



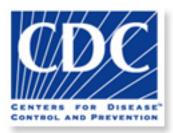
BioSense: Developing Nearly Real-Time Laboratory Surveillance Capacities for Emergency Preparedness and Response

Nikolay Lipskiy, DrPH, Jerome I. Tokars, MD, MPH, Armen Asatryan, MD, MPH and Roseanne English. Division of Emergency Preparedness and Response, National Center for Public Health Informatics, CDC

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- BioSense is a national program intended to improve the nation's capabilities for conducting real-time biosurveillance and health situational awareness through access to existing data from healthcare organizations.
- Chief complaint and/or diagnosis data are received from over 360 federal hospitals.
- Currently BioSense collects laboratory results from 30 hospitals in 9 states (mostly inpatient visits).
- BioSense collects microbiological results from outpatient visits in 49 states (w/o Hawaii) and Puerto Rico through one of national laboratories
- All providers send data to CDCusing the Public Health Information Network Messaging System (PHINMS) and HL7 standards.

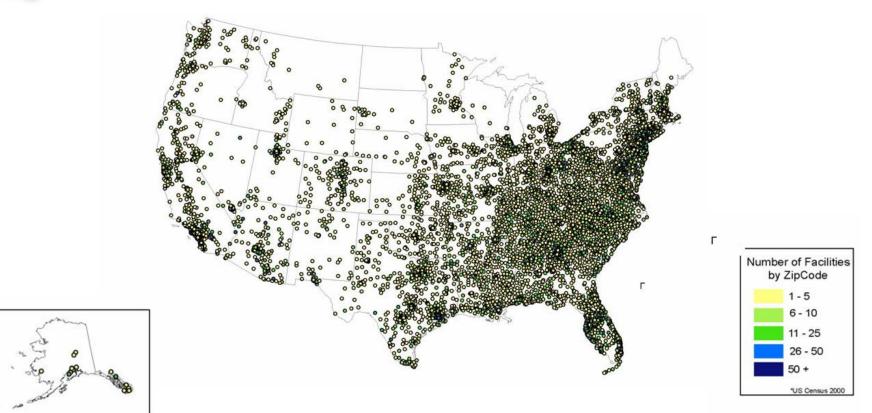
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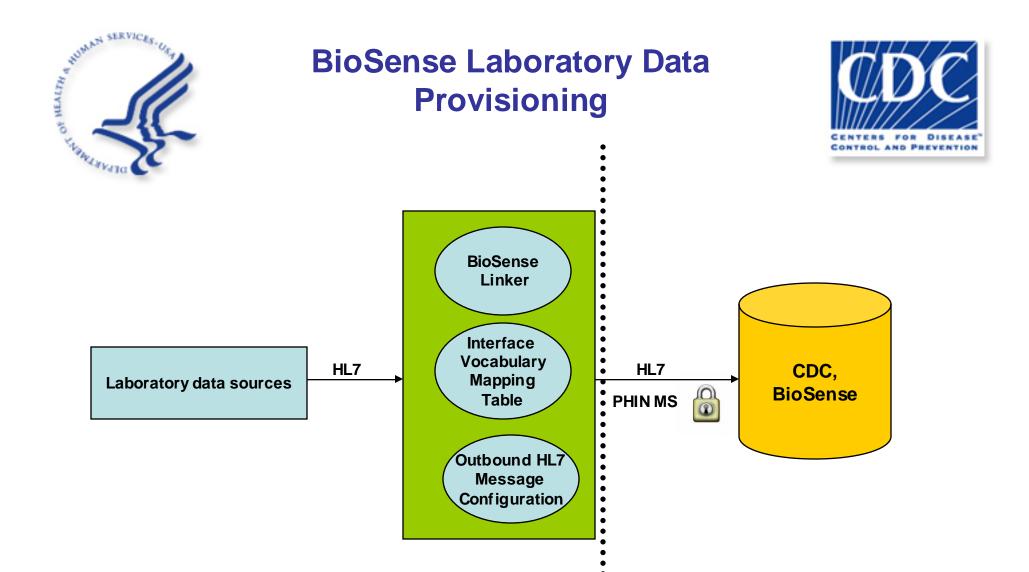
Data Sources for the National Laboratory





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Utilization of Vocabulary Mapping Tools

