Clinical Decision Support Tools in IntelliVue Patient Monitors

Philips Healthcare, Monitors & Measurements
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Clinical Decision Support

Why CDS?

- **CDS** turns data into information
  - Smarter presentation of data reduces information overload
- **CDS helps to improve** clinicians’ workflow and economics associated with health care
- **CDS** helps detect critical conditions earlier
- **CDS** supports healthcare providers by helping to:
  - Enhance workflow
  - Improve financial outcomes
  - Save and improve patient lives
ST Map
What is it?

- Invented by Philips in 2004
- Philips’ exclusive ST Map is a graphical representation of a patient’s ST values in an easy to read multi-axis diagram
- Display ST values measured by the ST/AR algorithm from the frontal (limb leads) and horizontal (chest leads) planes
- Provides trend information with intervals from 12 seconds to 30 minutes
ST Map
Key benefits for clinicians

• Non-invasive tool that provides information to help to identify ischemic events
• Intuitive even for caregivers who are unfamiliar with diagn. ECG
  – Graphical format consistent with 2009 AHA/ACC guidelines
• Helps monitoring patients at risk for ischemia or myocardial infarction, e.g.
  – OR: Intra- and post-operatively for cardiac and high-risk surgical procedures
  – ED/CCU/Chest Pain Center: Chest pain patients
• Helps the clinicians to determine whether the intervention is having the desired effect
  – Evaluate reperfusion after thrombolytic therapy
  – Monitor re-occlusions after angioplasty (PCI)

“ST Map provides a non-invasive approach to monitoring patients who are at risk of myocardial ischemia. Inexperienced staff have a clear visual display which prompts them to seek expert advice sooner.”
ST Map
Available studies

- Yale University, US: ST Map ECG software improves nurses’ use of and attitude toward ischemia monitoring and the quality of patient care


“With ST Map, 90% of the nurses in the Cardiac ICU are now regularly monitoring for ischemia, compared to a baseline of 13%. Use of ST Map reduced time to acquisition of 12-lead ECG from as long as 15 minutes to under 5 minutes.”

Dr. Marjorie Funk, PhD, RN, FAHA, FAAN
Professor Yale University School of Nursing
New Haven, CT, US

Download the document at www.philips.com/evidence or from Philips Incenter (4522 962 60641)
ST Map
Available studies

• Lund University Hospital, Sweden: Using ST Map shortens response time and improves efficiency
  Dr. Jovinge, April 2010

“ST Map gives an integrated view of the directional ST movements over time. All our nurses are trained on it, so it allows for a shorter reaction time than the traditional ST indexes. If you have a shorter reaction time, that gives you, in the long run, a shorter time in the hospital for the patient, which means you are more efficient.”
Dr. Stefan Jovinge, CCU Medical Director, Lund University Hospital, Lund, Sweden

Download the document at www.philips.com/evidence or from Philips Incenter (4522 962 56601)
Horizon Trends

What is it?

• Invented by Philips in 2008
• A graphical representation of changes to a patient’s measurements
• An intuitive view of where a patient’s measurements stand in relation to a baseline or target values
• Shows which direction the overall trend of measurements is moving in
Horizon Trends
Key benefits for clinicians

• Philips’ exclusive Horizon Trends, make changes easier to see as they occur
• Enables clinicians to see at one glance whether or not a measurement has been maintained within a set range (horizon)
• Makes it easy to determine if a clinical intervention has had the desired effect
• Saves time over comparing current with past measurements in a chart
• Can help with alarm management: Use horizon to detect less severe, unactionable changes. Set alarm limits wider to only alarm on severe conditions

“The use of Horizon Trends helps us visually see how we are doing with IV medication titration in keeping our blood pressures at goal. It is nice being able to see trends with one quick look.”
Tara Drew, RN and Jody Case, RN, Clinical Leaders, ICU Concord Hospital, Concord, New Hampshire
**Horizon Trends**

**Available studies**

- Concord Hospital, US: Optimization of blood pressure management with vasoactive medications using Horizon Trends


“The use of Horizon Trends helps us visually see how we are doing with IV medication titration in keeping our blood pressures at goal. It is nice being able to see trends with one quick look.”

