



HL7 Solution Guide

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Last modified: 2023-02-10 06:29

SLC-Production-Docs build 84

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Introduction to HL7 Solutions

Vocera HL7 solutions integrate Vocera with one or more third party systems using the Vocera HL7 adapter, other Vocera adapters, and sometimes specific packages, to create a more complex integration.

HL7 implementations in the healthcare industry can help reduce the administrative burden on staff and improve care delivery for patients. HL7 is designed to improve communication between health IT applications. When a facility can share healthcare data among disparate systems, performance across all functions can become more efficient.

About this Document

This HL7 Solutions document explores some of the ways that Vocera utilizes HL7 in healthcare environments. These current strategies can stimulate new ideas for future implementations to speed workflows and enhance healthcare delivery objectives.

HL7 International specifies a number of flexible standards, guidelines, and methodologies by which various healthcare systems can communicate with each other. Such guidelines or data standards are a set of rules that allow information to be shared and processed in a uniform and consistent manner. These data standards are meant to allow healthcare organizations to easily share clinical information.

While HL7 is designed for health and medical transactions, it's reliability and structure lend it for use in sending transactions from other source systems, such as RTLS. The problem is understanding how, when, and why HL7 is used by Vocera.

What is HL7?

Health Level Seven (HL7) is an accredited set of standards for the transfer of data between software applications used in the healthcare industry.

These standards enable facilities to make effective use of clinical resources, and develop efficient administrative workflows. HL7 enables communication between the many required applications to integrate the data stores for easier data sharing. In this way Vocera assists facilities to perform administrative and clinical functions across the business.

Types of Integrations

Vocera HL7 solutions provide potential improvements in administrative functionality and patient care.

HL7 can be utilized to increase productivity, provide safety and security, and enhance patient care throughout the facility. The solutions described in this document demonstrate how HL7 has been employed.

Administrative Functionality

- RTLS: Communicate location and events captured by a real time location systems (RTLS) in the health system.
- Staff Assignment: Aggregate staff member assignments to roles or patients across the health system.
- Bed Tracking: Track patient movement through the health system for efficient resource management.

Patient Care

- PRN Medication Effectiveness: Trigger automatic reminders for clinical staff to followup on a medication administration event.
- STAT Orders: Care teams are efficiently notified of urgent clinician orders for patients.
- Patient Monitor Device: Notification messages can incorporate patient details for additional clinical context in a regulated device alert.
- Vocera Care Experience: Cloud-based rounding tool used to optimize patient safety and experience, operational quality, and staff engagement.

Typical Solutions

Here are some typical solutions to specific clinical problems that HL7 can help facilitate.

Each use case provides a brief description of effective HL7 implementation in healthcare. These are validated instances of successful implementations which can be expanded upon, or might invite new conceptualizations for your own facility configurations.

Patient Census Solution

Healthcare facilities use the HL7 ADT interface (normally a module of the EHR system) as a mechanism to share patient census changes with many clinical systems. These patient census updates include changes to patient demographics and patient status.

Vocera can leverage a wide variety of this patient census and demographic information provided in the HL7 ADT messages and display the appropriate portions of this information in the clinician's peripheral view. Vocera can intelligently provide different portions of this contextual information based on the patient population or care unit. Vocera can also present relevant context to augment the delivery of a specific alert or notification (e.g., Bed Exit alert, Critical Lab result, or New Admission alert).

Vocera can process Admit/Discharge/Transfer/Update patient census and demographic information based upon the corresponding ADT trigger events listed below:

ADT-A01	Admit / Visit Notification
ADT-A02	Transfer A Patient
ADT-A03	Discharge/End Visit
ADT-A04	Register A Patient
ADT-A05	Pre-admit A Patient
ADT-A06	Change An Outpatient To An Inpatient
ADT-A07	Change An Inpatient To An Outpatient
ADT-A08	Update Patient Information
ADT-A09	Patient Departing - Tracking
ADT-A11	Cancel Admit / Visit Notification
ADT-A12	Cancel Transfer
ADT-A13	Cancel Discharge/ End Visit

Using an ADT-A08 Event

An ADT-A08 trigger event is used when any patient information has changed but when no other trigger event has occurred. For example, an A08 event can be used to notify the receiving systems of a change of address or a name change.

