



Screening and possible case identification in clinical care

**2014 Ebola Response in the U.S.
Cerner Corporation – EHR Ebola Response**

**ONC - A logic model and vocabulary for Initial Triage and
Screening EHR and Infectious Disease Workflows**

January 13, 2015



- **Knowledge Representation – A brief overview**
- **Cerner Corporation - Bryan Clark**
 - Role of the EHR in Ebola Response
 - EHR Ebola Response Workflow
 - Partnering to Provide EHR Content to Health Facilities
 - Lessons Learned and Thoughts for the Future
- **ONC – Daniel Chaput**
 - A logic model and vocabulary for Initial Triage and Screening EHR and Infectious Disease Workflows

Knowledge representation framework (Boxwala, 2011)



Narrative

- Narrative text
- Easy to communicate

Semi-Structured

- Organized text
- Eliminates ambiguity, defines terms

Structured

- Coded and interpretable by computer
- Sharable, reusable

Executable

- Coded and interpretable by Clinical Decision Support

J Am Med Inform Assoc. 2011 Dec;18 Suppl 1:i132-9. doi: 10.1136/amiajnl-2011-000334. Epub 2011 Nov 3.



- The EHR should not replace human intervention when dealing with infectious disease but instead be utilized as a tool to support clinical decision making by focusing on the following “rights”:
 - Ask the ***right*** question(s)
 - Provide the ***right*** information
 - Notify the ***right*** people at the ***right*** time

EHR Ebola Response Workflow – Ask the *right* questions



- Screening questions for travel, exposure, and symptoms are the initial questions asked as a part of screening prior to other assessment in a separate quick format that identifies the need to isolate the patient as early as possible in this process.
- Responses of “yes” to either of these requires the user to also determine which type of isolation the patient potentially needs upon signing this form
- A more comprehensive grid of infectious disease risk factors/symptoms is available in the triage assessment in order to codify responses that may later need to be studied for prevalence of communicable diseases. It also includes symptoms for diseases other than Ebola/MERS

EHR Workflow – Ask the *right* questions



- Symptoms for Ebola/MERS specified by CDC
- Including a link to the CDC website to direct the user to the latest guidelines as they evolve for the home page for Ebola and MERS
- Reference text displays donning and doffing instructions for PPE per CDC guidelines

EHR Workflow – Ask the *right* question



The screenshot shows an 'ED Quick Registration' form with the following fields and values:

Is the patient identifiable?	Sex: Female	Last Name: HARRISON	First Name: MILDRED	Middle Name:	Date of Birth: 06/09/1941
Age: 73Y	Arrive Date: 10/30/2014	Arrive Time: 18:56	Display in Directory?:	VIP:	Travel to high-risk country? (highlighted)
Exposed to contagious disease? (highlighted)	Disaster Tracking:				
Building: BW Hospital	Nurse/Ambulatory: ED				
Chief Complaint:					
Medical Service: Emergency Medicine	Medical Record Number: 01022316	Financial Number:			
Registration Time: 18:56	User ID: EDRN	Arrival Mode:			

Buttons: Complete, Cancel

Status bar: STTEST EDRN 10/30/2014 6:56 PM

Screening questions in Quick Reg allow prompt identification of infectious disease risks

Infectious Disease Risk screening questions are required fields

EHR Workflow – Provide the *right* information



Infectious Disease Travel Screen

***Contact With Person With Highly Contagious Disease Like Ebola or MERS AND Have One or More of the Symptoms Below**

Yes No

***Travel to a Country With Wide-Spread Ebola or MERS in the Past 21 Days AND Have One or More of the Symptoms Below**

Yes No

Ebola Symptoms:

Fever, Headache, Weakness, Muscle Pain, Vomiting, Diarrhea, Abdominal Pain or Hemorrhage.