_Tara Drew, RN and Jody Case, RN Clinical Leaders, ICU Concord Hospital Concord, NH_

<table>
<thead>
<tr>
<th>Group 1</th>
<th>Mean BP mmHg</th>
<th>% of time at or above 65 mmHg</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n = 30)</td>
<td>68.1 (6.8)</td>
<td>63.7 (25.3)</td>
</tr>
<tr>
<td>Group 2</td>
<td>70.9 (7.2)</td>
<td>71.1 (21.6)</td>
</tr>
<tr>
<td>(n = 21)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 3</td>
<td>74.7 (6.4)</td>
<td>81.1 (20.5)</td>
</tr>
<tr>
<td>(n = 23)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p = .001*

*p = .009*

Table 1: means values and standard deviation for BP, % of time ≥ 65 mmHg

* Significant differences between groups 1 & 3

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Histogram
What is it?

Histogram in Photography
Histograms

What is it?

- A graphical representation of the distribution of a patient’s measurements over an extended time period
- Answers the question: “For how much of a certain period of time was my patient within or outside a certain range of values?”
Histograms

Key benefits for clinicians

- See at one glance whether or not a measurement has been maintained within a set range
- Verify if a clinical intervention has had the desired effect
- Predominantly used in neonatology, e.g. for evaluation of discharge readiness
- Can be used on any trended measurement parameter, e.g.
  - BIS: Titrating anestetic medication
  - HR: Titrating anti-arrhythmnic medication
  - Inv. Pressure: Titrating vaso-active drugs

“Histograms present the distribution over time of vital parameters, enabling significant trends to be seen at a glance, without the risk of being overwhelmed by an excess of information.”

Dr. Jürgen Christoph, Assistant Medical Director Neonatology, „Auf der Bult“ Pediatric Hospital Hannover, Germany
Histograms
Available studies

• Poster: Childrens Hospital “Auf der Bult”, Hannover, Germany: Oxygen saturation histograms in premature babies and neonates in convalescence
  J. Christopher, E. Kattner, Childrens Hospital auf der Bult, Hannover

Conclusion:
The impact of a reduction in cardiopulmonary function on the oxygen saturation in the histogram is clearly quantified. This new monitor function elegantly complements the oxycardiorespirography.
Advanced Event Surveillance

What is it?

- Invented by Philips in 2004
- Monitors for changes happening in up to four clinical parameters in the same time period
- An event is triggered when two, three, or all parameters violate their trigger conditions
- Clinician is notified by either a prompt message or an alarm
- Any event is stored with its surrounding data which can be reviewed
- Fully customizable by clinicians
Advanced Event Surveillance (AES)

Key benefits for clinicians

• Philips’ exclusive AES assists decision making by identifying and documenting clinically significant patient episodes
• Enables clinicians to create their own Smart Alarms
  – Multi-parameter alarming increases specificity of alerting for specific clinical events
  – Potential to reduce alarm fatigue phenomenon
• Possible uses:
  – Sepsis screening
  – Alert for SVT with effect on blood pressure
  – Alert for cardiogenic (left-ventricular) shock

“The configuration of event groups is easy and quick. If configured appropriately, event surveillance is a helpful new tool for monitoring patients. It allows for accurate analysis of changes in the patient’s condition and displays related trends. This helps to support and validate clinical decision making.”

Johannes Planck, MD, Städtisches Klinikum München, Munich, Germany
Advanced Event Surveillance
Available studies

• Poster: Univ. of Chicago, US: Correlating data from different sensors to increase the positive predictive value of alarms: an empiric assessment
  Yuval Bitan, Ph.D. and Michael F. O'Connor, M.D.

“The data we have collected suggests that information correlated across sensors might generate more reliable alarms. Correlation of information across sensors can be used to detect and suppress artifact in a manner similar to how human operators analyze data… The ability to correlate information across sensors may allow the monitor to detect important clinical conditions in manner similar to human operators.”
  Yuval Bitan, Ph.D. and Michael F. O'Connor, M.D.
Pulse Pressure Variation

What is it?

- A minimally invasive measurement, designed to help clinicians see and evaluate fluid responsiveness in mechanically ventilated adult patients
- Derived from beat-to-beat arterial pressure and expressed as a percentage
- Should be assessed over a trended time period and in context with other hemodynamic information
Pulse Pressure Variation

Key benefits for clinicians

• PPV provides a non-invasive way of evaluating whether a patient will respond to fluid administration or not
• Helps to find the important balance between too little and too much fluid
• For predicting fluid responsiveness PPV is more accurate than CVP
• Typical indications:
  – OR: monitor for hypovolemia in trauma or other major surgeries
  – ICU: assess fluid status of patients in hypovolemic or cardiogenic shock
Pulse Pressure Variation

Available studies

• Univ of California, Irvine, US: The ability of a novel algorithm for automatic estimation of the respiratory variations in arterial pulse pressure to monitor fluid responsiveness in the operating room.