For example, a healthcare facility EHR may send ADT-A08 messages similar to this:

```
MSH|^~\&|ADT|1891799227^NH4L^|||20200303141148|1|ADT^A08|232023|T|2.5.1|||||||
EVN|A08|20200303141148||REG_VIS_CHANGE|^EPIC^USER^^^^^NHC^^^^^NPS||
PID|1|EP01715202^^^EPIC^MRN~ENTH0700756^^^NORTON^ENTH|
EP01715202^^^EPIC^MRN~ENTH0700756^^^NORTON^ENTH||SQDOWNTOWN^MATT||
19820109|M||WH|1567567^^LOUISVILLE^KY^40202^USA^P^^JEFFERSON|JEFFERSON|
(502)123-1234^P^PH^^^502^1231234||SGN|S|CAT|200000386|888-82-4159|||NHS||N|||||N||ZPD||
MYCH~Mail~Phone||NOT_USED|||N|||||||
PD1|||NORTONHOSPITAL^^100031|
1932217858^HEILMAN^STEVEN^J.^^^^^NPI^^^^NPI~HEIST^HEILMAN^STEVEN^J.^^^^^EPIC^^^^PROVID|||||
NK1|1|ROSEMARY^POVERMAN^^|1^^LOUISVILLE^KY^40202^USA|(502)123-1234^^PH^^^502^1231234||
Emergency Contact 1|||||
NK1|2||^USA||Employer||PILOT||NOT EMPLOYED|||||||3100385|UN
PV1|1|I|N.4L^N.4L03^4L031^NH^R^^^^^DE|EM||042435^PATEL^VIVEK^AMRAT^||EMERGENCY ME^|||
125||043397^RAMINENI^JAYASREE^^|615829933|CHTY|||||||R^^^^^DE
^^^^^^|20200303141136||76583.84||||||242004^SEVEN N HOSPITALIST^7N HOS
OBX|1|NM|1038^Weight|74^5|KG|||||F|||||
AL1|1||49773^NO ACTIVE ALLERGIES^|||||
```

The PID segment is used by all applications as the primary means of communicating patient identification information. This segment contains permanent patient identifying and demographic information that, for the most part, is not likely to change frequently. In this example, the MRN displays in PID.2, and the patient name displays in PID.5.

This table describes many of the attributes shown in the code sample:

Sample Admit, Discharge & Transfer – Patient Status Message	Patient Census & Patient Context Attributes
MSH ^~\& ADT 1891799227^NH4L^ 20200303141148 1 ADT^A08 232023 T 2.5.1	The MSH (Message Header) segment defines the intent, source, destination, and some specifics of the syntax of a message.
EVN A08 20200303141148 REG_VIS_CHANGE ^EPIC^USER^^^^^NHC^^^^^NPS	Contains the ADT^A08 trigger event. The EVN (Event Type) segment communicates trigger event information to receiving applications.
PID 1 EP01715202^^^EPIC^MRN~ENTH0700756^^^NORTON^ENTH EP01715202^^^EPIC^MRN~ENTH0700756^^^NORTON^ENTH SQDOWNTOWN^MATT 19820109 M WH 1567567^^LOUISVILLE^KY^40202^USA^P^^JEFFERSON JEFFERSON (502)123-1234^P^PH^^^502^1231234 SGN S CAT 200000386 888-82-4159 NHS N N ZPD MYCH~Mail~Phone NOT_USED N	The PID segment communicates patient identification information. MRN Patient unique ID: PID.2 Patient First name, Last Name: PID.5
PD1 NORTONHOSPITAL^^100031 1932217858^HEILMAN^STEVEN^J.^^^^^NPI^^^^NPI~HEIST^HEILMAN^STEVEN^J.^^^^^EPIC^^^^PROVID	The PD1 (Patient Additional Demographic) segment contains demographic information that is likely to change about the patient. Primary Care Provider: PD1.4
NK1 1 ROSEMARY^POVERMAN^^ 1^^LOUISVILLE^KY^40202^USA (502)123-1234^^PH^^^502^1231234 Emergency Contact 1	The NK1 (Next of Kin / Associated Parties) segment contains information about the patient's other related parties. Emergency contact Name: NK1.2 Emergency contact Phone: NK1.5
NK1 2 ^USA Employer PILOT NOT EMPLOYED 3100385 UN	The NK1 (Next of Kin / Associated Parties) segment contains information about the patients other related parties.
PV1 1 I N.4L^N.4L03^4L031^NH^R^^^^^DE EM 042435^PATEL^VIVEK^AMRAT^ EMERGENCY ME^ 125 043397^RAMINENI^JAYASREE^^ 615829933 CHTY R^^^^^DE^^^^^^ 20200303141136 76583.84 242004^SEVEN N HOSPITALIST^7N HOS	The PV1 (Patient Visit) segment is used by Registration/Patient Administration applications to communicate information on an account or visit-specific basis. Patient Class: PV1.2 (I = Inpatient in this example; other options: E = Emergency, O = Observation, etc.) Attending Physician: PV1.7 Admitting Physician: PV1.17
OBX 1 NM 1038^Weight 74^5 KG F	The OBX (Observation / Result) is used to transmit a single observation or observation fragment.
AL1 1 49773^NO ACTIVE ALLERGIES^	Weight: OBX1.5 The AL1 (Patient Allergy Information) segment contains patient allergy information of various types. Allergen code/description: AL1.3