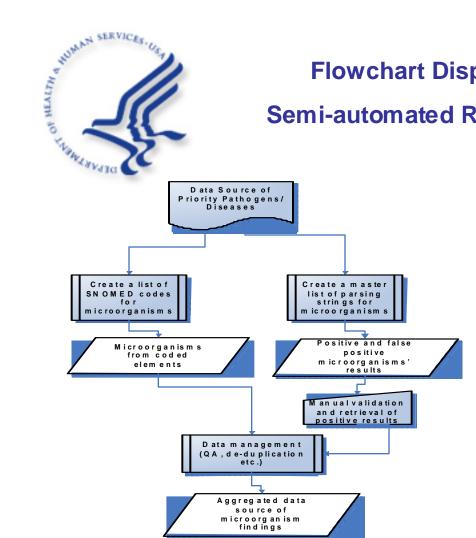


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78	Lab Micro Results	BioSense Patient ID	Unique identifier created by the BioSense integrator application to allow the healthcare facility to track non-identified BioSense data back to a patient's medical record within the healthcare facility.	PID-3 Patient Identifier List	сх				
79	Lab Micro Results	BioSense Visit ID	Unique identifier created by the BioSense integrator application to allow the heathcare facility to track non-identified BioSense data back to the corresponding visit record or records within the facility.	PID-18 Account Number	сх				
80	Lab Micro Results	Reporting laboratory	Reporting laboratory identifier and name	MSH-3 Sending Application	HD		CLIA number if available	None	Yes
81	Lab Micro Results	Diagnostic Service Section ID	Identifies the department that performed the service.	OBR-24 Diagnostic Service Section ID	ID		PHVS_DiagnosticS erviceSectionID_HL 7_2x	None	Yes
82	Lab Micro Results	Performing laboratory	Performing laboratory id and name (may be different for referral lab testing)	OBX-15 Producer's ID	CE		CLIA number if available	None	Yes
83	Lab Micro Results	Result Status	Status of the report (preliminary, final, corrected). This field is required in a result message, and is typically used where the level of detail does not need to be at the individual observation level (OBX-11). This element was added to support the Radi	OBR-25 Result Status	ID		PHVS_ResultStatu s HL7 2x	Mandatory	No
84	Lab Micro Results	Report date/time	Report Date – applies to entire message as a report, not to individual results	OBR-22 Results Rpt/Status Change Date/Time	TS				
85		Collection date	Sample collection date	OBR-7 Observation Date/Time	TS				
	Lab Micro Results	Collection method	Specimen collection method, e.g. (swab, bronchoscopy, phlebotomy), if present in the	OBR-15.3 Collection Method	тх				

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Flowchart Displaying Processes for a Semi-automated Retrieval of Microorganisms



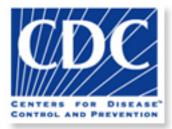
- automated retrieval of microorganisms from coded elements;
- automated retrieval of free-text records containing parsing wordstargets;
- manual analysis of records from the task #2 and validation of positive findings, and
- automated aggregation of results from tasks 1 and 3.

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HL7 Version 2.x : is it the Best Solution for Laboratory Data Users?



Version 2.x	Version 3.x
Focus: Syntax, and Communications	Focus: Semantics, and use of information at the receiving end
Less explicit; free	More explicit; formal
Lacks models and vocabulary	Based on conceptual models and vocabulary
Bar-encoded syntax (EDI, +XML alternative)	XML syntax, (XML schemas enforce concept definitions)

Source: http://www.dhs.ca.gov/dcdc/disb/nedss/docs/Nancy%20v1%20CCLHDM%20NEDSS%20102202.ppt

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Tracking Microorganisms by Parsing OBX Messages : Examples



1. Example of a real message (OBX 5)

PROCEDURE: PEDIATRIC BLOOD CULTURE COLLECTED: 11/27/2006 10:30 SOURCE: BLOOD-Peripheral STARTED: 11/27/2006 11:46 BODY SITE: ACCESSION: 06-331-01714 FREE TEXT SOURCE: *** STAINS / PREPARATIONS *** Gram Stain Report Veri fied:11/28/2006 21:19 Gram Negative Bacilli Phoned Gram Stain results to: MJ REILLY, RN PEDS 11/28/2006 9:19:01 PM BY CBEALS Read back was completed *** FINAL REPORT *** Final Report Verified:12/05/2006 20:37 Salmonella species **SEROTYPE PARATYPHIB** Organi sm sent to ### for confirmation. Called to H.Dias /peds 11/30/2006 8:03:16 AM D.Hall *** SUSCEPT IBILITY RESULTS *** Salmonella species MDIL MINT Ampicillin <=0.25 S Cefotaxime <=4 S Ci profloxacin <=0.5 S Trimethoprim/Sulfa <=10 S S=Susceptible, I=Intermediate, R=Resistant, N/A=Not Applicable _______