  “The results of this study show that $\Delta P_{\text{PP,auto}}$ can be displayed continuously and can predict fluid responsiveness in mechanically ventilated patients in the operating room. This index allows for $\Delta P_{\text{PP}}$ monitoring from the arterial pressure waveform alone and has potential for goal-directed intraoperative fluid administration in the operating room.”
  Dr. Maxime Cannesson, MD PhD
  HS/Associate Clinical Professor University of California – Irvine, Department of Anesthesiology and Perioperative Care

Source: The Ability of a Novel Algorithm for Automatic Estimation of the Respiratory Variations in Arterial Pulse Pressure to Monitor Fluid Responsiveness in the Operating Room.

REQUESTED A PERMISSION – 26 11 2012
TO USE THIS REFERENCE. http://www.anesthesia-analgesia.org/content/106/4/1195.full
ProtocolWatch Sepsis
What is it?

- Automated detection system for early signs of sepsis
- Treatment that helps determine when the patient has been stabilized
- First ever application to reside on a patient bedside monitor that continuously screens patients for sepsis and guides clinicians through treatment protocol
ProtocolWatch Sepsis

Key benefits for clinicians

• Philips’ exclusive ProtocolWatch Sepsis helps with the early detection of sepsis, which is difficult – subtle changes in vital signs are easily missed
• Delayed detection leads to severe sepsis
• Currently* 30% of patients who develop severe sepsis die within the first month
• Delay in starting antibiotics increases mortality by 10-15%**
• ProtocolWatch Sepsis facilitates early detection of sepsis
• With J.0 now fully configurable

• Differentiators
  – Endorsed by the Surviving Sepsis Campaign (SSC)
  – Default configuration compliant with SSC guidelines
  – Provides access to protocol status and action list where it matters most - at the bedside

** Lyseng-Williamson KA & Perry CM. Drugs. 2002; 62: 617-30
ProtocolWatch Sepsis

Available studies

- Using clinical decision support to improve the care of patients with sepsis

Karen K. Giuliano, RN, PhD, Erica Cummings, RN, Mary Jahrsdoerfer, RN, MHA and Gerhard Tivig, Philips Healthcare, Andover, MA. Michele Lecardo, RN, St. Vincent’s Medical Center, Bridgeport, CT., LuAnn Staul, RN, Legacy Health System, Portland, OR.

Completion of resuscitation bundle significantly increased from 57.6% to 68% (p=.003). Time to antibiotic administration was significantly reduced from 181.9 minutes to 112.3 minutes (p=0.02), representing more than a one hour improvement (Table 1).

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Neonatal CDS Package – Oxy-CRG

What is it?

- Available in Philips (HP) monitors since 1978
- A comprehensive view of a neonate’s cardiac and respiratory status
- Combines compressed trends of the most important parameters for evaluating apneas and desaturations with neonates
  - Heart Rate
  - Oxygen Saturation
  - Respiration Rate
Neonatal CDS Package – Oxy-CRG

Key benefits for clinicians

• Helps monitor and document apnea, bradycardia and hypoxia in neonates
• Helps monitor other critical conditions, including periodic and disturbed breathing
• Oxy-CRG is a well established indicator of breathing efficiency and brain maturity
Neonatal CDS Package – Neonatal Event Review

What is it?

- A tool that captures and stores clinically significant events in neonates
- Invented by Philips (HP) in 1997
- Documents number, severity and distribution of events over the last 24 hours
- Clinicians can step through the list of events, reviewing the Oxy-CRG trend data associated with each event
Neonatal CDS Package – Neonatal Event Review

Key benefits for clinicians

• Helps identify significant events and their underlying condition
• Contributes to overall efficiency by
  – Displaying changes in neonate status from one day to the next
  – Automating the daily documentation of neonatal events

"The key benefit of Neonatal Event Review is that it is possible for clinicians to assess the number and severity of apnea episodes objectively and accurately."
Prof. Toshio Yamazaki, MD, PhD, Department of Pediatrics, School of Medicine, Fujita Health University Hospital, Tokyo, Japan
Neonatal CDS Package - Car Seat Assessment Record (CAR)

What is it?