Staff Assignment Solution

The Staff Assignment solution synchronizes the list of staff members assigned to roles or patients in a third-party system with the assignments in the Vocera Platform database.

Either system (Vocera or third party external vendor) can serve as the source of truth. Vocera can aggregate assignments from multiple systems, including Vocera, and visually display all assignments for each unit/department. If the source of truth for the assignment is something other than Vocera, then Vocera will display the assignment with a lock and users will not update those assignments from within Vocera.

In some situations you may use a third-party system (such as Epic Systems, an EHR provider) as the source of truth for some assignments, a nurse call system (such as Hillrom) for other assignments, and Vocera for additional assignments. Vocera will manage all cumulative assignments to populate Vocera Groups in order to message, broadcast, send alerts to, or to call by role. The Vocera Platform should aggregate the correct team members so that individuals can use voice commands to call by role, particularly important when they do not know who is filling the role at a given time.

In your facility, the providers and nursing staff may make assignments to patients in Epic, which is used for charting as well as scheduling. Charge Nurses and Patient Care Techs may make assignments in the nurse call system to facilitate communication. Ancillary services that cover units, such as Respiratory Therapy and Pharmacy, may use Vocera to make assignments to the unit. Roles like House Supervisor can also be set in Vocera. Collectively, all of these assignments, whether at the patient level, room level, unit level or facility level, can be visualized in Vocera for one comprehensive view. These assignments may then be utilized to:

- Call 3W Charge Nurse
- Send Panic Alert to all Unit Staff and House Supervisor
- Broadcast to 6 North Staff
- Send Rapid Response Alert to Rapid Response Team
- Send a Message from Pharmacy to Room 301 Nurse

Using the ROL Segment in the ADT-A08 Message

Staff assignment leverages the ROL segment of an HL7 ADT-A08 message. The ADT-A08 trigger event is used when any patient information has changed and can include information specific to an episode of care.

For instance, an A08 event can be used to notify the receiving systems of a change of address or a name change. The staff assignment system creates an update event in the EHR for the Charge Nurse role (ROL|1) when the staff "mpaschal" is scheduled for that role and unit in the system. The information included in the HL7 message includes an admit update segment (ADT^A08) as well as patient identification (PID) and visit information (PV1).

This HL7 sample can be configured to trigger (send a notification) immediately on a related assignment change in Vocera.

```
MSH|^~\&|VOCERA^VOCERA^GUID|||20200206141230|||
ADT^A08|9a6f1dce-2a89-4a00-ae22-18828e7721f5|P|2.3
PID|||00112233445||Smith^Joan||19640710|M
PV1|||UNIT^1^1|||||||||||||||||||||FACILITY
ROL|1||Charge Nurse|^.....^mpaschal2|20200206141155
```

Bed Tracking Solution

The Bed Tracking solution enables bed management modules within or integrated with the EHR to provide ADT transactions that can facilitate alerting staff of bed status.

Movement of patients throughout a facility can be enhanced by sending notifications to staff for awareness for arrival, transfer and departures, such as when a patient is being transferred from the ICU to a Step Down Unit.

When the pending transfer is entered in the bed tracking module, a notification can be triggered to the ICU nurse assigned to the patient and the Charge Nurse of the Step Down Unit for awareness of the pending transfer. Once the transfer is completed and entered in the bed tracking module, and ADT is updated for the patient's new location, a notification can be triggered to the housekeeper assigned to the ICU to clean the room.

If a patient is discharged to home and the update is made in ADT, the housekeeper assigned to that location can be notified to clean the room. When the room has been cleaned, the housekeeper can enter the clean status in the bed tracking module, which can then notify the charge nurse that the room is ready. The ADT discharge event is communicated to Vocera in the HL7 feed, and triggers a Vocera rule configured to notify staff in housekeeping of the change in bed status.

