

Use Case Title: Silent Pediatric ICU for Improved Patient Care

Short Description: Harper is a ventilated, pediatric patient undergoing daily sedation interruption (DSI) trials. The hospital's focus is to provide high quality, safe, patient care while leveraging the latest technological advances. A specific topic the hospital wants to address is the noise pollution in the patient room. Noise pollution in intensive care units (ICUs) can interfere with the preferred conditions that help promote a healing environment; and it is suspected of being a high risk for patient delirium, which is associated with longer lengths of stay, increased readmission rates, cognitive and functional impairment as well as increased mortality. This showcase demonstrates how open interoperability technology based on the ISO/IEEE 11073 SDC standard enables safe distribution of medical alarms from different vendors while allowing bedside medical devices to stay silent for a comfortable healing environment. Harper is monitored with a multi-modality system that is used for data aggregation, remote intervention from a medical grade PC, and most importantly reliable forwarding of alarm data and associated information to the appropriate caregivers. This alarm forwarding technology based on the SDC standard enables the bedside device to stay silent – therefore, distressing neither Harper nor her parents when an alarm occurs. Designated caregivers receive all information about their assigned patients' alarms directly on their handheld devices. Additionally, the alarm information is displayed on a dashboard located in the central nurses' station, so that colleagues are informed about the (alarm) status of Harper and all other patients.

Value Statement: Having a silent patient room with alarm forwarding technology supports patient healing, potentially prevents the development of delirium, and improves workflows for PICU care providers.

Participating Organizations: Dräger, Ascom, B. Braun, Epic

#	Scenario	Vendor	Products	Standards
1	<p>Introduction</p> <p>Harper is a critically ill pediatric patient, who receives mandatory ventilation using a Dräger ventilator and B. Braun syringe pumps for a controlled analgo-sedation.</p> <p>To help prevent delirium and follow modern therapy approaches she receives daily sedation interruption (DSI) trials where the sedation level is changed so that she reaches an adequate level of sedation where she is able to react to communication and breathe assisted from the ventilator while being pain- and stress free. This is measured using the RASS (Richmond Agitation and Sedation Score) a scoring system to check and control the patient sedation</p>	<ol style="list-style-type: none"> 1. BBraun 2. Dräger 	<ol style="list-style-type: none"> 1. Spaceplus Perfusor with Propofol 1% 2. Evita V600 Ventilator Patient Monitor 	See table below

	and agitation level, split into 10 levels to separate from deep coma up to heavy agitation and aggression).		
2	<p>Before the DSI trial of the current day starts, the syringe pump forwards an alarm to the responsible caregiver that the volume of the medication inside the syringe is nearly empty (pre-alarm).</p> <p>The alarm is forwarded to the handheld device of the caregiver and also visualized on the Ascom dashboard.</p> <p>Because of the reliable transmission of the alarm the pump in the patient room can remain silent, so that our patient <i>Harper</i> is not disturbed. Together with the alarm the caregiver is informed about which medication runs empty so he can prepare the medication replacement before going into the room.</p> <p>Also, the caregiver is informed about the acuity of the alarm so in this case the caregiver acknowledges the alarm at first to end the work he is doing right now before starting to prepare the medication and go over to <i>Harper's</i> room.</p>	<ol style="list-style-type: none"> 1. BBraun 2. Dräger 3. Ascom 	<ol style="list-style-type: none"> 1. Spaceplus Perfusor with Propofol 1% 2. Targeted Alarm Service 3. Ascom Digistat and Unite
3	<p>Unfortunately, our caregiver needs longer than expected to finish his current work so that the syringe finally runs empty (operating alarm) and <i>Harper's</i> heart rate starts to rise due to the missing sedation and the uncontrolled awakening.</p> <p>A new alarm ("HR high" and "RR high" alarm) pops up, this time provided from the patient monitor and the ventilator. Our caregiver decides to immediately go to <i>Harper</i> to change the medication and to control the wakeup process.</p> <p>In addition to the patient monitoring inside the room, the ward also uses a point-of-care cockpit in front of the patient's rooms that displays the patient's status. With this, caregivers have the possibility to check the patient's vitals and data from connected source devices to get an overview of the situation (e.g. other medication pumps that will alarm in the next few minutes), before entering the room.</p>	<ol style="list-style-type: none"> 1. BBraun 2. Dräger 3. Ascom 	<ol style="list-style-type: none"> 1. Spaceplus Perfusor with Propofol 1% 2. Evita V600 Ventilator Patient Monitor 3. Ascom Digistat and Unite 4. Access & Control Package