MERS (Middle East Respiratory Syndrome) Symptoms:

Fever, Chills/Rigors, Headache, Sore Throat, Cough, Shortness of Breath, Nausea, Vomiting, Diarrhea, Abdominal Pain or Muscle Pain

High risk countries for Ebola:

Democratic Republic of Congo, Guinea, Liberia, Sierra Leone

High risk countries of MERS:

Middle East - Bahrain, Gaza, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates, West Bank, Yemen

***Verify Droplet, Contact Precautions for Ebola (Reference for CDC)**

Yes N/A

I verify that the patient will be placed in a private room, placed on Droplet and Contact Precautions, Provider and Manager have been notified and Infection Preventionist has been called

***Verify Airborne, Contact Precautions for MERS**

Yes N/A

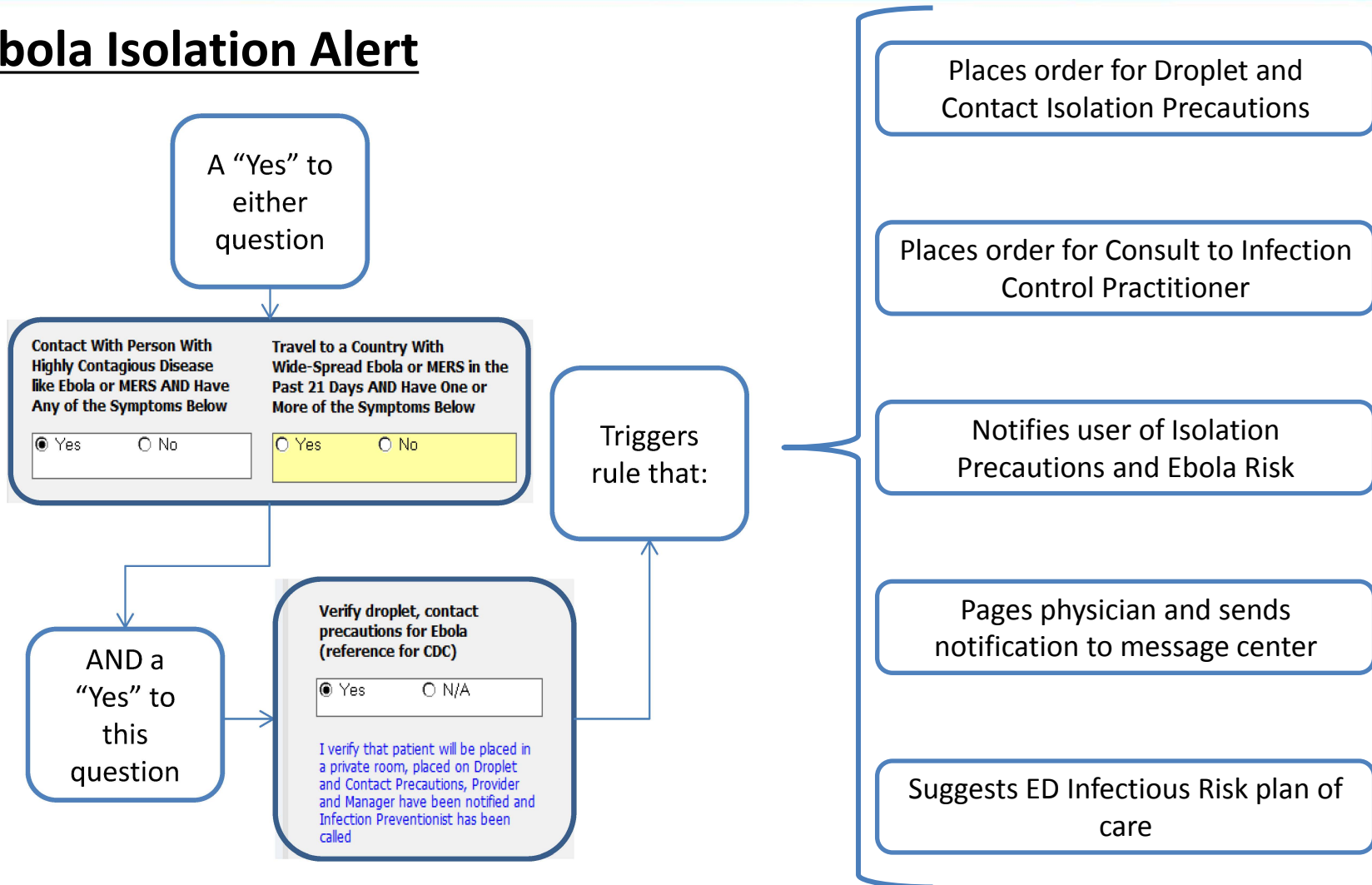
I verify that the patient will be placed in a private room, placed on Airborne and Contact Precautions, Provider and Manager have been notified, and Infection Preventionist has been called