Using a PV1 Field in the ADT-A03 Event

An HL7 ADT-A03 event signals the end of a patient's stay in a healthcare facility. In the ADT-A03 event, the patient visit segment (PV1) identifies the location which is being vacated by the discharged patient. This location can be communicated to the housekeeping department in near real time, allowing efficient updates to staff and task scheduling, and resulting in a rapid bed turnover for the facility.

The Vocera rule sends a notification message to the facility's housekeeping department that identifies the discharged location, and the manager can then check their resource system, and assign the cleaning and set up tasks to staff.

In this HL7 sample, a patient is to be discharged from bed 1 in room 214, as shown in the PV1.3 field. The ADT-A03 update event will trigger a message notification to housekeeping, allowing the room to be prepared for the next patient.

```
MSH|^~\&|AccMgr|1|||20050112154645||ADT^A03|59912415|P|2.3|||EVN|A03|
20050112154642|||
PID|1||10006579^^^1^MRN^1||DUCK^DONALD^D||19241010|M||1|111^DUCK ST^^FOWL^CA^999990000^^M
1|8885551212|8885551212|1|2|40007716^^^AccMgr^VN^1|123121234|||NO
PV1|1|I|IN1^214^1^1^^S|3|IN1^214^1|37^DISNEY^WALT^^^^^AccMgr^^^^CI||01|||1||
37^DISNEY^WALT^^^^^AccMgr^^^^CI
2|40007716^^^AccMgr^VN|4|||1||1|P||20050110045253|20050112152000|3115.89|
3115.89|||
```

Patient Monitor Device Solution

The Patient Monitor Device solution can incorporate additional clinical context with the patient monitoring device alarms in an escalation pathway.

FDA regulated devices require our 510k clearance compliance. Vocera integrates with regulated devices, such as Physiological Monitors, Ventilators, and IV infusion pumps that use the HL7 standard to communicate device events. Vocera can receive alarms from the regulated device, and send notifications to the appropriate staff with an escalation pathway as designed. The notification alert can include the patient details for additional clinical context.

When a patient monitor (such as a Philips Physiologic Monitor) triggers an Extreme Bradycardia alarm, the HL7 message sends an alarm notification event to Vocera, and a rule is triggered to send an alert notification to the nurse assigned to the patient. If that nurse is unable to respond, the alert notification is sent to the Charge Nurse. The alert notification includes additional patient context such as the Heart Rate at the time of the alarm event and the admitting diagnoses of the patient.

Using an OBX Segment in an ORU-R40 Event

In an HL7 ORU-R40 message, the Observation Request (OBR) segment defines the attributes of a particular request for diagnostic services (e.g., laboratory, EKG) or clinical observations (e.g., vital signs or physical exam). The Observation/result (OBX) segment is used to transmit a single observation or observation fragment.

In this HL7 sample, the Mindray eGateway device identified in the OBR segment reports a Low SpO2 value in the first OBX segment. This ORU-R40 event will trigger a configured Vocera rule to initiate an escalation path to notify caregivers of the alert for the identified Surgery patient.

```
MSH|^~\&|MINDRAY_EGATEWAY^00A037EB2175780F^EUI-64|MINDRAY|
AM|PHILIPS_IEM^00095CFFFE741952^EUI-64|PHILIPS|20120111150457- 0600||ORU^R40^ORU_R40|1|P|
2.6|||AL|NE||UNICODE UTF-8|||IHE_PCD_ACM_001^IHE_PCD^1.3.6.1.4.1.19376.1.6.4.4.1^ISO
PID|||HO2009001^^^Hospital^PI||Hon^Albert^^^^^L||18991230|M
PV1||I|HO Surgery^OR^1
OBR|1|1^MINDRAY_EGATEWAY^00A037EB2175780F^EUI64|#
1^MINDRAY_EGATEWAY^00A037EB2175780F^EUI64|
196616^MDC_EVT_ALARM^MDC|||20120111150457- 0600|||
^1&MINDRAY_EGATEWAY&00A037EB2175780F&EUI-64 OBX|1|ST|196670^MDC_EVT_LO^MDC|
1.3.1.150456.1|LowSpO2||L~PM~SP||F|||201201111504570600|||
F1519EFX^SHENZHEN_DEVICE^mindray.com^DNS
OBX|2|NM|150456^MDC_PULS_OXIM_SAT_O2^MDC|1.3.1.150456.2|88|262688^MDC_DIM_PERCENT^MDC|
90-96|||F|||20120111150457-0600
OBX|3|ST|68481^MDC_ATTR_EVENT_PHASE^MDC|1.3.1.150456.3|start|||F
OBX|4|ST|68482^MDC_ATTR_ALARM_STATE^MDC|1.3.1.150456.4|active|||F
OBX|5|ST|68483^MDC_ATTR_ALARM_INACTIVATION_STATE|1.3.1.150456.5|enabled|||F
```

PRN Medication Effectiveness Solution

The PRN Medication Effectiveness solution delivers automatic reminders to care givers in order to ensure patients are reassessed for medication effectiveness after a dose is administered.

