 2004. At the final tally, surveys had been returned by forty-nine of the fifty states (98% return rate).

Returned surveys were used to populate a master data table. The master data set was analysed and compiled into meaningful output formats for distribution. Individual states were not identifiable in the final, distributed aggregate results, thus ensuring anonymity for the respondents.

RESULTS

As illustrated in Figure 1, the survey response indicated a high degree of interest in ELR by public health departments. Of the fifty states, one state did not respond to the survey and one state indicated no interest in ELR, but the remaining forty-eight states were evenly divided among those already implementing some degree of ELR and those in the planning stages for ELR.

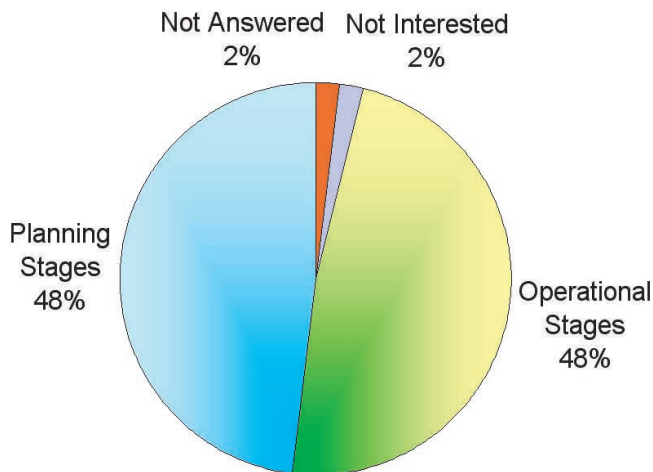


Figure 1. *Current implementation of ELR in the United States, 2004*

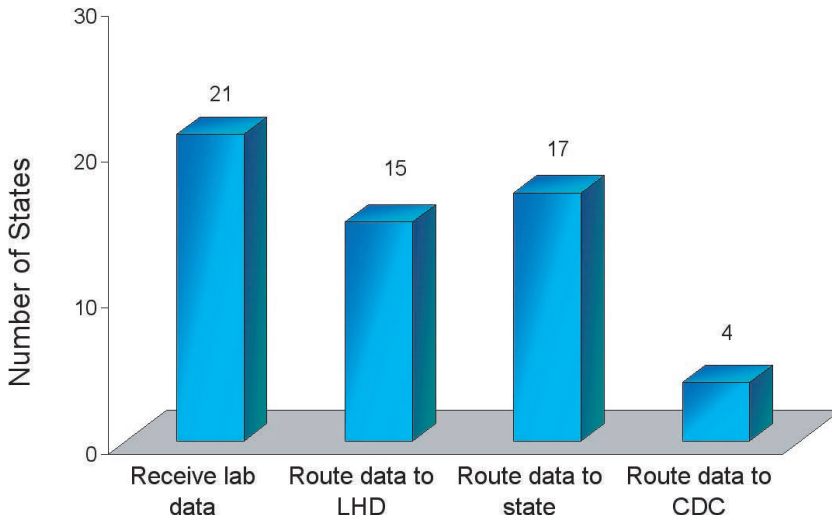


Figure 2. Operational ELR systems, parts currently in production mode, 2004
 lab = laboratory; LHD = Local Health Department; CDC = Center for Disease Control

States self-identifying as having operational ELR systems were queried on the elements of their systems that were actually in production mode. Figure 2 shows the status of states with regards to four ELR elements:

- Receipt of laboratory data
- Routing of laboratory data to local health departments (LHDs)
- Routing of laboratory data to state programme areas
- Routing of laboratory data to CDC

Receipt of laboratory data was the most prominent element, with twenty-one states indicating that this stage of ELR was in production mode.