If a Yes response to verify precautions for Ebola or MERS is answered, the system will place an order for the appropriate isolation

EHR Workflow - Notify the *right* people at the *right* time

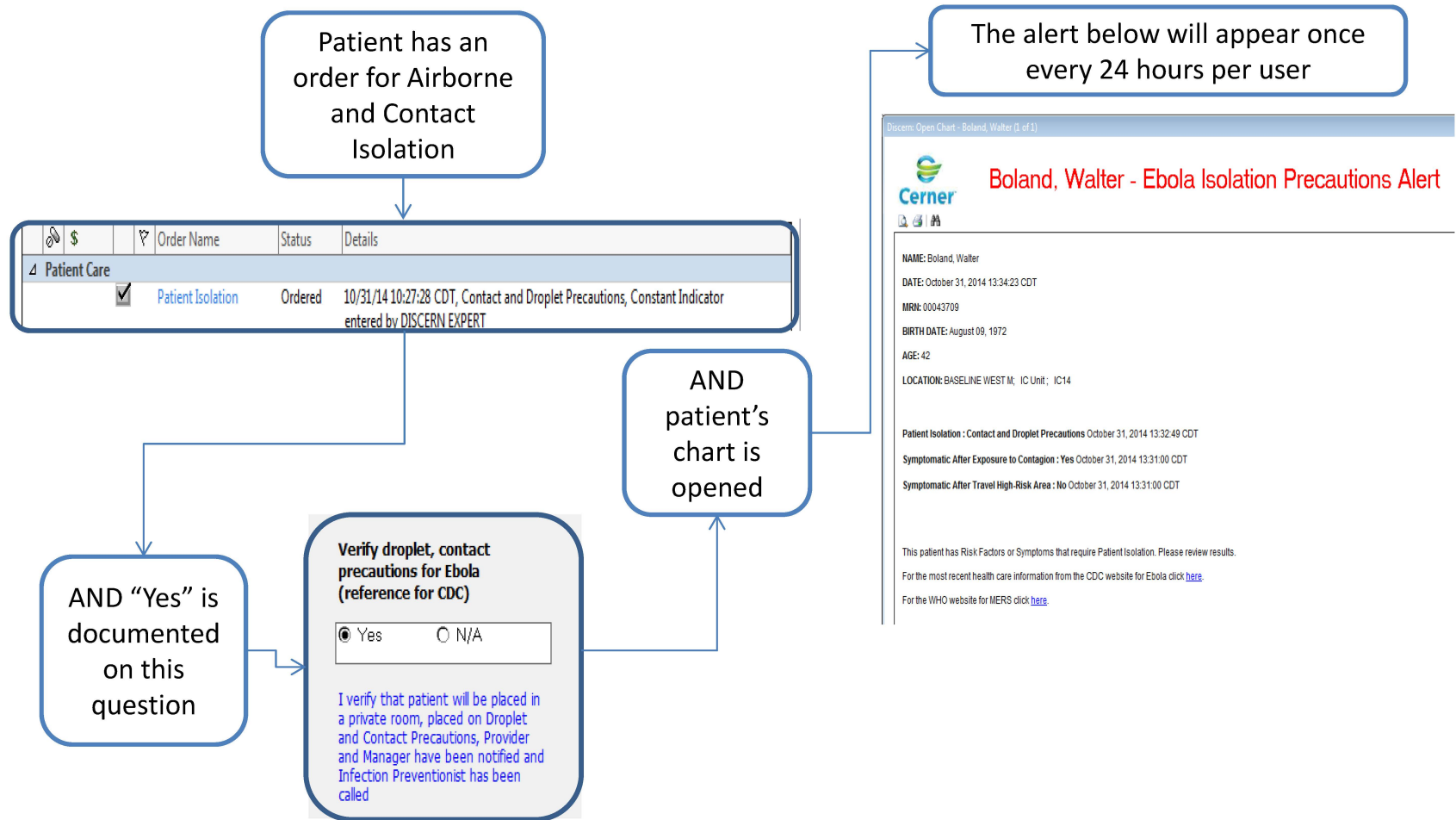


Ebola Isolation Alert



EHR Workflow - Notify the *right* people at the *right* time

EHR Open Chart Alert





EHR Workflow – Notify the *right* people at the *right* time



CDC/WHO Links to Latest Disease Information

Discern: Open Chart - Boland, Walter (1 of 1)


 **Boland, Walter - Ebola Isolation Precautions Alert**




NAME: Boland, Walter
DATE: October 31, 2014 13:34:23 CDT
MRN: 00043709
BIRTH DATE: August 09, 1972
AGE: 42
LOCATION: BASELINE WEST M; IC Unit; IC14

Patient Isolation : Contact and Droplet Precautions October 31, 2014 13:32:49 CDT
Symptomatic After Exposure to Contagion : Yes October 31, 2014 13:31:00 CDT
Symptomatic After Travel High-Risk Area : No October 31, 2014 13:31:00 CDT

This patient has Risk Factors or Symptoms that require Patient Isolation. Please review results.
For the most recent health care information from the CDC website for Ebola click [here](#).
For the WHO website for MERS click [here](#).



 Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

Ebola (Ebola Virus Disease)

CDC > [Ebola \(Ebola Virus Disease\)](#) > [Healthcare Workers](#)

About Ebola + **Safe Management of Patients with Ebola Virus Disease (EVD) in U.S. Hospitals**

2014 West Africa Outbreak +

2014 Democratic Republic of the Congo Outbreak

Outbreaks +

Language:

Frequently Asked Questions

