MOBERG ICU Solutions

micromed® solutions for neurophysiology

BUILDING A MULTIMODAL NEUROMONITORING PROGRAM

A PROJECT LIFE-CYCLE APPROACH

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Careful planning and a shared vision are key for the creation of a multimodal neuromonitoring program. Stakeholders from different departments need to work as a team in all phases of the project (initiation, planning, implementation, and evaluation), each contributing to the successful development of the project.

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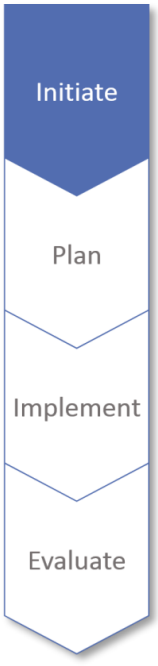
Neurocritical care depends on careful patient monitoring to provide high quality, safe, and cost-effective care. Multimodal Monitoring (MMM) is now routinely performed in many neuroscience intensive care units to supplement clinical examination. However, establishing a new MMM program, or expanding an existing one, is a complex and demanding process. Applying Project Management concepts can help succeed in this process. Program or project development typically progresses through four phases, referred to as the project life-cycle – initiation, planning, implementation, and closure/evaluation [1] . Together, the project manager and team share the goal of progressing through each phase to successfully meet the project objectives. Using these phases in the life-cycle of a project, this guide will address questions and provide information regarding building of a MMM program in neurocritical care.

INITIATE

During this first phase, the need or problem to be addressed is defined and a solution is identified. Issues of feasibility and justification are addressed [1].



HOW DO I JUSTIFY BUILDING A MMM PROGRAM?

Care of the critically ill neuro patient focuses on prevention and treatment of secondary injury which results from swelling, metabolic derangements, and ischemia. The degree of secondary injury has a critical impact on outcome, making early detection of these secondary events a major goal of neuromonitoring [2]. Intracranial pressure (ICP), cerebral perfusion pressure (CPP) and electroencephalography (EEG) are widely accepted neuromonitoring parameters. Coupled with newer techniques for monitoring brain oxygenation, cerebral blood flow, cerebral metabolism and substrate delivery, a multimodal approach has evolved. Multimodal monitoring is defined as the continuous, simultaneous evaluation of cerebral function and vital signs from multiple modalities in a single patient, with the goal of avoiding or mitigating secondary brain insults [3-5]. The concept of MMM is widely accepted and becoming standard of care in many ICUs caring for patients with brain injury.

SUMMARY

Building a multimodal neuromonitoring program requires a team invested in the project from its inception and throughout its life-cycle.

INITIATE: The need is defined and a solution is identified.

PLAN: The details of the solution are outlined and tasks are identified.

IMPLEMENT: The project plan is put into action and progress is monitored.

EVALUATE: The process is reviewed and refined in an iterative fashion.

An integrated vision and strategic planning will provide a path to success in establishing a multimodal monitoring program at your institution.

Despite increasing utilization, questions regarding multimodal neuromonitoring remain. Clinicians and researchers continue to study the accuracy of existing technologies and what the data from localized monitors mean for global brain health [5, 6]. Little robust evidence exists regarding which MMM-physiologically derived variables are the most clinically relevant, how and when they should be monitored, and whether MMM affects patient outcome [4]. Yet accumulating evidence suggests that information gained from MMM augments patient assessment beyond clinical examination and can enhance outcome when used to guide clinical management in a patient-specific, targeted fashion [7-9].

The use of advanced neuromonitoring technologies and MMM may be viewed as aggressive measures in patient management and opponents may question the cost–effectiveness of aggressive care for brain injured patients. A recent study by Whitmore et al. (2012) compared comfort care, routine patient care (<50% compliance with Brain Trauma Foundation (BTF) Guidelines), and aggressive patient care (>50% compliance with BTF Guidelines). Considering all costs of severe TBI, aggressive treatment was determined to be a cost-effective option, even for older patients. The authors further concluded that comfort care for severe TBI is associated with poor outcomes and high costs, and should be reserved for situations in which aggressive approaches have failed or testing suggests such treatment is futile [10].