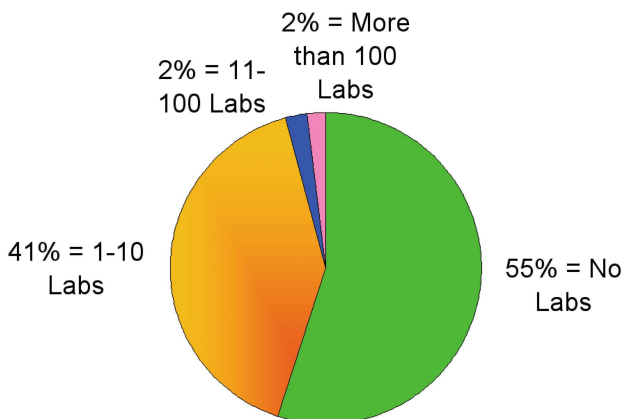


Figure 3. Number of laboratories per state reporting by ELR, by % of state respondents, 2004

States were queried about the number of laboratories in their state that were reporting by ELR. Figure 3 shows that the majority of states (55% of the 49 respondents) currently had no laboratories reporting electronically. 41% of the respondents stated that 1–10 laboratories were reporting electronically to their state. Only one state (2% of respondents for each category) had either 11–100 or more than 100 laboratories reporting electronically.

Data quality is an important aspect of any reporting/surveillance system, and ELR is no exception to this generality. When asked to identify the current status of their quality control (QC) systems for ELR (Figure 4), 9 of the 49 respondents indicated they had not yet begun development of a QC system and 2 did not answer the question. Of the remaining respondents, 24 indicated they were in the planning

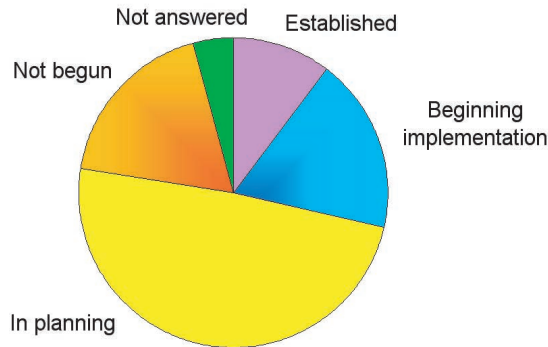


Figure 4. Quality control of ELR data, status of state systems, 2004

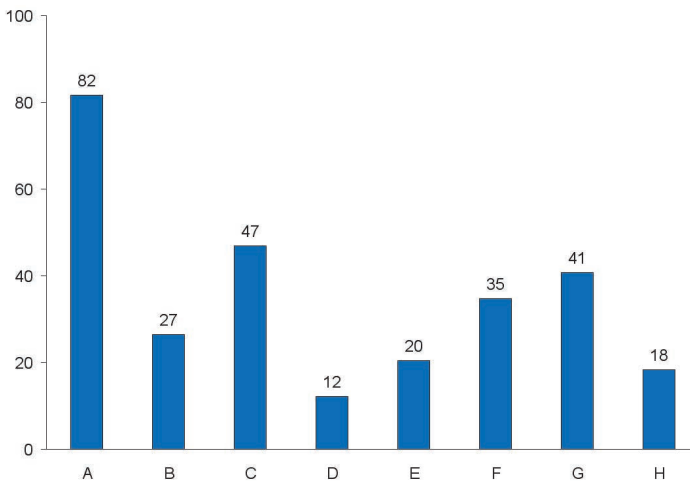


Figure 5. Elements of state security by % of respondents, 2004

A) State firewall; B) Partner firewall; C) Encryption; D) State-issued certificates; E) Certificates from Certifying authority; F) Virtual private network (VPN); G) Secure Sockets Layer (SSL); H) Secure File Transfer Protocol (sFTP).

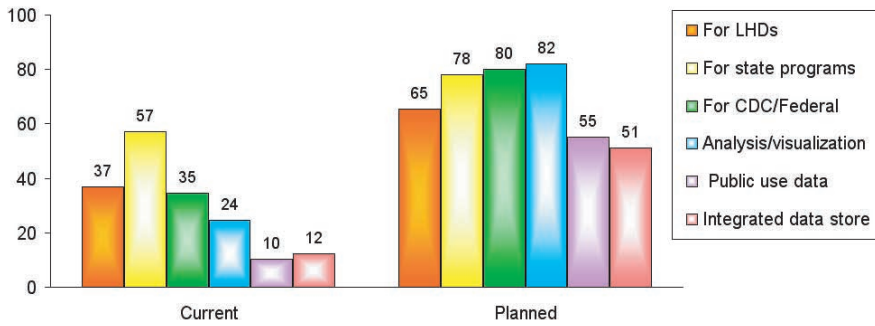


Figure 6. Current and planned uses for ELR data, by percentage of respondents

stages of QC, 9 stated they were beginning implementation of a QC system, and 5 states asserted they had an established QC system in place.

