

# Creating measurable value on investment with critical care automation

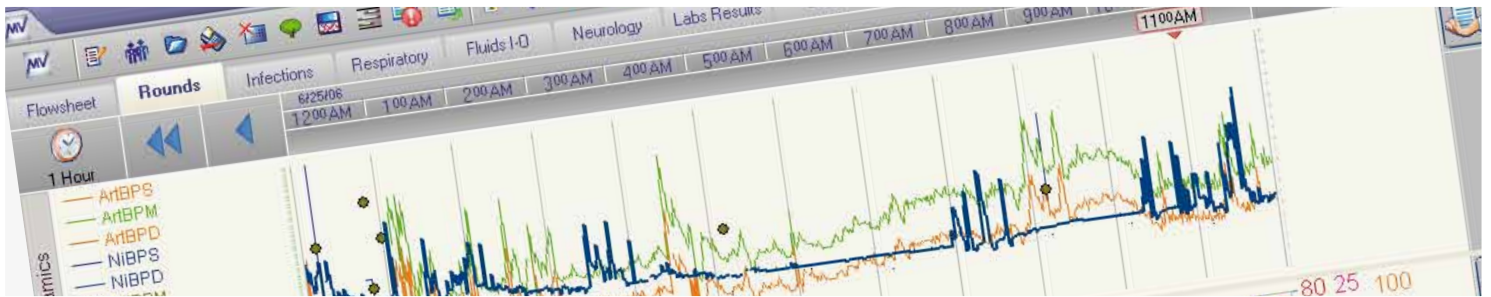
MetaVision White Paper



**Better Care**  
**Better Decisions**  
**Better Information**

# Creating measurable value on investment with critical care automation

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## 1. This document

Today, both patients and payers expect more from hospitals, in particular higher care quality along with greater cost-efficiency. Meeting these new market realities requires navigating multiple strategic issues, including attracting and retaining the most qualified care givers and effectively utilizing scarce resources while improving patient safety. With tighter budgets and ever-increasing capital needs, hospital executives are forced to make tough decisions on where to invest. Not surprisingly, many are now choosing to focus on critical care, where even a modest investment can result in tremendous improvements in outcomes and financial performance.

Outside the ICU, other hospital areas have seen significant benefit from implementing clinical information systems. In the critical care domain, clinical information systems are not only beneficial, but essential. They collect patient information generated from disparate sources, and arm providers with timely, accurate, actionable information. By combining this data with rule-based decision support, clinical staff can react prospectively to deteriorations in patient condition, deviations from protocol, and other gaps-in-care, thereby reducing cost-per-case and improving care quality.

Unfortunately, the unique needs of critical care- its complex workflows, its highly-collaborative patient management model, its minute-by-minute data streams, and other confounding factors combine to make ICU automation daunting. However, there is now a solution: this white paper explores how hospitals across the globe have seen tremendous gains through critical care automation using *iMDsoft's* MetaVision.

*iMDsoft* is a leading provider of Clinical Information Systems for the critical care and perioperative environments. Over 100 hospitals on three continents use *iMDsoft's* MetaVision Suite, which includes MVICU for intensive care units, the MVOR Anesthesia Information Management System supported by the MVScheduling application, and the MVcentral critical care tele-monitoring solution. First implemented in 1999, the MetaVision family of products improves patient care while ensuring the most effective use of valuable resources.

Headquartered in Massachusetts and with offices in Europe, Israel, and Japan – *iMDsoft* is globally recognized for its innovative products and world-class service and support.

## 2. Measurable value on investment

When hospitals successfully overcome the challenges of critical care automation, they quickly create three distinct yet interrelated sets of benefits:

- > Improved patient safety and care quality
- > Improved hospital operating margins
- > Enhanced strategic positioning

### 2. A. Improved patient safety and care quality

The past decade has seen great leaps forward in therapeutic options and safe operating practices for critical care. However, significant opportunities for improvement remain. For example, the literature is rich with new evidence-based protocols to improve outcomes, speed healing, and reduce complications. Also, many hospitals have shown the positive impact of providing intensivist care 24/7, even applying remote monitoring technology to do so. Finally, pharmacy systems, bar coding, and other inventions have reduced medication errors and other gaps in care. While all of these programs have had positive impacts, hospitals that implemented a broad set of quality improvement initiatives, employing IT systems to help, are the ones that have been most successful. Specifically, critical care IT systems create an accessible, complete medical record that informs clinicians and supports their decision-making throughout the care process.