Strong support for MMM in neurocritical care is found in the Consensus Summary Statement of the International Multidisciplinary Consensus Conference on Multimodality Monitoring in Neurocritical Care. In 2014 The Neurocritical Care Society in collaboration with the European Society of Intensive Care Medicine, and the Latin America Brain Injury Consortium organized an international, multidisciplinary consensus conference. International experts from neurosurgery, neurocritical care, neurology, critical care, neuro-anesthesiology, nursing, pharmacy, and informatics were recruited on the basis of their research, publication record, and expertise. Participants developed recommendations about specific topics on physiologic processes important to the care of neurocritical care patients. Recommendations were based upon literature review, quality of the evidence, translation of the evidence into practice, and collective experience. The document recommends the use of multiple modes of neurophysiologic monitoring, along with clinical evaluation, diagnostic imaging, laboratory testing and other physiologic monitoring as part of a comprehensive strategy for care of patients with neurologic injury [7].

> "Multimodality monitoring including clinical and laboratory evaluation, imaging, and continuous physiologic data is an important feature of neurocritical care."
>
> *Consensus Summary Statement of the International Multidisciplinary Consensus Conference on Multimodality Monitoring in Neurocritical Care*

Why do we need Multimodal Monitoring in neurocritical care?

To detect early neurological worsening before irreversible brain damage occurs
To individualize patient care decisions
To guide patient management
To monitor the physiologic response to treatment and to avoid any adverse effects
To allow clinicians to better understand the pathophysiology of complex disorders
To design and implement management protocols
To improve neurological outcome and quality of life in survivors of severe brain injuries
To develop new mechanistically oriented therapies where treatments currently are lacking or are empiric in nature

From: Le Roux P., Menon D.K., Citerio G., Vespa P., Bader M.K., et al., *"Consensus Summary Statement of the International Multidisciplinary Consensus Conference on Multimodality Monitoring in Neurocritical Care"* [7].

PLAN

In this second phase, the solution is developed in further detail and steps necessary to meet the project objective are planned. Project tasks and required resources are identified along with strategies for producing them [1].

Other methods of strategic analysis, such as SWOT Analysis – identifying existing strengths, weaknesses, opportunities, and threats, are helpful in this phase [11]. Also during this phase, all stakeholders should be identified along with a plan for their ongoing communication and involvement in the project.

WHAT DO I NEED TO CONSIDER IN THE PLANNING STAGES?

- **Define your goals/vision**. What technology/monitors do you want? Are you adding one modality or several modalities? What are the priorities? Think big but start small. Add one new technology at a time. Allow time for adaptation before adding another new technology.
- **Define and collaborate with all stakeholders** - neurology, neurosurgery, critical care, EEG, nursing, researchers, biomedical engineering, IT. What role will they play, what is their involvement? It is critical to have their buy-in and support UP FRONT.
- **Promote awareness** by discussing the project (technology and monitors) with providers and nursing – in rounds, journal clubs, etc.

SWOT ANALYSIS

STRENGTHS

- Internal capabilities that may help reach the project's objectives

WEAKNESSES

- Internal limitations that may interfere with the ability to reach the objectives