PRN (pro re nata) translates to "as the situation requires." A PRN order means that a medication may be ordered as needed for the patient. With administration of the medication, the nurse should reassess the patient for effectiveness of the medication at a defined interval depending on the route of administration. When the medication is marked as given in the electronic medication administration record (eMAR), Vocera can receive the time of administration and start a timer to send a notification to the nurse when the re-assessment is due. The administration details are recorded in the facility's EHR along with the prescribing physician's ID, and integrated with the patient's details (ID, location) from the ADT records.

An order for pain medication orally every four hours as needed (PRN) has been ordered in the EHR for a patient. The nurse administers the medication at 1:20 due to a reported high pain score by the patient and records the administration in the eMAR. Sixty minutes after administration, a Vocera notification reminds the nurse that the patient should be reassessed for pain relief and the results documented.

Using an ORC Segment in the RAS-O17 Message

The EHR record is updated when a nurse delivers a pain medication dose to the patient. The update event includes the time of the dose, and is received by Vocera in a distinct HL7 feed (eMAR) by Vocera. This eMAR interface includes specific HL7 messages detailing the medication dose, medication route, and medication delivery time, which triggers a configured rule. A Vocera rule integrates all available details and in a set period of time after the dose is administered, sends a reminder to the caregiver at the ideal, clinically relevant time to check on the patient's pain score.

The HL7 RAS-O17 message may be created by the administering application (e.g., nursing application) for each instance of administration for an existing order. The RAS-O17 event uses the ORC segment to identify the medication information.

In this HL7 sample, the ORC.7.1-3 (quantity, interval, duration) fields identify the patient's medication dosage; 5MG Q6H PRN. Upon a medication delivery update event in the EHR, Vocera triggers the reminder notification to be sent to the caregiver.

```
MSH|^~\&|R1LAEX NURSE CALL|509|R1LAEX NURSE CALL|509|20171227081354-0500||RAS^017|
5092635771984|T|2.4||AL|NE|USA
PID|||222938|58^^^^AGE|SMITH^JANE^IHH||19590413|F|||||||101230007
PV1||U|6D MED 6D117-1^^^509|||297691^STEPHENS^AKERIA^D
ORC|XX|30257834^R1LAEX^30257834^IEN|144U|||5MG^Q6H PRN^^^^^^P||201701190020-0500|
297691^STEPHENS^AKERIA^D|
|||201701190020-0500|||297691^STEPHENS^AKERIA^D
```

RTLS Solutions

The RTLS solution enables Real Time Location Systems (RTLS) to use HL7 to communicate location and events which Vocera can integrate with EHR data in an enhanced notification message to recipients.

RTLS uses tags with a unique ID, which are assigned to the individual patient or equipment to be monitored. Stationary sensors record the location of the tags in the RTLS system, and the location of each sensor is known in the system.

When a tag is located by a sensor, the tag's data is recorded in the RTLS system, and a record update is sent to Vocera in the HL7 feed. When triggered, a rule integrates the RTLS data with the EHR details in an alert sent to caregivers for configured events.

HL7 is one choice, however, other protocols are still commonly used by RTLS systems such as SMTP, TAP, and SOAP.

RTLS Presence and Location Solution

The RTLS solution utilizes RTLS systems to manage alerts and messages sent to staff based on the user's Presence status, or the location of an RTLS tag.

RTLS tags worn by nurses can be used to control the messages and alerts sent to the nurse while in the medication room, reducing the potential for medication errors due to distraction.

Using RTLS, a sensor in the medication room captures a nurse's RTLS tag data upon entry or exit, and updates the record in the system. When the nurse enters the medication room, the RTLS system informs Vocera in an update event. The update triggers Vocera rules that are configured to change the nurse's Presence to Do Not Disturb (DND), and redirect alarm notifications to the designated alternate recipients in the escalation path.

RTLS tags can also be used to avoid sending alerts to a nurse's device when the nurse is present in the patient's room that is alarming. Suppressing unnecessary notifications reduces alarm fatigue for caregivers.