#### Creating a comprehensive clinical record

First, a clinical information system reduces errors caused by poor information management, including lost, inaccurate, illegible, and inaccessible data. Second, automating information capture and documentation allows clinical resources to focus less on paperwork and more on care delivery. The impact of this can be astounding: OLVG hospital in Amsterdam, the Netherlands showed that MetaVision can save 29 minutes of documentation time per eight-hour nursing shift, that could then be reinvested in patient care (Intensive Care Med 2003 29:83-90). Finally, a comprehensive digital critical care record reduces errors from miscalculations, simplifies sign-out, transfer, and other complex workflows, and enables other quality initiatives, such as bar-coding and RFID.

#### Arming clinicians with actionable information

A comprehensive, structured, medical record for critically ill patients is necessary to the delivery of high quality care, but is not sufficient. For hospitals, clinicians, and patients to realize the full potential improvement, the information must be made available to the clinical users in ways that support their workflow, not interfere with it. Given the workflow complexity and data volume of the ICU, critical care systems must be flexible enough to change the presentation of data for different users, different patients and different stages of treatment.

#### MetaVision in action...

*"With all that is going on in a burn patient it is very difficult to spot abnormalities, to spot trends, to spot changes. MetaVision is able to present us with a vast array of physiological data, with lab results, with drug data, that... empowers our decision making on a daily basis..."*

*...The other big change for us really is a multi-disciplinary approach, we have significant input to burn patients every day from intensivists, from burn surgeons, from physio-therapists, dieticians, psycho-therapists, and trying to communicate amongst such a diverse group of people in the hospital was traditionally very difficult. [Now] with all the notes, the drugs, the communications in one place, we all know where to look to find what each professional group thought."*

Dr. Steve Oakey, Clinical Director, Burns ICU, Broomfield Hospital Chelmsford, UK

For example, MetaVision creates specific views for nurses, physicians, residents, and respiratory therapists; workflow-specific modules, such as assessments, note writing, and order entry; and views for different points in the patient's care as well as disease-specific and alert/codes screens.

## Ensuring delivery of high-quality care

The most powerful way critical care automation improves quality is the ability to amplify the providers' clinical expertise using *rule-based decision support*. Rule-based decision support is not merely a question of one-dimensional alerts. Rather, decision support tools continually scan the entire patient record, both current and past information, to prospectively detect health deteriorations, gaps-in-care, and potential errors. The nature of ICU patients necessitates extensive, longitudinal decision support algorithms, including complex branching logic and trending analysis. In some ICUs today, MetaVision automatically evaluates 20 different data elements every minute to ensure patientsafety.

Employing rule-based decision support has helped hospitals like Carmel Lady Davis Medical Center in Israel improve patient safety. Compliance with a guideline for the reactivation of pulse oximeter and end-tidal CO<sub>2</sub> monitors post cardiopulmonary bypass increased from 22% to 64% while using MetaVision's decision support tools (Dr. Eden, Arie et. al., Carmel Lady Davis Medical Center, 2006. Unpublished). OLVG hospital in Amsterdam, The Netherlands, increased the timeliness of administering glycemic control protocols and adherence to Insulin dose guidelines from 35.5% to 40.2% and from 64.2% to 77.3% respectively (Rood et. al, Computerized Guideline for Glucose Regulation, Journal of the American Medical Informatics Association Vol 12, pp 172-180, 2005).

A large hospital and health system in the US has effectively implemented a series of complex care protocols, contributing to significant reductions in both length-of-stay and mortality and morbidity (to be published in 2008). Examples such as these are numerous.

To sum up: access to timely, clear, accurate, relevant information supported by rule-based decision support, allows hospitals to enhance care quality for those patients that need it the most.