- 2. Dealing with direct and indirect negations in text strings:
- "BACILLUS SPECIES, NOT BACILLUS ANTHRACIS"
- "BACILLUS SP., NOT B. CEREUS OR ANTHRACIS"

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Dealing with Cases of Incomparability of Local Codes for Laboratory Procedures and LOINC Standards

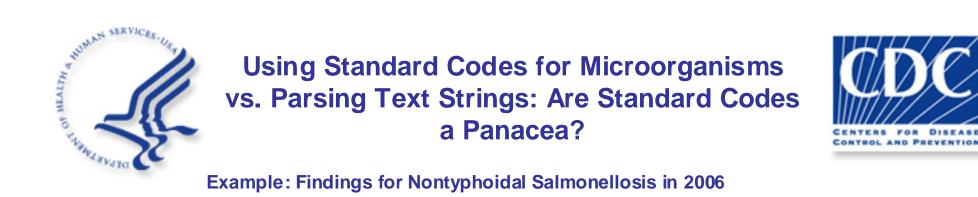


Example of local codes for laboratory procedures

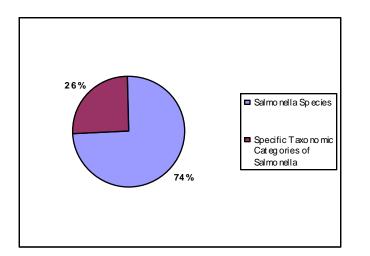


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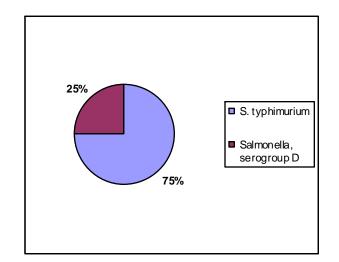
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Results from Coded Elements (N=42)



Results from Text Strings (N=28)

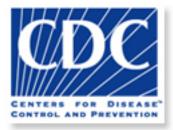


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Comparing Results from Hospital Laboratories and a National Laboratory



• Most frequently hospital laboratories are suppliers of results from inpatient and ER visits. In a contrast, the national laboratory is processing samples from outpatient visits

• In most cases the "strength" of clinical symptoms of outpatient patients is lower than inpatient patients. Probably, it explains a phenomenon that microorganisms with the highest toxicity intend to be more frequently in inpatient results while outpatient results incline to report results regarding a commensal flora

• Testing of microorganisms for a resistance to antibiotics in outpatient settings is less common than in hospitals

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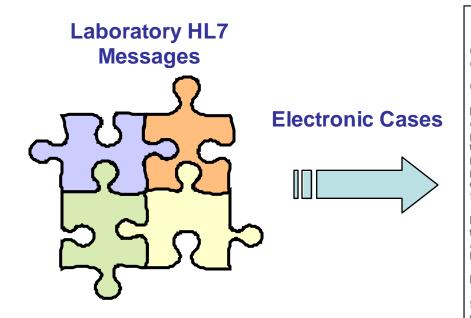
Development of Case Definitions for the Electronic Laboratory Surveillance of Notifiable Diseases



Vol. 46 / No. RR-10

MMWR

5



Definition of Terms Used in Case Classification

Clinically compatible case: a clinical syndrome generally compatible with the disease, as described in the clinical description.

Confirmed case: a case that is classified as confirmed for reporting purposes.

Epidemiologically linked case: a case in which a) the patient has had contact with one or more persons who either have/had the disease or have been exposed to a point source of infection (i.e., a single source of infection, such as an event leading to a foodborne-disease outbreak, to which all confirmed case-patients were exposed) and b) transmission of the agent by the usual modes of transmission is plausible. A case may be considered epidemiologically linked to a laboratory-confirmed case if at least one case in the chain of transmission is laboratory confirmed.

Laboratory-confirmed case: a case that is confirmed by one or more of the laboratory methods listed in the case definition under Laboratory Criteria for Diagnosis. Although other laboratory methods can be used in clinical diagnosis, only those listed are accepted as laboratory confirmation for national reporting purposes.