OPPORTUNITIES

- External factors that may be exploited to the project's advantage

THREATS

- Current and emerging external factors that may challenge the project

- **Define a champion within each department** – particularly in nursing (Educator, CNS, NP, etc.) – someone to partner with for acquisition, training, ongoing staff competence, protocol development, and project coordination.
- **Consider having an overall project manager** – someone who will own all communication coordination for the team.
- **Define your indications for use** – clinical, research, or both.
    - What are your expectations for clinical use – is the information for trending purposes or is it actionable?
    - Consider your needs for ongoing and future research projects. Will you need high resolution data? Will different measurements need to be synchronized? Will you need data annotation capabilities?
- **Define your available resources** – people, time, money. Consider additional budget items – IT infrastructure, etc.
- **Consider your environment** – Is there adequate physical space for monitor storage and use in patient rooms?
- **Consider training needs** – nurses, providers, biomedical engineering. Training for providers and nurses will be intensive and ongoing and should be mandatory for everyone who will interact with the monitors
    - Are there state guidelines for required numbers of staff to be trained?
    - How is competency assessed and how often?
- **Consider your current workflow** – what impact does additional monitoring have on patient care, provider coverage, nursing workload and processes (i.e. documentation, monitor set-up and maintenance, etc.).
- **Establish protocols and basic treatment algorithms** before use to provide guidance and help ensure compliance.
- **Consider the integrative abilities of the technologies you want to adopt.** Do the technologies integrate with each other and with existing or proposed data repositories (Electronic Health Record [EHR] or other data management system)? Are companion software or components required, such as data review software, adapters, activation of ports on host monitors?
- **Define data management processes**
    - How are data stored – DVD, Flash Drive, server on the hospital network?
    - What are data storage requirements?
    - How are data accessed – at the bedside through the monitor? Remotely over the hospital network?
    - Are high-resolution data available or can you export only snapshots of the monitoring session?
    - Are data meant for research use? Can data be easily de-identified?
    - Are data sent directly into the EHR?

IMPLEMENT

During this phase the project plan is put into action and the associated tasks and activities are performed. Progress is continually monitored and necessary adjustments are made [1]. Team members and key stakeholders should be kept informed of the project's status.

In the case of Multimodal Neuromonitoring, a key component of implementation is acquisition of the required monitors and technologies. This frequently involves the formal process of value analysis.

HOW DO I NAVIGATE THE VALUE ANALYSIS PROCESS?

The economic landscape in health care today makes every purchasing decision critical. Healthcare leaders need to be sure that each dollar is spent wisely and that the products and services purchased will contribute to improved quality and efficiency. Organizations are challenged as never before to meet the goals of delivering low-cost, high-quality care while doing more with less. Yet hospitals find themselves needing to make large investments—

particularly in new technology—to improve quality, efficiency, and competitive position, and to capture all appropriate revenue [12].

For a new product, the primary factor driving a purchasing decision is value. Value is the ability of a product to deliver a return on investment. Most institutions require a process of Value Analysis for acquisition of new products and additional processes for vetting desired technology. Value analysis involves a multidisciplinary assessment of the following factors [12]:

- Product quality and effectiveness
- Impact on patient outcomes and alignment with strategic goals
- System impact (how wide an impact if approved – one department, service line or whole system)
- Price, storage requirements, regular availability, and packaging
- Contract compliance
- Operation and repair criteria; the five year cost of acquisition
- Benchmark information
- Necessary education and training
- Safety and OSHA considerations
- Infection Control and engineering issues
- Waste stream/environmental impact
- Connectivity/interoperability with hospital infrastructure

It is imperative to know your institution's process for Value Analysis and technology acquisition. Be prepared to invest significant time and effort in completing required paperwork, attending committee meetings, arranging for product demonstrations etc. Seek assistance from product vendors for required information, supportive literature, customer list, demo or trial support. If funds are tight, consider acquiring the ideal number of monitors over several capital cycles.

Value is the most important factor on which hospital executives base their purchasing decisions, both for products and services.

OTHER IMPLEMENTATION CONSIDERATIONS

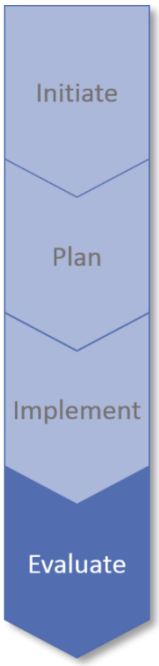
- After monitor acquisition, be certain all biomedical checks and processes have been followed.
- Work closely with IT for initiation of network connections, server management, IT infrastructure and security.
- Implement the training plan after installation and completion of IT processes.
    - Ensure all appropriate staff have been trained and demonstrated competence.
- For initial cases, consider a core group of well-trained SuperUsers – providers who can implant probes and nurses who can set up and manage the monitors. Do implants during daytime hours only with a consistent team to assure successful implantation and monitoring start up. Expand the team gradually until everyone is competent. This helps prevent initial errors (typically operator errors) from being attributed to the technology.