Security of data systems is an ever-present concern. Figure 5 reveals that while a clear majority (82%) of respondents have a state firewall, less than half of the respondents indicated a current use of any of the remaining seven security elements.

Central to any data-gathering system is the practical usage of the data. Beneficiaries of the ELR data systems are shown in Figure 6. More than half the respondents (57%) indicated that their ELR data were utilised by state programme areas, and just over one third (35%) stated that their ELR data were used for reporting to CDC/Federal agencies.

DISCUSSION

The 2004 National Snapshot Survey was conducted as the first of a planned annual survey. The survey highlighted many aspects of the status of ELR in the USA. The key findings were that almost all states were either in the process of implementing or were planning to implement ELR. The actual number of labs reporting electronically by state was generally small: at the time of the survey only one state had more than 100 laboratories reporting electronically and only one other had more than ten laboratories. With respect to the reporting format, most state health departments indicated a clear preference for HL7 versions 2.3.z and 2.3.1. The survey also revealed that only a few states (5) had actually established quality control systems, although most of the others were either planning (24) or were in the process (9) of implementing these. With respect to security, most states had a state firewall, but no other security measure was employed by a majority of states.

The results with respect to use of the data produced some interesting discrepancies. The number of respondents (57%) who claimed that their ELR data were utilised by state program areas was higher than the number of states who claimed to have operational ELR systems (45%). Similarly the number of states (seventeen)

who claimed that their ELR data were used for reporting to CDC/Federal agencies was much higher than the number of states (four) who responded that reporting to CDC was an operational part of their ELR system. This number might reflect use of ELR data in other CDC reporting, such as in grant updates. However, it is equally likely that some of the questions on the survey were not sufficiently specific or clear. For example, there may have been confusion about what constitutes 'implementation' and 'planning' stages. It is planned that in future surveys, questions will be designed to rely more heavily on categorised responses. However, regardless of these apparent inaccuracies, it is clear that the future trend is towards increasing usage of data in all categories. The largest predicted growth surges were in the categories of public use data and integrated data stores.

In future surveys, consideration will be given to making portions of the survey identifiable, i.e. by releasing specific rather than aggregate answers to some items. This was not possible with this survey due to the author's stated intention to maintain state confidentiality. The best method for doing so is still under consideration. It may be that states will be allowed to make their choice of whether certain answers will remain 'private'. Another option is to designate different sections of the survey as 'private' or 'public', so respondents will be aware of potential disclosures.

This first National Survey has produced much interesting information, but also highlighted the difficulty of ensuring the accuracy and validity of the information provided. It is certain that future versions of the National Snapshot Survey will continue to be a source of both information and challenges.

ACKNOWLEDGEMENTS

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REFERENCES

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- 4 Effler P, Ching-Lee M, Bogard A, Jeong M, Nekomot T, Jernigan D. Statewide system of electronic notifiable disease reporting from clinical laboratories: comparing automated reporting with conventional methods. *JAMA* 1999; **282**: 1845–50.
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APPENDIX



2004 National ELR Snapshot Survey

1 Contact Information for survey respondent:

Name:	
Agency:	
Title:	
Street:	
City:	
State, Zip:	
Tel:	
Email:	

2 Is your state currently implementing Electronic Lab Reporting (ELR)?

- Yes, we have an operational ELR system in production mode (check the following parts of your system that are currently in production)
 - Reportable disease data are being received from at least one lab, electronically and at regular intervals
 - The lab data are being distributed to appropriate county/local public health personnel
 - The lab data are being distributed to appropriate state public health personnel
 - NETSS/NNDM data are being submitted electronically to CDC through your ELR system
- No, we are not yet operational but we are in the planning stages
- No, we have no interest in doing ELR in our state. (Note: If you have no interest in ELR, please answer only items #3, 4, 9, 10, 12, and 13, and then stop, you do not need to answer any other questions in this survey.)