The recent EVD outbreak in West Africa has increased the possibility of patients traveling from the impacted countries to the United States. Additionally, two American citizens with EVD were medically evacuated to the United States to receive



EHR Workflow – Notify the *right* people at the *right* time

Notification to Infection Control Practitioner (ICP) within EHR

The screenshot displays an EHR interface with a list of patients and a 'Details' window. The patient list includes:

- Barker, Hazel** - 42 Years Female
Loc: 4N ICU:401 Admit/Reg: 09/11:11
MRN: 00094821 LOS: 18c
DOB: 09/11/1972 PCP:
Tags:
- Override2, VTE** - 75 Years Male
Loc: 4N ICU:401 Admit/Reg: 09/11:11
MRN: 00096624 LOS: 10c
DOB: 09/29/1939 PCP:
Tags:
- Cain, Alex** - 34 Years Male
Loc: 4N ICU:401 Admit/Reg: 10/15:15 *
MRN: 00099414 LOS: 0d [Contact and Droplet Precautions](#)
DOB: 01/01/1980 PCP:
Tags:
- lab_id5** - 0 Days
Loc: 4N ICU:402 Admit/Reg: 08/09:09:4
MRN: 00093597 LOS: 40d
DOB: PCP:
Tags:
* [Reportables: Methicillin-Resistant Staphylococcus aureus](#)
- Roberts, Josh** - 55 Years Male
Loc: 4N ICU:402 Admit/Reg: 09/11:11
MRN: 00094823 LOS: 18c
DOB: 09/11/1959 PCP:
Tags:

The 'Details' window for Alex Cain shows:

- Risk** | **Patient Information** | **Isolation** | **Micro** | **Serol** | **Fecal** | **Notificatio** | **X-Ray** | **Device** | **Follow Up**
- Patient:** Cain, Alex
MRN: 00099414
DOB: 01/01/1980
- Isolation Type** | **Start Personnel Start Date** | **Discontinue Personnel Discontinue Date**
- [Contact and Droplet Precautions](#) | Blakemore, Melany 10/24/2014 15:26
- Comment Date** | **Comment**
- 10/24/2014 15:26 | Documentation indicates the patient has had exposure to Ebola with symptoms that require isolation.