Probable case: a case that is classified as probable for reporting purposes.

Supportive or presumptive laboratory results: specified laboratory results that are consistent with the diagnosis, yet do not meet the criteria for laboratory confirmation.

Suspected case: a case that is classified as suspected for reporting purposes.

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1. Regenstrief LOINC Mapping Assistant Software*, RELMA: Defining Laboratory Codes for Microorganisms (Example)

ocal Term File Mapped to: Shortnar	mei				Local Term			
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4 2xww Short Common Name 1 B anthracis Ab Ser IB-aCnc 2 B anthracis Ab XXX IF-aCnc 3 B anthracis Ab XXX QI Cult 4 B anthracis Ab XXX-aCnc 5 B anthracis Ab Ser QI ID 6 B anthracis Ab Ser QI ID 8 B anthracis Ab Ser QI QI 7 B anthracis Ab Ser QI AggI 9 B anthracis Ab Ser QI EIA 10 B anthracis Ab Ser QI CF 11 B anthracis Ag Tissue QI IF 12 B anthracis Ag XXX QI IF	11467-8 Bacillus anthra 11469-6 Bacillus anthra 11469-4 Bacillus anthra 22109-3 Bacillus anthra 22859-3 Bacillus anthra 22860-1 Bacillus anthra 22861-9 Bacillus anthra 22863-5 Bacillus anthra 22864-3 Bacillus anthra 22866-8 Bacillus anthra 22867-8 Bacillus anthra	CIS Ab CIS CIS CIS CIS CIS CIS CIS CIS CIS CIS	АСпс АСпс АСпс Тіtr АСпс АСпс АСпс АСпс АСпс Тіtr АСпс АСпс АСпс	Pt Pt Pt Pt Pt Pt Pt Pt Pt Pt Pt Pt	Ser XXX XXX Ser Ser Ser Ser Ser Ser Ser Tiss XXX	Qn Ord Qn Ord Ord Ord Ord Ord Qn Ord Ord Ord	Tree View Print Grid Map Same Copy to Clipbo	

Source: http://www.regenstrief.org/medinformatics/loinc/relma



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2. HL7 Messaging Workbench: Parsing Original Messages*

tessage Definition Data Sources Display/Reports Message Capture	
C Get Message File Mag Fornat Message Text	Message Parze Tree:
MeH-WaLABCCRP-CORPULABCORP/340063091*CUL4PTDC-PETT20070250038101016 PP010058007004001*******************************	# 00 MSH A # 00 PO # 00 # 00 CACC # 00 CACC # 00 CACC # 00
MSH /PID, OBC, OBR, OBX, OBX, MSH /PID, ORC, OBR, OBX, OBX, MSH /PID, ORC, OBR, OBX, OBX, MS Validate to Spec	11 12 12 12 12 12 12 12 12 12 12 12 12 12 12 13 12 14 12 15 12
Capture Example Vals Capture Example Vals Adjust Length Male implementable	

* Messaging WorkBench, version 1.6.6.20, author Peter Rontey, at: http://www.hl7.org/lib_admin/do cs.cfm?dir=library/committees/c onf&comm=conf

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3. HL7 Messaging Workbench: Validating Definitions of Messages*

Lancorn com		The second second second second	
ecification LABCORP-CORP	Msg Type ORM Event Typ		
ganization LABCORP Event D	escription Order message (also RDE, RDS,	(GV, RAS)	
7 Version 2.3.1 Structure MSH,F	PID,ORC,OBR,OBX,OBX,MSH,PID,ORC,OBR,OB	(,0BX,MSH,PID,ORC,OBR,OBX,OBX,MSH,PID,ORC,OBR,OE	
Status Spec Version	Role © Sender C Receiver	P Implementation note Encoding - ER7	
Conformance Type	sender i Receiver	Follow HL7 Processing Rules	
G HL7 C Implement C Constrain	C Extended Usage Eid Co	formance Profile Query Message	
		1 weery message	* Meeser sing Werk Depok
dessage Tree Legend Discrepancy Log	Element Parameters		* Messaging WorkBench,
🐑 🧰 MSH 🔗	Element Name OBX		version 1.6.6.20, author Peter
F D PD	Description observation/result segr	ent	
🗉 🧰 ORC	1		Rontey, at:
🗉 🧰 OBR	iterr#	Optionality Predicate	
😑 🍛 OBX	True		http://www.hl7.org/lib_admin/do
- B Set ID - OBX	Type Segment		
- Nalue Type	Usage Ren Red		cs.cfm?dir=library/committees/c
🖅 💼 Observation Identifier	Usage Required	Implementation Notes	
Observation Sub-ID	Repeatable		onf&comm=conf
Observation Value	Cardinality 1 🜩 max 1	≑ min	
🛞 🗁 Units	Cardinality max		
References Range	Position 25 🜩		
Abnormal Flags		14 M	
- Probability	In Use 🕼		
Nature of Abnormal Test	Data Type 🚽	Local Element Definition	
Observation Result Status Date Last Obs Normal Values	Lands III	A	
User Defined Access Checks	Length 0 max		
Dete/Time of the Observation	Table		
F-C Producer's D			
Responsible Observer	Data Link		
Observation Method	Example Value	Fixed Value	
E field 18	Exançõe value		
	Reference	Roger	