3 Please indicate the public health structure in your state:

State	Counties
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- And/Or Direct recipient of reportable disease data from labs (check **one/both** boxes, as applicable)
- Or Primarily responsible for conducting disease/outbreak epidemiologic investigations (check only **one** box)

4 Web available information:

Reportable Diseases URL: If your state has a public URL for your list of reportable diseases, please list it here:

If your state has a public URL specifically for ELR-related information (not a general public health site), please list it here:

5 How are you conducting (or planning to conduct) ELR in your state? (Note: "NBS", referenced in this question, refers to the CDC's NEDSS Base System). Please choose only **one** box.

- Only NBS: We use (or plan to use) **only** the NBS for all our ELR needs. For this choice **only**, please skip Question #6 and go to #7.
- Part NBS: We use (or plan to use) at least **part** of the NBS to meet at least **some** of our ELR needs. Please proceed to Question #6.
- No NBS: We do not plan to use **any** part of the NBS. Please proceed to Question #6.
- Don't Know: We are currently undecided as to if or how we will use the NBS. Please proceed to Question #6.

6 For ELR plans that involve components/systems other than the NBS, please choose **one/more** boxes from the following:

- We have built (or are building) our own components/system, using state personnel. Please specify primary operating system (ex. NT, DOS, OS/2, Linux, UNIX, Windows):
- We have purchased (or are purchasing) our own components/system. Please specify:
Vendor: Product:
- We have contracted for (or are contracting for) our own components/system. Please specify primary operating system (ex. NT, DOS, OS/2, Linux, UNIX, Windows):

7 For ELR plans that involve at least some part of the NBS, please indicate which part(s) you plan to use (check **all** that apply):

- PHIN/NBS Message Out - messaging from state to CDC
- PHIN/NBS Message In - messaging from labs to state
- NBS Database/Data Architecture
- NBS Contact Management/User Interface
- Other: Please specify

8 Is your state **currently** using the NBS?

- Yes, we are currently using this **entire** system
- Yes, we are currently using **some** part of this system
- No, we are not currently using **any** part of this system

9 Please estimate the number of labs in your state that are **large, reporting** labs? In other words, labs that report test results to public health and have a test volume **high** enough to make it worthwhile to submit batch reports through ELR?

10 Please estimate the number of labs in your state that are **small, reporting** labs? In other words, labs that report test results to public health and have a test volume **low** enough to make it reasonable to submit individual reports through web-entry ELR?

11 How many labs are **currently** reporting results electronically to your state? (Refers to ELR labs reporting in actual production, not testing, mode) Note: If your state is in planning stages only, please skip this questions and proceed to the next question, #12.

12 Of all the total **labs** that are reporting disease results to your state (electronically or otherwise), how many of the labs are:

Local Labs (most of lab's work is for patients residing within your state)

Regional Labs (most of lab's work is for patients residing either within your state OR within neighboring states)

National Labs (lab routinely services patients residing in all states of the US)

13 Of all the total lab **reports** submitted to your state for reportable conditions (electronically or otherwise), please estimate the percentage that come from:

Local Labs (most of lab's work is for patients residing within your state)

Regional Labs (most of lab's work is for patients residing either within your state OR within neighboring states)

National Labs (lab routinely services patients residing in all states of the US)

14 For ELR data, does your state **actively** retrieve data from any labs (ex. by dialing into a lab server or going to a lab secure website)?

- No
- Yes (If yes, please answer the following. Check only **one primary** option, but check as many **supported** options as necessary):

Primary	Supported	
<input type="checkbox"/>	<input type="checkbox"/>	Modem
<input type="checkbox"/>	<input type="checkbox"/>	Web interface
<input type="checkbox"/>	<input type="checkbox"/>	FTP
<input type="checkbox"/>	<input type="checkbox"/>	Other TCP/IP
<input type="checkbox"/>	<input type="checkbox"/>	Other: Please specify <input style="width: 150px;" type="text"/>

15 For ELR data, do any labs actively send data to your state (ex. lab deposits data onto state server)?

- No
- Yes (If yes, please answer the following. Check only **one primary** option, but check as many **supported** options as necessary):

Primary	Supported
---------	-----------

- Email
- Modem
- Web data entry
- FTP
- Other TCP/IP
- Disk (mailed or delivered)
- PHIN/NBS Messaging
- Other: Please specify

16 For both current and future ELR data, check the **primary** and **other** state-supported formats in which data is/will be received at your state (check only one primary option, but check as many supported options as necessary):

Note: If you plan to continue to support a current option in the future, then be sure to checkmark it for **both** the Current and Future columns.