## 2. B. Improved hospital operating margins

The clinical benefits of automating the ICU translate directly to improved operating margins. The ways these are achieved include:

- > Reducing clinical complications and their corresponding costs
- > Reducing variability in the use of discretionary services
- > Improving revenue capture
- > De-bottlenecking other critical parts of the hospital while creating new revenue streams

### MetaVision in action...

*Qualitative and quantitative outcomes... have been numerous after only 10 months of operation.*

*The inception of the electronic medical record [MetaVision] has transposed some of the time spent documenting into time spent delivering care to the patients and support to their families and loved ones. Additional outcomes have been:*

- > *Improved staff and family satisfaction*
- > *Decreased patient complications*
- > *Decreased time to treat and increased workflow efficiency*
- > *Improved mortality rates and LOS in the ICU*

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## Protocol-driven care

In the ICU, less than 20% of patients account for over half of total expenditure. Effective management of these “outliers”, most of whom are characterized by one or more preventable complications, can dramatically improve cost-performance. Peer-reviewed literature published over the past decade demonstrates that care protocols can both reduce complication rates, most notably ventilator-acquired pneumonia (VAP) and sepsis, and improve recovery time via aggressive vent-weaning and glycemic control (<http://www.ihl.org/IHI/TopicCriticalCare/IntensiveCare/Literature/BestpracticeprotocolsVAPprevention.htm>; <http://www.ihl.org/IHI/Topics/CriticalCare/Sepsis/>).

Each of these protocols can translate into millions of dollars of annual savings for the institution implementing them.

Protocol	What others have found...
VAP reduction	Over 30 hospitals employing the IHI VAP Bundle went an entire year without a single VAP Each VAP adds an estimated \$12K to \$45K to the cost of the case
Glycemic control	Stamford Hospital (Stamford, CT) reduced total ICU costs by \$1.8M per year through introduction of a glycemic control protocol (Chest. 2006;129:644-650.) <sup>©</sup> 2006 American College of Chest Physicians Cost Analysis of Intensive Glycemic Control in Critically Ill Adult Patients* James Stephen Krinsley, MD, FCCP and Richard L. Jones * From the Department of Medicine, Division of Critical Care, Stamford Hospital, Stamford, CT.
Vent weaning	UMass Memorial Medical Center (Worcester, MA), reduced total ICU costs by \$3.4M per year by implementing an aggressive vent weaning protocol (Crit Care Med 30(6):1224-1230, 2002)

However, implementing complex clinical protocols requires tight coordination of multiple clinical resources, continual monitoring, and early detections of protocol-deviations and health deterioration. Many hospitals turn to clinical information systems like MetaVision to make such surveillance feasible. These systems create a comprehensive clinical record and employ rule-based decision support that reveals the hidden insights in the data.

## Reduce ancillary cost per case

A 2006 study out of MetroHealth Medical Center (Cleveland, OH) demonstrated significant variations in resource utilization among the hospital’s nine intensivists – over \$1000 per case between the highest and lowest tercile. There was no difference in clinical outcomes. (Am J Respir Crit Care Med Vol 174. pp.1206-1210, 2006).

Such disparities in resource consumption are common. A rule-based critical care information system that has embedded guidelines throughout the care process, and the ability to allow clinicians to easily analyze practice patterns is a powerful tool in managing ancillary cost variability.

## Revenue capture

Constant demands on clinician time, coupled with the often Byzantine billing rules, make ICU revenue maximization very challenging. Different providers therefore experience great variations in reimbursement levels, even when the patient mix, acuity, and level of care provided are all the same. Many hospitals have found that implementation of a clinical information system has led to an increase in total billable events and average DRG weightings. For example, a 2006 study by the University of Pennsylvania showed a 77% increase in 99291 critical care codes and a 13% increase in overall billable events after the introduction of a CIS. (CHEST 2006, Kohl. 112S – slide presentation)

## Improving overall hospital throughput

The Healthcare Financial Management Association states that “lack of ICU availability can limit emergency department visits because ambulance patients may need to be diverted to other hospitals, and it can cause elective surgeries to be cancelled, forcing physicians to use other hospitals. ... Eliminating this ICU bottleneck opens the door to a significant cash flow benefit...” The financial benefit of improved ICU throughput is hundreds of thousands of dollars a year to even a small hospital.

## Creating new revenue sources

Demand for intensivists significantly outstrips supply, and will continue to do so for the next decade at least. This reality has resulted in several new business models. In particular, as hospital and physician groups develop more and more sophisticated remote intensive care monitoring solutions, they have the ability to provide services outside their traditional health system. This “outreach” model, along with the more traditional remote ICU approach, is already being successfully applied in markets across the United States.