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Partnering to provide EHR content to health facilities



- Cerner responded to the heightened Ebola alert by assisting our clients in using capabilities inherent in the EHR to take active measures to mitigate this risk.
- Response measures included:
 - Sending a priority review Flash containing specific recommendations for all clients to configure their system to ensure that disease-specific documentation is collected as early as possible, as well as instructions for activating decision support alerts for potential infectious disease that are broadly communicated across venues of care.
 - Implementing Ebola Response content into all Cerner managed client environments.
 - Reviewing existing EHR capabilities for ability to meet current CDC guidelines for infectious disease screening. Updates to design were made accordingly (i.e. specific countries within Africa, etc.)
- Cerner collaborated with trusted partners such as Emory Healthcare and the Cerner Emergency Medicine Special Interest Group to develop appropriate content. We also shared Ebola response thoughts and strategies with other EMR vendors via the CommonWell Health Alliance.

Lessons Learned and Thoughts for the Future



- Given the dynamic nature of the Ebola response literature, it was difficult to keep EHR content updated with the latest CDC recommendations. It is recommended that all content releases from the CDC should contain clear and concise version numbers and release dates to better assist healthcare workers and EHR providers.
- In the future, the CDC and EHR vendors should work to identify technology such as SMART on FHIR to streamline and deploy a standards-based “surveillance app” that could be plugged in to any compliant EHR.
 - The EHR vendors gain from this approach since they don't have to continuously update their local decision rules to keep up with rapidly evolving situations.
 - The CDC benefits in that it would get near-real-time information about presentations of potentially dangerous patients.
- It is vital that patient data from confirmed Ebola cases be shared across the continuum of care so health professionals in the community are aware of a risk as soon as the patient enters their facility. This can be done by standardizing and contributing infection risk data to regional HIEs, state repositories, and groups like the CommonWell Health Alliance.



- Objective
 - To begin definition of a simple, minimal set of knowledge artifacts to communicate requirements for decisions to EHR implementers and developers.



- Produce knowledge artifacts that describe the process flow, decisions, and reference standard recommended value sets
- Move towards shared resources that enable easier, faster, effective implementation of guidelines, rules, and decisions
- Improve clarity of clinical recommendations and consistency of implementation



- Our test scenario utilizes “Identify, Isolate, Inform: Emergency Department Evaluation and Management of Patients with Possible Ebola Virus Disease” dated November 5, 2014.
- The documents used in today’s presentation are for discussion only and are not intended for use in developing software, or as clinical guidelines.



- Would this type of documentation have made it easier for you (EHR implementers and developers) to implement guidelines such as these?
- Would this type of documentation reduce the amount of time necessary to adapt to new or changed guidance?
- Would this type of documentation improve the consistency of implementations across your customer sites (ED, ambulatory, etc.)



- Primary documents: A process flow and companion narrative
- Reduce a guideline to processes and decisions.
- Processes: May be manual, implemented in the EHR, or a combination of both. Expected that implementation would vary based on EHR, workflow, etc.
- Decisions: Logic only. No variation. No room for interpretation. Development of a test case should be straightforward.



AN EXAMPLE



Identify, Isolate, Inform: Emergency Department Evaluation and Management of Patients with Possible Ebola Virus Disease



1 Identify exposure history:
Has patient lived in or traveled to a country with widespread Ebola transmission or had contact with an individual with confirmed Ebola Virus Disease within the previous 21 days?

NO

Continue with usual triage and assessment

YES

2 Identify signs and symptoms:
Fever (subjective or $\geq 100.4^{\circ}\text{F}$ or 38.0°C) or Ebola-compatible symptoms: headache, weakness, muscle pain, vomiting, diarrhea, abdominal pain, or hemorrhage

NO

A. Continue with usual triage and assessment
B. Notify relevant health department
C. Monitor for fever and symptoms for 21 days after last exposure in consultation with the relevant health department