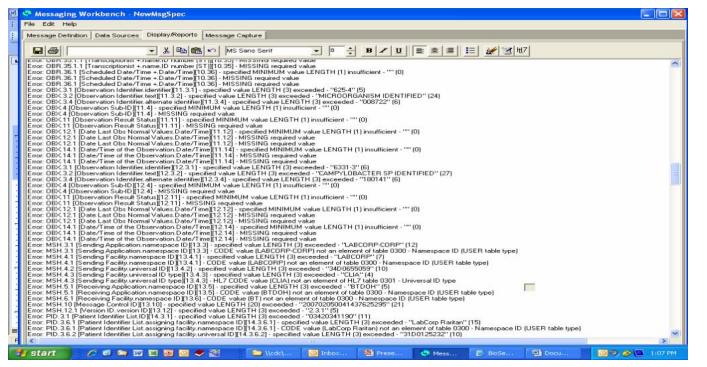
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4. HL7 Messaging Workbench: Creating Error Reports*

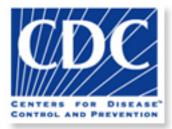


* Messaging WorkBench, version 1.6.6.20, author Peter Rontey, at: <u>http://www.hl7.org/lib_ad</u> <u>min/docs.cfm?dir=library/</u> <u>committees/conf&comm=</u> <u>conf</u>

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5. Using Microorganism Browsers for validation of SNOMED codes. Example: NCI Terminology Browser*

Concept Details Bookmark thispage

Streptococcus (organism)
Identifier

An aerobic streptococcus (organism)
ode

An aerobic streptococcus (organism)
Informati

An aerobic streptococcus (organism)
Informati

Hemolytically variant streptococcus (organism)
Correg

Beta-hemolytic streptococcus (organism)
NHS C

Non-Beta-hemolytic Streptococcus (organism)
SNOM

Alpha non-hemolytic streptococcus (organism)
SNOM

Alpha prime hemolytic streptococcus (organism)
SNOM

Alpha prime hemolytic streptococcus (organism)
SNOM

Streptococcus mitis group (organism)
SNOM

Streptococcus pneumoniae (organism)
UMLS

Streptococcus pneumoniae intable Pag (organism) Id entifiers Streptococcuspneumoniae (organism) L-25116 Information about this concept Code in Source 9861002 Concept Status Current X73GQ NHS Clinical Terms Version 3 SNOMED Legacy-style Code 1-25116 SNOMED PREFERRED TERM Streptococcus pneumoniae SNOMED TERM Di plo cocc us prieu moniae SNOMED TERM P neumo cocc us SNOMED TERM Streptococcusp neumoniae (or canism) UMES CUL C0038410 UMLS Semantic Type Bacterium subset н NAV CTV3 subsot Superconcepts

Source:

http://nciterms.nci.nih.gov/NCIBrowser/Connect.do?bookmarktag=1&diction ary=SNOMED_CT&licensetag=true&code=null

- Alpha-hemolytic streptococcus (organism)
- Gram-positive diplococcus (organism)



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Conclusions



- Lack of standardization continues to be the major challenge in a development of laboratory biosurveillance
- Development and implementation of automated and semi-automated algorithms for data processing significantly reduce a burden of tracking of pathogenic microorganism from various data sources
- Further efforts should be undertaken for a promotion and utilization HL7 v.3.x messages
- BioSense continues to be one of major tools for investigation and testing of further public health laboratory activities

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Questions?



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