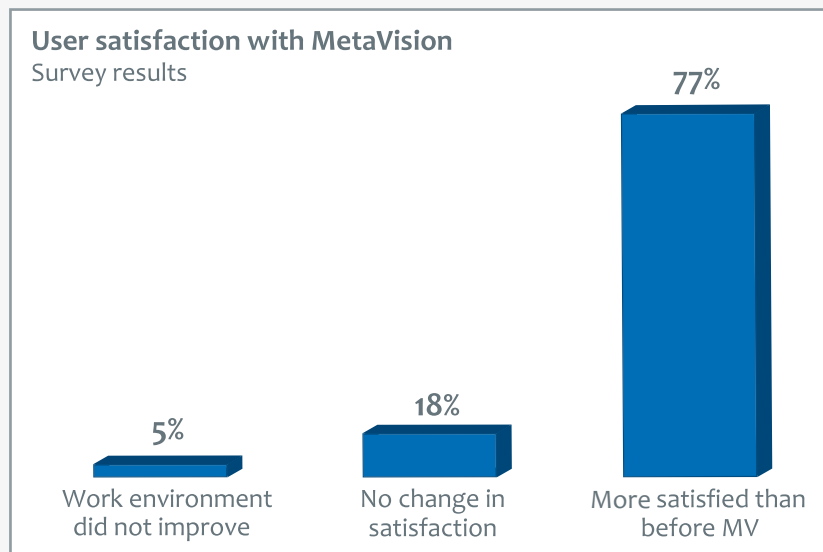
## 2. C. Enhanced strategic positioning

Hospitals today must compete not only for patients, but for the most qualified and talented care givers and researchers. At the same time, pay-for-performance initiatives and published quality rankings continue to grow in importance. Nowhere in the hospital are these trends more transformative than in critical care.

Critical care nursing shortages continue to plague many local markets, and similar shortages exist for pharmacists, respiratory therapists, and other specially trained providers. However, hospitals have found strong correlation between increased professional satisfaction and reduced nursing turnover and vacancy rates. Clinical information systems that reduce documentation time and raise care quality have been shown to raise professional satisfaction, and directly improve nurse recruiting.

Attracting the best intensivists represents an equally challenging problem. The US Department of Health & Human Services speaks of an “intensivist shortfall” of over 1,000 FTEs, and projects that gap enlarging by the year 2020. Hospitals that effectively extend the reach of these scarce physicians, that allow intensivists to maximize revenue capture, and that offer an environment with a high quality of life and high degree of professional satisfaction, will be the winners in this war for talent.

Finally, automation of the ICU creates accurate, actionable data, the life-blood of any system-wide improvement initiative. With a queryable critical care clinical information system, hospitals have unprecedented abilities to conduct clinical research, implement activity-based-costing methodologies, deploy and sustain quality improvement programs, refine best practices and protocols, and support pay-for-performance initiatives.



### 3. MetaVision - A single solution for ICU automation

MetaVision collects information from medical devices such as patient monitors, respirators, and IV pumps. It integrates these with data from hospital information systems to retrieve laboratory, billing, and demographic data together with imaging and pharmacy information. The system also collects multidisciplinary clinical and administrative data from staff to create a rich patient-centric information repository.

MetaVision leverages rule-based algorithms to efficiently automate comprehensive critical care workflows covering patient flow sheets, medication and fluid management, diagnosis, problem lists, care plans, clinical scores, reporting, assessments, and more. The system is also able to constantly scan the patient-centric information repository, flag problems, and issue notifications that help expedite effective clinical interventions while monitoring administrative process enforcement. Furthermore, the system leverages these notifications and other capabilities to enable small numbers of clinicians located in centralized command centers to provide care to large numbers of patients in far away locations in and outside their delivery network.

MetaVision is a fully integrated clinical information system for data collection, presentation, decision support, and operational reporting across the critical care continuum. With the implementation of MetaVision, hospitals can enhance patient safety and the quality of care provided, as well as their financial performance and competitiveness for contracts and healthcare consumers through more precise adherence to regulations and standards, better tools for decision making, and optimizing resource and staff utilization to lower costs.