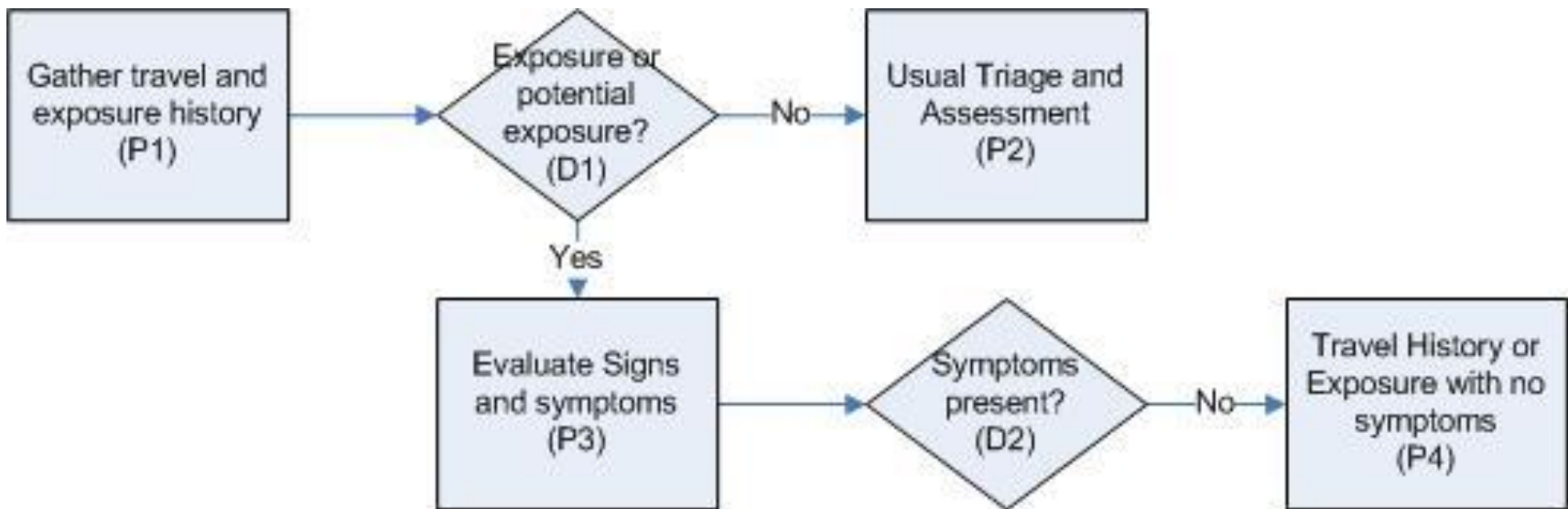
YES

3 Isolate and determine personal protective equipment (PPE) needed
Place patient in private room or separate enclosed area with private bathroom or covered bedside commode. Only essential personnel with designated roles should evaluate patient and provide care to

YES

4 Inform
A. IMMEDIATELY notify the hospital infection control program and the relevant staff

Process flow (example)



Detail Description - Process 1



Process or decision	Notes	Value Sets
<p>(P1) Gather travel and exposure history.</p>	<p>Gather and document information from the patient on travel and exposure history.</p>	<p>Countries with Widespread Transmission: Value Set: PHVS_CountriesWidespreadTransmission_EVD Value Set Name: Countries Widespread Transmission (EVD) OID: 2.16.840.1.114222.4.11.7248 Code System: PH_PHINVS_CDC Codes (ISO 3166-1 Code System): GIN: Guinea LBR: Liberia SLE: Sierra Leone</p> <p>Ebola Virus Infection risk (i.e., patient exposure) can be defined using the value set: PHVS_ExposureRisk_EVD Name: Exposure Risk (EVD) OID: 2.16.840.1.114222.4.11.7249 CDC PHIN-VADS Concept Code Code System: PH_PHINVS_CDC OID: 2.16.840.1.114222.4.5.274 7 codes: EVD 1-7</p> <p>The level of the question, however, will not provide sufficient information to code exposure to an Ebola patient</p>

symptoms: headache, weakness, muscle pain, vomiting, diarrhea, abdominal pain, or hemorrhage

C. Monitor for fever and symptoms for 21 days after last exposure in consultation with the relevant health department



YES

YES

3

Isolate and determine personal protective equipment (PPE) needed

Place patient in private room or separate enclosed area with private bathroom or covered, bedside commode. Only essential personnel with designated roles should evaluate patient and provide care to minimize transmission risk. The use of PPE should be determined based on the patient's clinical status.