Current		Future	
Primary	Supported	Primary	Supported

- HL7**
- Version 2.2
- Version 2.3.z
- Version 2.3.1
- Version 2.4
- Version 2.5
- Version 3
- XML**
- Other Text file**
- Tab delimited
- Space delimited
- Comma delimited
- Other: Please specify
- Spreadsheet:** Please specify type:
- Database**
- MS Access
- dBASE
- SQL
- Other: Please specify

17 Does your state have a defined set of variables for ELR data?

- No
- Yes

If yes, what was the primary determining factor for this dataset?

- Paper reporting forms
- HL7 formatting
- In-state data systems
- Other: Please specify

If the data set is available on the web, please give the URL:

18 Which of the following are part of your state's **current** security system for ELR? Which are **planned**? (Check all applicable boxes) Note: If you plan to continue a current option, then check it for **both** the Current and Planned columns.

Current	Planned	
<input type="checkbox"/>	<input type="checkbox"/>	State firewall
<input type="checkbox"/>	<input type="checkbox"/>	Partner firewall
<input type="checkbox"/>	<input type="checkbox"/>	Encryption
<input type="checkbox"/>	<input type="checkbox"/>	Certificates - state issued
<input type="checkbox"/>	<input type="checkbox"/>	Certificates - certifying authority
<input type="checkbox"/>	<input type="checkbox"/>	VPN
<input type="checkbox"/>	<input type="checkbox"/>	SSL
<input type="checkbox"/>	<input type="checkbox"/>	sFTP
<input type="checkbox"/>	<input type="checkbox"/>	Other: Please specify <input style="width: 250px;" type="text"/>

19 Quality control (QC) is an important issue for all data. Please check all boxes that apply for your ELR:

- Our state already has policies and procedures in place for ELR data, and implementation is established and ongoing
- Our state already has policies in place for ELR data, and is working on implementation of the policies
- Our state is in the planning stages of developing QC for ELR data
- Our state has not yet begun consideration of QC issues for ELR data

20 Does your state use commercial-off-the-shelf applications for any part of electronic data interchange? Please complete the following:

- | | | | | |
|--------------------------|--------------------------|----------------------|-----------------------------------|----------------------|
| Yes | No | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | Messaging/scheduling | If yes, then please list: Vendor: | <input type="text"/> |
| | | | Application: | <input type="text"/> |
|
 | | | | |
| <input type="checkbox"/> | <input type="checkbox"/> | Translation/parsing | If yes, then please list: Vendor: | <input type="text"/> |
| | | | Application: | <input type="text"/> |

21 Please identify your current and planned uses for ELR data. Note: If you plan to continue a current use in the future, then check it for **both** the Current and Planned columns.

Current	Planned
---------	---------

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | Provide data to county/local health departments |
| <input type="checkbox"/> | <input type="checkbox"/> | Provide data to state program areas |
| <input type="checkbox"/> | <input type="checkbox"/> | Provide data to CDC or other federal agencies |
| <input type="checkbox"/> | <input type="checkbox"/> | Contribute to data analysis and visualization. Please check all that apply: <ul style="list-style-type: none"> <input type="checkbox"/> Geographic mapping (GIS) <input type="checkbox"/> Alert/monitoring systems (ex. EARS) <input type="checkbox"/> Statistical analyses (ex. SAS, SPSS) <input type="checkbox"/> Other: Please specify |
| <input type="checkbox"/> | <input type="checkbox"/> | Contribute to public use data available on the web. Check all that apply: <ul style="list-style-type: none"> <input type="checkbox"/> GIS capabilities <input type="checkbox"/> User-modifiable reports (user can modify both format and content of report) <input type="checkbox"/> 'Canned' reports (pre-set reports that are not modifiable by users) |
|
 | | |
| <input type="checkbox"/> | <input type="checkbox"/> | Populate an integrated, centralized data store for ELR reports |

22 Would you be interested in representing your state in any of the following special interest groups* (SIGs), as offshoots of the national ELR Call group? Check all boxes that apply.

- Data Quality Control
- ELR Security
- HL7
- Other: Please specify

* These potential groups would be smaller, focused groups interested in collaborating and sharing knowledge. SIGs might communicate by conference calls, emails, meet by arrangement during general conferences, etc.