- To evaluate discharge readiness of preterm babies – in many hospitals a car seat challenge test is performed
- Baby is put in a semi-reclining car safety seat for a selected period of time and is monitored for bradycardia, apnea and desaturation events

- CAR application supports this procedure by
  - Providing an optimized view for evaluating discharge readiness
  - Providing a special report that contains all findings and offers ability to add annotations
Neonatal CDS Package - Car Seat Assessment Record (CAR)

Key benefits for clinicians

• CAR helps with detecting events during the test
• Enables quick, comprehensive and standardized documentation
• Supports hospitals in instituting the car seat challenge procedure as recommended by the American Association of Pediatrics\(^1,2\)
• Can be easily tailored to the hospital’s own discharge criteria

Neonatal CDS Package
Available studies

- Fujita Health University Hospital, Tokyo Japan: Using Philips Neonatal Event Review to enhance management of apnea episodes

“Without Neonatal Event Review, the physician could not evaluate the disease from one moment to the next in a critical situation. ...By using Neonatal Event Review, it was possible to get objective and highly reliable data.”
Prof. Toshio Yamazaki, MD, PhD, Department of Pediatrics, School of Medicine, Fujita Health University Hospital, Tokyo, Japan

Download the document at www.philips.com/evidence or from Philips Incenter (4522 962 61811 and 4535 641 15651)
Early Warning Scoring
What is it?

- A CDS application residing on a spot-check monitor that
  - Combines vital signs acquisition with Early Warning Scoring (EWS)
  - Aids in early detection and intervention of patients at risk of deterioration
  - Is highly customizable to match the hospital’s EWS criteria
  - Can help standardize care across an institution’s facilities
Early Warning Scoring

Key benefits for clinicians

• Philips EWS system meets a growing need for more vigilant monitoring on the general floor
• Provides caregivers on the general floor with an automated scoring system potentially reducing calculation and transcription errors
• Allows caregivers to automatically acquire vital signs, automate EWS scoring calculations, detect early signs of deterioration, and inform responsible clinicians for early, effective intervention.
• Empowers caregivers to make valid calls to the Rapid Response Team, when calling criteria are met
• Supports rapid response team programs. The use of these teams is gaining popularity due to their success in reducing unexpected ICU transfers.¹

“The MP5SC [with EWS] is a new generation monitor that presents data in a way that helps nurses and doctors at the bedside identify patients at risk. By calculating an early warning score and providing pictorial clues to the need to respond, it transforms monitoring to a combination of detection and advice. In my opinion such advisory monitoring is the future of ward monitoring.”

Rinaldo Bellomo, M.D., Ph. D., director of Intensive Care Research, Austin Hospital, Heidelberg, Australia

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Early Warning Scoring

Available studies

- A Controlled Trial of Electronic Automated Advisory Vital Signs Monitoring in General Hospital Wards

  - Multi-centre, multi-national, before and after, controlled study
  - 10 hospitals, 5 countries, 3 continents
  - 18305 patients, 9617 patients before and 8688 after deployment of the IntelliVue MP5SC

“Early identification of deteriorating patients through vital signs monitoring and analysis carries no conceivable risk but has a significant upside”

Rinaldo Bellomo, M.D., Ph. D., director of Intensive Care Research, Austin Hospital, Heidelberg, Australia

"Early identification of deteriorating patients through vital signs monitoring and analysis carries no conceivable risk but has a significant upside”

Rinaldo Bellomo, M.D., Ph. D., director of Intensive Care Research, Austin Hospital, Heidelberg, Australia
Early Warning Scoring
Available studies

The multi-center trial found that:

• The multi-center trial found that using the MP5SC with EWS allowed care givers to complete vital signs taking and score calculations for Early Warning Scoring faster.
• The multi-center trial found the addition of the MP5SC with EWS to the hospitals’ existing protocol was associated with a 6.3% increase in survival rate at the end of the RRT call
• For the participating US hospitals, incorporating the MP5SC with EWS into their system was associated with a reduction of length of stay by 3 percent for all patients admitted to the study wards *.

*3rd bullet may only be used in USA