- Is the patient exhibiting obvious bleeding, vomiting, copious diarrhea or a clinical condition that warrants invasive or aerosol-generating procedures (e.g., intubation, suctioning, active resuscitation)?

4

Inform

- A. IMMEDIATELY notify the hospital infection control program and other appropriate staff
- B. IMMEDIATELY report to the health department

NO

For clinically stable patients, healthcare worker should at a minimum wear:

- A. Face shield & surgical face mask
- B. Impervious gown
- C. 2 pairs of gloves

If patient's condition changes, reevaluate PPE

YES

- A. Use PPE designated for the care of hospitalized patients <http://www.cdc.gov/vhf/ebola/hcp/procedures-for-ppe.html>
- B. If the patient requires active resuscitation, this should be done in a pre-designated area using pre-designated equipment.

5

Further evaluation and management

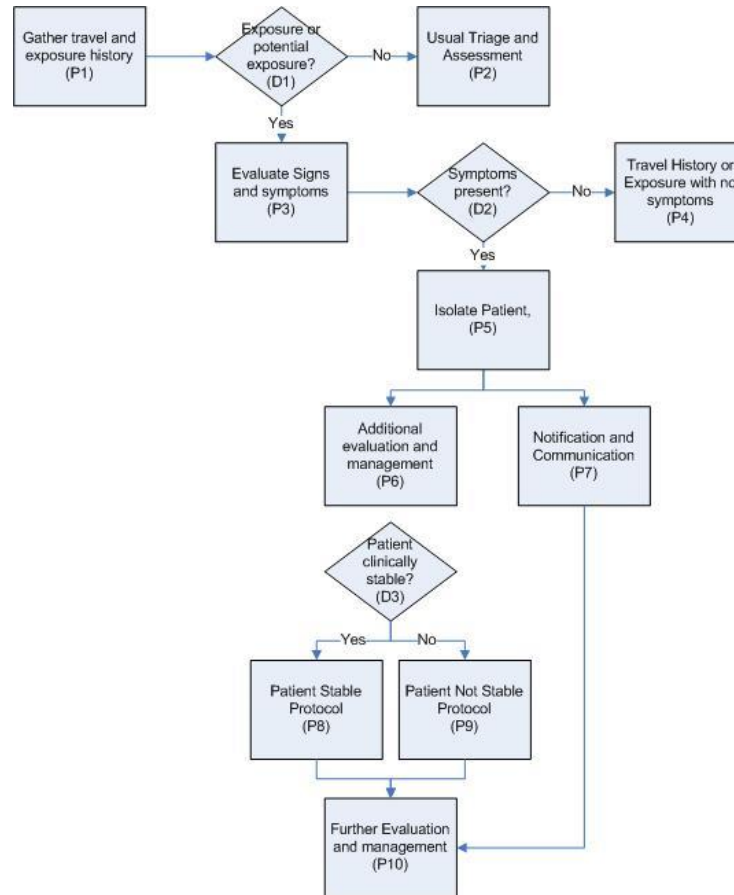
- A. Complete history and physical examination; decision to test for Ebola should be made in consultation with relevant health department
- B. Perform routine interventions (e.g. placement of peripheral IV, phlebotomy for diagnosis) as indicated by clinical status
- C. Evaluate patient with dedicated equipment (e.g. stethoscope)



U.S. Department of
Health and Human Services
Centers for Disease
Control and Prevention

November 5, 2014 CS_202407

Full flow – Semi-structured (+ narrative)



Ebola Triage Schematic – Processes and Decisions

	11/13/2014	Example: for discussion only
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- Yes
 - this type of documentation have made it easier for EHR implementers and developers to implement guidelines such as these
 - this type of documentation would reduce the amount of time necessary to adapt to new or changed guidance
 - this type of documentation would improve the consistency of implementations across customer sites (ED, ambulatory, etc.)



- Identify other ways that semi-structured and structured knowledge can be shared with EHR vendors, expanding on types of diseases and increased use of automation