### 4. What only MetaVision can bring to the ICU

For a system to create measurable, sustainable value through ICU automation, it must adapt to the complex, data-intensive, collaborative based nature of critical care, must support the care giver through information capture, presentation, and decision support, must interoperate fully with the existing IT infrastructure, and overall must improve the working environment of the clinicians.

#### **MetaVision uniquely meets these requirements:**

- > Assistive. MetaVision is a single application that meets all the disparate workflow needs of different patient types (NICU, PICU, CICU, Burn), different user types (nurses, physicians, respiratory therapists), and different workflows and clinical states
- > Actionable. The fully configurable MetaVision Event Manager continually identifies opportunities to improve care, using branching, longitudinal logic to foster delivery of protocols and best practices
- > Adaptable. MetaVision offers full customizability of the user interface for workflow integration, standards-based device information capture, and service-oriented-architecture interoperability with ADT, lab, pharmacy, and other HIS systems. Further, because MetaVision is modular in its deployment, hospitals can leverage its

#### **MetaVision in action...**

*Chaim Sheba Medical Center is one of the largest tertiary care hospitals in the State of Israel. Starting in 2003 the hospital initiated managing blood glucose levels in their general ICU based on the 2002 Van den Berghe study. In 2006 a MetaVision rule-based event was added to the clinical workflow to support implementation of the protocol. Results were immediate:*

- > Rate of blood glucose tests between 80-120 mg/dl increased 53%
- > Proportion of measurements over 200 mg/dl fell from 19% to 9%
- > Rate of hypoglycemic measurements fell from 0.53% to 0.42%

Eran Segal, MD, Director, General ICU, Chaim Sheba Medical Center, 2006. Unpublished

CPOE and/or note-writing modules, or continue to use their existing technologies for these workflows MetaVision's ability to wrap around the existing workflow stems from its parameter-based architecture, and its overall separation of the logical layers of the application. Thus, users can configure flowsheets, calculations, reports, forms, and pre-populated note templates without any modification to the underlying application.

MetaVision's Event Manager, a full-featured, longitudinal, configurable rules-engine is fully integrated into the application, making decision support a core functionality and not an add-on. Meanwhile, the Query Wizard allows users to search for trends in parameters, allowing clinicians, and not technical resources, to review the data. Because the data set is flexible and extensible, the application can be quickly customized to meet different needs.

Finally, beyond features/functions and technology architecture, **iMDsoft** assigns to each implementation a dedicated team of professionals solely focused on critical care information systems. With offices around the world, **iMDsoft** provides local support, while leveraging the expertise of a global installed base and active user group.

**In totality, iMDsoft technology and team create:**

- > Extremely satisfied clinical users of all types - nurses, physicians, pharmacists, respiratory therapists, and others
- > Improved care quality, workflow efficiency and profitability
- > 100% success in implementations, 100% retention of clients

## 5. Taking the next step

Today, implementing critical care information systems has never been easier. Technology innovations allow systems like MetaVision to fully adapt to existing workflows, while web-services, HL7, and extensible architectures simplify the IT integration.

However, key to ensuring successful deployment is setting challenging yet achievable short- and long-term goals for the project. By aligning all stakeholders on what the benefits of the new system will be, the implementations are focused and smooth. Here again **iMDsoft** can help: **iMDsoft** experts work with your hospital to quantify potential benefits, prototype the system with your clinical users, and define a roadmap for clinical information system deployment.

Please contact us at [sales@imd-soft.com](mailto:sales@imd-soft.com) to take a risk-free step towards dramatic improvement in critical care performance.

### MetaVision in action...

*"We brought up our trauma neuro unit and our medical-surgical ICU first and they were up in about 2 months.*

*"One of the nurses from the medical-surgical ICU was pulled one day to the open heart unit which was not using MetaVision at that time. So she went into the unit and she was taking care of her patient and not paying much attention to her documentation. About 6 hours into her shift, she turned around to the computer to start validating her documentation and suddenly she realized that they were not there electronically like she was used to. She turned around and went out into the middle of the unit and said 'You people need to have MetaVision in this unit. You have no idea how great this system is.' "Soon after that, I received some calls from the open heart unit wanting to know when they were going to go live."*

Judith Bailey, IS Analyst ,Lehigh Valley Hospital and Health Network, Allentown, PA, USA