- Incorporate monitoring data in daily rounds. Nurses and providers should make it part of their assessment and reporting. Use data to guide clinical decisions.
- Continue discussion about the project with providers and nurses during rounds or educational forums to maintain engagement and promote feedback.
- Schedule frequent meetings with stakeholders to promote open communication, identify issues, and evaluate progress.

Continuous assessment of the progress in the implementation phase of a multimodal monitoring program allows timely course corrections and ensures project success.

EVALUATE

The final phase, evaluation, doesn't necessarily mean project closure, but rather that implementation steps and tasks have been completed and it's time to review and refine the process. Evaluation may occur in conjunction with implementation to allow timely course corrections and help ensure project success. Evaluation can be formal or informal, but should involve feedback from all stakeholders.



Consider the impact that implementation of MMM has had on the following:

- Nursing and Provider – What has the impact been on use of clinical time, resources, and workflow?
- Training – Was it adequate? How do we improve it? What is our plan for ongoing training and proof of competency?
- Informatics and Data Management – Has display and management of data been adequate?
- Patient care – Has use of MMM made a difference in clinical decision making, treatment, or outcome?
    - Debrief after each case – what went well, what didn't, what did we learn, how do we improve next time?
    - Revisit and refine protocols for monitor use and patient treatment.

Even with executive support, clearly defined goals, and an engaged clinical team, a multimodal monitoring program will not succeed without a strong organizational structure. Effective leadership, good communication, dedication to process improvement, and attention to all four phases of the program life cycle are critical to success.

MOBERG ICU SOLUTIONS CAN HELP

Moberg ICU Solutions, now a member of Micromed, can help you assess your multimodal monitoring needs and our dedicated team will help facilitate conversations among all key stakeholders, offering the expertise required for success.

Our portfolio of products offers a comprehensive data integration solution specialized in neurocritical care. The Moberg CNS Monitor, the core component of our solution, provides real-time multimodal data integration by connecting to over 30 medical devices, offering support for approximately 200 physiologic measurements. The collected signals include vital signs, temperature, hemodynamic data, EEG, and other neurological parameters such as ICP, cerebral blood flow and oxygen. Data can be displayed at the bedside or reviewed remotely (using CNS Envision) and it can be incorporated in a comprehensive database (the CNS Multimodal Database); the platform can also be complemented by data networking and archiving solutions. The neurocritical care data integration platform provided by Moberg ICU Solutions offers unique advantages when building a multimodal monitoring program:

1) It allows your institution to leverage investments it has already made in its capital equipment (e.g. vital signs monitors and other devices), since the CNS Monitor is vendor neutral and can interface to a wide variety of medical devices.
2) It facilitates the stepwise rollout of your multimodal monitoring program. Technologies can be easily added in stages without affecting data integration and management.
3) It gathers data from the original devices: it is stored in its original quality and can easily be accessed at a later stage for comprehensive review or research purposes.
4) It creates a consolidated and time-synchronized record of the collected data and offers flexible data archiving options, including automatic archiving.
5) It solves complex informatics challenges with a turn-key solution, without which the power of multimodal monitoring is not fully harnessed.
6) It supports the inclusion of all multimodal monitoring data into daily rounds and assessment through customizable protocols and displays and through the ability to easily annotate monitoring sessions.
7) It promotes training for providers and nurses through extensive animated tutorials and context-sensitive help/troubleshooting.

Moberg ICU Solutions has a history of innovation to meet our customers' needs and we partner with healthcare organizations, clinicians, scientists, and businesses so we can keep our customers at the forefront of success. We advise all our clients on the successful planning and implementation of their unique, customized multimodal neuromonitoring program.

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