4	<p>The caregiver acknowledges the alarms on the pumps, patient monitor and the ventilator and changes the syringe. Now that the medication can flow again, and the HR related alarm is solved the caregiver leaves the room to help a colleague before starting the first controlled DSI trial of the day. Suddenly a new alarm from the syringe pump occurs which is again communicated to the handheld device as well as to the Ascom dashboard.</p> <p>The infusion pump has recognized an occlusion and has stopped infusing the medication. Due to the safe alarm forwarding the caregiver is informed directly while the pump still stays silent inside the room. <i>Harper</i> is again not disturbed in her light sedation.</p> <p>The caregiver quickly moves over to <i>Harper</i> and solves the occlusion before restarting the therapy and the DSI trial.</p>	<ol style="list-style-type: none"> 1. BBraun 2. Dräger 3. Ascom 	<ol style="list-style-type: none"> 1. Spaceplus Perfusor with Propofol 1% 2. Evita V600 Ventilator Patient Monitor 3. Ascom Digistat and Unite 	
5	<p>This scenario explains how reliable alarm forwarding could reduce noise pollution in a PICU and help caregivers optimize their workflows.</p> <p>But what happens in case of an infrastructure or network failure so that the alarm forwarding from the patient monitor, pumps or ventilator is no longer possible?</p> <p>In such a case, the devices will immediately fall back to annunciate upcoming alarms (audible and visual) locally, which means inside of the room while the dashboard provides a “disconnection alarm”. This will inform caregivers on the ward that the alarm forwarding is currently not in operation.</p> <p>The Ascom dashboard will also communicate the disconnection situation and recommend opening the patient room doors to ensure that alarms are heard during the network/infrastructure failure.</p> <p>If we now replay the scenario we already had: an occlusion alarm of the pumps but with a network connection error, then the pumps will alarm locally in the patient room and due to the noise inside the room and her light sedation level <i>Harper’s</i> heart rate will rise again maybe generating a new alarm (on the patient monitor)</p>	<ol style="list-style-type: none"> 1. BBraun 2. Dräger 3. Ascom 	<ol style="list-style-type: none"> 1. Spaceplus Perfusor with Propofol 1% 2. Evita V600 Ventilator Patient Monitor 3. Ascom Digistat and Unite 	

	<p>And as the doors of the patient rooms are open the responsible caregiver can hear the alarms, go over to <i>Harper</i>, pausing the alarms and explain the situation. <i>Harper</i> will no longer be concerned and stressed, and the heart rate alarm goes away naturally.</p> <p>As soon as the network or infrastructure issue is resolved, the system connections are restored (which is displayed on the infusion pumps UI as well as on the dashboard), alarms will be forwarded again to the responsible caregivers and the devices at the bedside will go back into the “silence” state.</p>			
6	At the end of the shift, during the handover, the caregiver uses the medical grade PC in front of the room, which also runs Epic besides the Core SW. In the Epic SW the caregiver can check whether all data from the bedside devices has been integrated properly and can confirm it accordingly.	Epic		

Data Exchange Standards:

Vendor	Product	Category	Protocol	Interop Body	Interop Profile	Interop Actor	Interop Message	Send or Receive	Transaction Description
Dräger	Patient Monitor	Monitoring	SDC		DEV-SDPi	SOMDS Provider	DEV-29 (and other DEV)	Send & receive	Device sends alerts to TAS and gets delegation command from TAS
Dräger	Evita V600	Ventilator	SDC		DEV-SDPi	SOMDS Provider	DEV-29 (and other DEV)	Send & receive	Device sends alerts to TAS and gets delegation command from TAS
Dräger	Core SW	Medical SW for remote view & control	SDC		DEV-SDPi	SOMDS Consumer	DEV-29 (and other DEV)	Send & receive	Core SW receives data from medical devices (V800, IACS, Spaceplus)
Dräger	Targeted Alarm Service	Alarm Distribution SW	SDC		DEV-SDPi	SOMDS Consumer	DEV-30 (and other DEV)	Send & receive	TAS receives alarms from all devices and delegates them to Ascom

Dräger	HL7 Export Service	IT Gateway Software	SDC/HL7		PCD-DEC SDPi	DOR SOMDS V2 Gateway	PCD-01/10 DEV -30 (and other)	Send & Receive	Sending Metrics from all SDC-Devices to Epic as HL7v2
B. Braun	Spaceplus Perfusor(R) + OnlineSuiteplus	Infusion Therapy	SDC IEC 60601-1-8	Intravenous administration	SDPi	SOMDS Provider	DEV-29 (and other DEV)	Send & receive	Device sends alerts to TAS and gets delegation command from TAS
Ascom	Digistat	Alarm Distribution			DEV-SDPi (through TAS)	SOMDS Consumer		Send & receive	SDC Communication indirectly through Dräger TAS
Epic		EMR	IHE DEV PCD		PCD-DEC	DOC	PCD-01	Receive	Receiving HL7v2 Messages for all SDC Devices

References: