Clinical Data Transmission
Preparing for Patient Arrival and Care

Application Note

Send

Consult

Prepare

The Goal: Better Information, More Informed Decisions

From the moment ALS responders arrive on the scene of a critical care patient, their hands are full stabilizing the patient and preparing for transport. Whether the patient is suffering a cardiac event, stroke, trauma or some other critical care condition, the immediate focus is on patient care. In these situations, ALS responders have little, if any, time to document, manually transmit data, or call ahead to medical control or the receiving hospital to advise that they are inbound. How then can this information be conveyed in a timely manner to alert emergency departments and treatment centers of the clinical status of inbound patients?

It has already been established that transmitting prehospital ECGs and 12-lead ECG reports to the hospital can help reduce first-medical-contact-to-balloon or door-to-balloon (D2B) time for patients in need of percutaneous coronary intervention (PCI)[1,2]. For patients suffering ST-segment elevation myocardial infarction (STEMI), EMS agencies and PCI hospitals are working together to create regional STEMI networks in their service areas to link responder agencies with receiving centers. This link results in significant conformity to a D2B time of less-than or equal to 90 min, and surpassing the American College of Cardiology D2B Alliance benchmark[3]. These same networks can also be leveraged to support more than just STEMI patients. Similarly, EMS personnel have transmitted ECGs to offsite cardiologists via a fully automated wireless network, resulting in shortened D2B times (63 min. average), as well as other reduced infarct size and shortened length of hospital stay.[4]

You can support all types of critical care patients when EMS agencies and PCI hospitals automatically receive patient vitals, 12-lead ECG reports, rhythm strips, and other clinical data on a periodic or event-driven basis through appropriate data transmission solutions.

This application note describes the basic components of an emergency care clinical data transmission network, how they function, and what is needed to put them into action.

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Clinical Data Transmission Solutions

Philips offers a suite of open data management solutions that streamline information delivery in an effort to optimize patient care and operational efficiency. One of these is focused on emergency care clinical data transmission from the ambulance to either the medical control office or directly to the receiving hospital. From there, this data can be shared with the emergency department and other specialists such as cardiologists, surgeons, neurologists, and respiratory therapists.

Send from the point of care

The solution begins with a Philips HeartStart MRx Monitor/Defibrillator. The MRx is a multi-modality ALS monitor capable of delivering electric therapy for pacing, cardioversion and defibrillation. It can be equipped with cellular, WiFi (Wireless Link), and/or *Bluetooth* wireless technology to send data to the hospital ahead of the patient.

Once connected to the internet, the MRx is able to send data to Philips' HeartStart Telemedicine System, a software application that receives, stores, and forwards the clinical data to a number of destinations. With the push of a few buttons on the MRx, 12-Lead reports and periodic clinical data can be sent to pre-configured distribution lists via the Telemedicine System. Figures 1-3 illustrate the end-to-end Wireless Link and Bluetooth data transmission flows.

NOTE: Only 12-Lead ECGs can be transmitted to Philips' TraceMasterVue ECG database.

Figure 1 **End-to-end Wireless Link 12-Lead Transmission**

Figure 2 **End-to-end Wireless Link Periodic Clinical Data Transmission**

Figure 3 **End-to-end Bluetooth Data Transmission**

Prepare and respond at the receiving center

HeartStart Telemedicine System software can reside on a server at an EMS dispatch center, medical control, one hospital, or a number of hospitals.

The HeartStart Telemedicine System can be shared among EMS agencies and can serve multiple hospitals and destinations in a regional network. A viewer component (HeartStart Telemedicine Viewer) allows clinicians or system administrators to interact with patient data found on the server and perform limited tasks, such as forwarding events to a variety of locations.

Figure 4 depicts the type of information available when looking at a "patient's view" on the PC installed with the HeartStart Telemedicine Viewer. In one glance, you can see the latest data on a particular patient and consult with medics in the field, as needed.

Figure 4 **Telemedicine Patient View**

Reports can be generated from the HeartStart Telemedicine System and printed or emailed. They can also be attached to electronic medical records to provide a complete clinical picture, including pre-hospital status, presenting rhythms, and historical trends. Figure 5 illustrates sample 12-lead, waveforms, and vital trends.

Figure 5 **Telemedicine System Reports**

12-Leads

Waveforms

Vital Trends

Vital Trends HEARTSTART HeartStart Telemedicine 4.0

Case date: 8/7/2009 **Patient ID:** 0908071501402b9f
Device: HeartStart MRx: US00330450 **Patient name:** VITTT
Reference ID: 111222 **Institution:** DMSG TEST LAB

Trend	15:32:00	15:31:00	15:30:00	15:29:00	15:28:00	15:27:00	15:26:00	15:25:00
HR (bpm)	72	72	72	72	72^	--	72	--
SpO2 (%)	98	98	99	98	98^	--	98	--
Pulse (bpm)	66	65	64	65	66^	--	60	--
EtCO2 (mmHg)	--	--	--	--	40	--	40	--
AwRR (rpm)	--	--	--	--	16	--	21	--
ABP diastolic (mmHg)	1	1	1	1	1^	--	1	--
ABP mean (mmHg)	10	10	10	10	10^	--	10	--
ABP systolic (mmHg)	25	25	25	25	25^	--	25	--
PAP diastolic (mmHg)	9	9	9	9	9^	--	9	--
PAP mean (mmHg)	11	11	11	11	11^	--	11	--
PAP systolic (mmHg)	12	12	12	12	12^	--	12	--
Temp (℃)	37	37	37	37	37^	--	37	--
NBP diastolic (mmHg)	--	--	--	--	69	--	--	--
NBP mean (mmHg)	--	--	--	--	82	--	--	--
NBP systolic (mmHg)	--	--	--	--	107	--	--	--

Figure 6 depicts a typical HeartStart Telemedicine System hospital implementation. Here patient data is received by HeartStart Telemedicine Server and viewed on various machines installed with HeartStart Telemedicine Viewer.

Figure 6 **Typical Telemedicine System Hospital Implementation**

Clinical Data Transmission Benefits

Philips' emergency care clinical data transmission solutions provide benefits to both EMS and hospital organizations.

For EMS, it means:

- **Hands-free, hassle-free transmission**

  Start data transmission. Then, forget it, so you can keep your focus on patient care.

- **Informed clinical support for help with critical patients**

  Screen unnecessary transports and get assistance (from the receiving hospital) with patients who are refusing transport.

If there is a dispatch or call center involved in the EMS system, personnel can see patient clinical status and provide medics remote support for critical patients. If needed, they can direct the medics to a more appropriate facility.

The net result? A more informed emergency department (ED) means shorter handoffs that enables you to reduce out-of-service times and to meet service level commitments.

For a receiving hospital, it means:

- **Advanced notice of inbound critical care patients**
  You'll have legible, objective data in hand to reduce manually recorded and verbally recalled information.

- **Making appropriate decisions**

  Find a bed for a patient, consult a specialist as required (or not), and refer to a patient's history.

The net result? A more informed receiving team may be able to reduce a patient's stay in the ED and better utilize the Cath Lab, Radiology, Surgery, and/or ICU.

Conclusion

Critical care patients require timely and accurate collaboration between EMS and receiving medical facilities. Meeting this requirement means adoption of new technology to streamline operations and increase access to and use of patient information.

Philips understands this requirement. Philips provides flexible, tracable, and easy-to-use data transmission solutions for exceptional patient care and operational efficiency in the field and in the hospital. And these solutions come with no contracts. Clinical data

transmission is just one part of a suite of data management solutions. Others include quality review software, data integration, and streamlining Event Summary file management workflow. For more details, please contact your Philips account representative or visit www.philips.com.

Hardware and Software Requirements

HeartStart MRx Software Version
T.00 or higher and Wireless Link option* ***Wireless Link options** ▸ D01 MRx Wireless Link – Generic (WiFi) ▸ D02 MRx Wireless Link – Verizon (US only) ▸ D03 MRx Wireless Link – AT&T (US only) **Wireless Link upgrades** ▸ 860378 MRx Wireless Link – Generic (WiFi) ▸ 860376 MRx Wireless Link – Verizon (US only) ▸ 860377 MRx Wireless Link – AT&T (US only)
B.05 or later for 12-Leads (Option B06 or upgrade M3801A*)
F.01 or later for Periodic Clinical Data Transmission (Option B18 or upgrade 861443*)

**Bluetooth* card 989803153411 may be needed with upgrade

Bluetooth Wireless Technology Software and Hardware for cell phone
***Bluetooth* software to support protocol version 1.1 or higher**
***Bluetooth* Dial Up Networking Profile**
Tethering data plan (Consult your cell phone service provider)