In this situation, a nurse may be performing a procedure on an infant which often causes a tachycardia episode. The patient monitor will alarm for the Tachycardia event, but since the nurse is in the room and aware of the alarm, Vocera does not need to send an additional notification to the mobile device. The RTLS system detects that the nurse is in the room and updates Vocera. The update triggers Vocera rules which specify that the patient monitoring system alert is not delivered to the nurse currently in the room, as well as specifying that the alarm is not escalated to other caregivers in the usual escalation path.

RTLS Safety and Security Solution

The RTLS solution can use RTLS systems to generate actionable alerts, such as notification of a possible breach of infant safety or unit security.

Ensuring infant security is critical in the healthcare environment to provide peace of mind for administrative and nursing staff, as well as the new parents. Many facilities use an infant protection and security system such as CenTrak to track patient movement in the hospital. If an infant's RTLS tag is loose or has been removed improperly, Vocera receives an alert from the infant security system. Vocera leverages rules to deliver alerts to the appropriate recipients, allowing a rapid evaluation of risk to the infant.

When a patient wanders outside of a unit, such as the Alzheimer's unit, or when a secure unit door is ajar, Vocera receives an alert from the RTLS system. Vocera leverages rules to deliver alerts to the appropriate recipients.

Using a ZPV Segment in the ADT-A08 Event

The HL7 ADT-A08 event is used when any patient information has changed, but when no other trigger event has occurred, and it can include information specific to an episode of care. The EVN segment is used to communicate necessary trigger event information to receiving applications.

In this HL7 sample, the RTLS tag information is included in the customized ZPV segment. An alert would be delivered to the staff associated with the location and the RTLS tag in a configured rule.

```
MSH|^~\&|CENTRAK|CENTRAK|VOCERA|VOCERA|[[MESSAGE_DATE]]|[[MESSAGE_ID]]|ADT|A08|2.3|AL|
EVN|A08|[[MESSAGE_DATE]]|LOCATION|[[EVENT_DATE]]
ZPV|[[TAG_ID]]|[[SAM_ACCOUNT_NAME]]|[[STAFF_NAME]]|[[LOCATION_ID]]|[[LOCATION_NAME]]|
```

STAT Order Solution

The STAT Order solution expedites a physician's STAT orders to the patient's care team, providing a systemic improvement in nursing efficiency.

The facility identifies the STAT orders for specific lab/radiology/pharmacy orders. Vocera receives the EHR HL7 feed for specified STAT order events.

Repeated logins to the EHR, searching for results or calling providers to check on an order, are typical examples of non-clinical tasks that reduce productivity and job satisfaction. Vocera-managed STAT order notifications result in nurses spending more time in the "executive functioning" required to navigate a patient's journey.

When a physician writes an order for lab/radiology/pharmacy for a patient, it is entered in the facility EHR. Vocera receives the event in the EHR HL7 feed, which triggers a rule to send a STAT order notification message to the patient's assigned nurse or care team.

Using an ORC field in the RDE-O11 Message

Vocera leverages the HL7 RDE-O11 message with ORC segments to identify STAT orders. The RDE-O11 message communicates the pharmacy or treatment application's encoding of the pharmacy/treatment order. An ORC.7 field addresses quantity and timing for the order.

In this HL7 sample, a STAT medication order displays the priority in ORC.7.6; the STAT priority is represented by the "S" flag at the end of this segment:

```
(^ 2 TIMES DAILY (9A \T\ 5P)&0900,1700 ^ ^ 20200915090000 ^ 20200917101916 ^ S)
```

The RDE-O11 message can include additional details in the RX (RXE, RXR, and RXC) segments, as shown.

```
MSH|^~\&|EPIC|1CDHP|ES|ES|20200917101921|SEVERINO|RDE^O11|24095549|P|2.3
PID|||999999999^^^MR^MR||LAST NAME^FIRST NAME^MI||19700101|F||W|Home Address|DUPA|Home
Phone^P^PH||ENGLISH|W|CHR|12345678|SSN|||N|^IL
```

```
MSH|^~&|EPIC|CC|GOODTOGO|CC|20200407024931|U0047989|ADT^A03|
307638910466968535078934920993831287912|P|2.4
EVN|A03|20200407024931||ADT_EVENT|U0047989^L11^Test111^M2156|20200407024931
PID|1||MRNAUTO11001^^^CC^^^^HUB^CC^MRN||L2^AUTO_11001update^M2||19790424|M||C|main
st^^MICHIGAN_CITY^IN^46360^USA||765-744-1695^^7||ENG|S||VISITAUTO11001
PV1|1|I|4NCC^4NCC1026001^P|1|||^||ERM|||||^||VISITAUTO11001|
MEDICAID|||||||20200407004931|20200407024931|||VISITAUTO11001
PV2|Priv|||||200|N|||||Y||||Self
DG1|1|ICD-10|641.13^Fever307638910546196697593423875618790341736^ICD-10-CM|
Fever307638910546196697593423875618790341736|20200407024931|^W
```

Workflow Examples

Workflow examples provide an architectural diagram of one solution, with a description of the exchange of data between the third party application and the Vocera system.

This section describes a few specific workflows. A high level view of the system provides opportunity for you to imagine some future integrations using Vocera adapters.

Critical Result Workflow

The Critical Result workflow provides patient testing results with critical levels in alert notifications to specified caregivers.

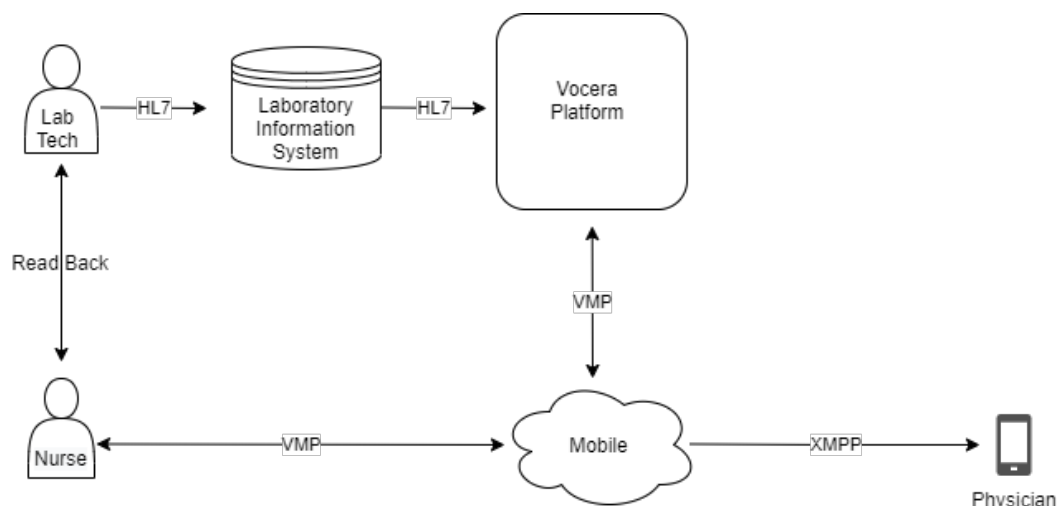
The facility identifies the critical values for specific lab/radiology/pharmacy results. Vocera receives lab/radiology/pharmacy events in the HL7 feed from the EHR, or directly from the lab/radiology/pharmacy HL7 feed. Vocera filters the HL7 feed for results or findings with critical values, which trigger a rule to incorporate the results and patient information in an alert notification message to send to configured recipients.

A physician orders lab/radiology/pharmacy tests or procedures for a patient upon admission to the facility. The lab/radiology/pharmacy group runs the ordered test and enters the result in the system. The assigned nurse receives the critical lab/radiology/pharmacy result in a message that incorporates the patient details. The nurse can add the physician directly to the patient's care team communication, if the physician is using Vocera's Vina app.

This critical result workflow generally results in a change in medication, or a change in care plan. The effect is to improve reliability of delivery to the physician, reduce time required tracking critical lab results, and adds up to improving the delivery of care.

Workflow Example

In this workflow you may note that HL7 is used to input data, and XMPP to output notifications. Other protocols could be used in these scenarios. Vocera provides multiple input and output adapters, as well as adapters to integrate with specific third party vendors.



As shown in this diagram, the workflow begins when the Lab Tech enters a critical lab result in the Laboratory Information System (LIS). The LIS sends the critical lab result to the EMR and the HL7 processor forwards the critical lab result to the Vocera Platform in the HL7 feed. The Vocera HL7 Adapter then saves the critical lab result to the Labs dataset. Vocera filters for A (Critical) or AA (Extremely Critical) flags in the OBX.8 segment for the critical lab results.

Vocera intelligently identifies the covering nurse. A third party On Call System can synchronize assignment data with Vocera. The Vocera OnCall Adapter saves the assignment data to the Assignments dataset. The Labs dataset contains the escalation rules that use the Assignment dataset to identify the recipient of the critical lab result notification.