Gateway/router Technology (instead of cell phone)
ISM Band: 802.11b and 802.11g using the 2.4 GHz ISM band
Security and Encryption: WEP (64/128 bit), WPA-PSK (TKIP/AES), WPA2-PSK (AES/TKIP)
Supported Cellular Technology (2G and 3G)
Supported Frequency Bands: ▸ GSM/GPRS/EDGE: 850/900/1800/1900 MHz ▸ UMTS/HSDPS/HSUPA: 800-850/900/1900/2100 MHz and AWS band (1700/2100 MHz) (B1, B2, B4, B5, B8) ▸ CDMA 1xRTT/EV-DO rev0/EV-DO revA: 800/1900 (BC0, BC1)

HeartStart Telemedicine System 4.2
Software **Operating system** ▸ For HeartStart Telemedicine Server *Required:* Microsoft® Windows Server 2008 R2 or Windows 7 that run with the corresponding Microsoft Internet Information Service (IIS) *Recommended:* 64-bit Microsoft Windows 7 ▸ For HeartStart Telemedicine Viewer *Required:* 32- or 64-bit Microsoft Windows 7 **Server** For HeartStart Telemedicine Server to configure the HeartStart Telemedicine system, database, and web service *Required:* • Microsoft SQL Server 2008 R2 Express Edition, 10 GB of data capacity • IIS Server for Windows Server 2008 R2 • IIS Server for Windows 7 **SMTP Server:** For HeartStart Telemedicine Server to forward emails (e.g., Auto Sent List) **Bluetooth** *Required:* Version 1.1 or higher **Accessories** Includes PDF Reader, back up and restore tool, ands email application

HeartStart Telemedicine System 4.2
Hardware **Processor speed** For HeartStart Telemedicine Server and HeartStart Telemedicine Viewer ▸ *Minimum:* 1 GHZ or higher **Display** For HeartStart Telemedicine Server and HeartStart Telemedicine Viewer ▸ *Minimum:* 1024 x 768 ▸ *Recommended:* 1280 x 1024 or higher **Memory** For HeartStart Telemedicine Server ▸ *Minimum:* 2 GB For HeartStart Telemedicine Viewer ▸ *Minimum:* 1 GB **Disk space** For HeartStart Telemedicine Server and HeartStart Telemedicine Viewer ▸ *Required:* 20 GB for database storage **CD-ROM drive** For HeartStart Telemedicine Server and HeartStart Telemedicine Viewer **Internet connection** For HeartStart Telemedicine Server and Viewer to activate the application software, forward patient transmissions, use the Email feature, and receive software updates **Telephone line** For HeartStart Telemedicine Server and HeartStart Telemedicine Viewer to fax patient data to destinations and dial in to the Internet *Required:* 1 analogue telephone line for each machine **Accessories** Includes fax modem, printer, Bluetooth adapter, and Bluetooth stack

Wireless Link Hardware
Wireless Link (Verizon)
Wireless Link (AT&T)
Wireless Link (Generic)
Wireless Link Cable Kit

References

1. Ong ME et al. *Nationwide Improvement of Door-to-Balloon Times in Patients With Acute ST-Segment Elevation Myocardial Infarction Requiring Primary Percutaneous Coronary Intervention With Out-of-Hospital 12-Lead ECG Recording and Transmission.* Annals of Emergency Medicine. S0196-0644(12)01419-9. Sep 2012.
2. Adams G. at el. *From theory to practice: implementation of pre-hospital electrocardiogram transmission in ST-elevation myocardial infarction - a multicenter experience.* Journal of Invasive Cardiology. 22(11):520-5. Nov 2010.
3. Rokos I.C. et al. *Integration of Pre-Hospital Electrocardiograms and ST-Elevation Myocardial Infarction Receiving Center (SRC) Networks. Impact on Door-to-Balloon Times Across 10 Independent Regions.* JACC: Cardiovascular Interventions. 2(4)(pp 339-346), 2009.
4. Sanchez-Ross M et al. *The STAT-MI (ST-Segment Analysis Using Wireless Technology in Acute Myocardial Infarction) trial improves outcomes.* JACC Cardiovascular Interventions. 4(2):222-7. Feb. 2011.

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