Notifications are sent to recipients connected to the system by one of the Vocera outbound adapters, such as the following:

- VMP Adapter for Voice Badge, SmartBadge, and/or VCE on Smartphone
- XMPP Adapter for Vina
- Outgoing WCTP Adapter for Epic Rover
- SMTP Adapter for email

Vocera sends a preliminary notification to the covering nurse. The notification is delivered to the mobile device, and then accepted by the recipient, the covering nurse. When the notification status is Accepted, Vocera takes the Lab Techs contact number from the HL7 feed, and creates a new button on the nurse's phone to allow them to initiate a voice call to the lab. Vocera also creates an enhanced Caller ID that displays in a popup on the lab's desktop phone, so the lab can identify the incoming call from the covering nurse.

The new button allows the nurse to perform a "Read Back" step to verify the critical lab result. The nurse presses the new button on their device to call the lab tech, and validates the test result with the lab tech before forwarding the result to the physician. The nurse may ask if there were any anomalies in the test or result, or any reason to do a retest.

Once validated, the nurse then forwards the critical lab result to the responsible provider, usually the ordering physician. The physician receives the lab result notification on their phone or communication device. When the ordering physician acknowledges or accepts the notification, they take responsibility for the critical lab result, and that completes the workflow process.

Fall Risk Score Workflow

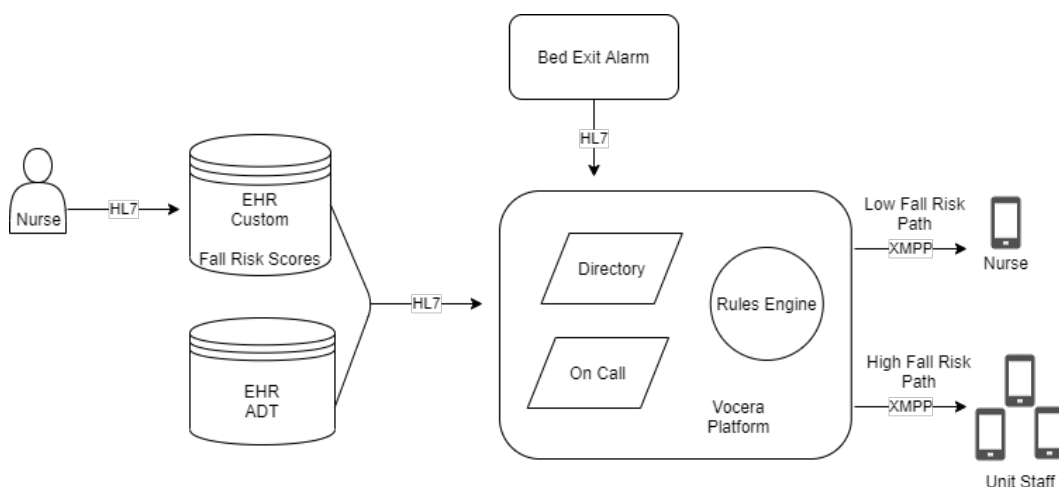
The Fall Risk Score solution can include the patient's fall risk score in notifications to care team members.

Clinical staff perform a fall risk assessment on a patient, or an MD provides the facility with it upon admission, resulting in a Fall Risk Score. The Fall Risk Score is part of the facility Clinical Details record in the EHR, though not part of the standard HL7 ADT feed. Vocera can be configured to integrate the patient's Fall Risk Score in the alert notification sent to the care team for an event triggered by a third party system.

The alert escalation pathway for a bed exit alarm can be configured depending on the fall risk score of the patient in the bed at the time the exit alarm is triggered. For example, when a patient who has a high Fall Risk Score triggers a bed exit alarm, the alert can be automatically escalated to the highest level, allowing a nurse or care team member to respond quickly.

Workflow Example

In this workflow you may note that HL7 is used to input data, and XMPP to output notifications. Other protocols could be used in these scenarios. Vocera provides multiple input and output adapters, as well as adapters to integrate with specific third party vendors.



As shown in this diagram, the workflow begins when a nurse enters the patient's fall risk score in the EHR. In many facilities this record is maintained in a custom interface, which is separate from the ADT records in the EHR. Vocera receives the patient's fall risk score in the clinical documentation contained in the custom feed, and integrates this score with the patient's details provided in the ADT data.

When the patient's bed exit system alarm is triggered, Vocera intelligently integrates the patient's fall risk score and any other aggregated data, and sends alerts to configured recipients.

Rules configured in Vocera enable the appropriate recipients to be identified and notified. When the patient's fall risk score is low, the rule configuration may specify only the assigned nurse is notified of the bed exit event. However, when the fall risk score is high, alerts may be sent to all staff on the unit to ensure the patient is protected. When the care staff acknowledge or accept the notification, they take responsibility for the fall risk alert, and that completes the workflow process.