

A Preliminary Evaluation of the Cost-Effectiveness of A Noninvasive Continuous Cerebral Perfusion Monitor

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Introduction: Noninvasive hemodynamic monitors have been identified as a sensitive and specific technology for assessing fluid responsiveness and driving a preemptive strategy for fluid optimization in the ED, OR and ICU. When implemented as part of an Enhanced Recovery After Surgery (ERAS) initiative, fluid optimization is associated with decreased Length Of Stay (LOS), morbidity and mortality following major abdominal surgery. Cerebral perfusion monitors have surfaced as a similar technology that can be used to pursue comparative clinical and financial effectiveness. However, clinical and financial data on their use in the operative and critical care setting is limited. In this abstract, we present a personalized and predictive model that can be leveraged to evaluate the cost-effectiveness of purchasing noninvasive cerebral perfusion monitoring equipment in ED, OR and ICU.

Methods: Data on mean LOS and LOS reduction were integrated into the model from peer-reviewed literature. The C-Flow (Ornim Medical) was used as an example of a continuous, noninvasive cerebral perfusion monitor. Customized variables were created to allow hospital leadership to enter demographic and financial data. The model synthesizes these data and provides cost-avoidance predictions in patient specific and aggregate form comprehensively and in isolated care areas.

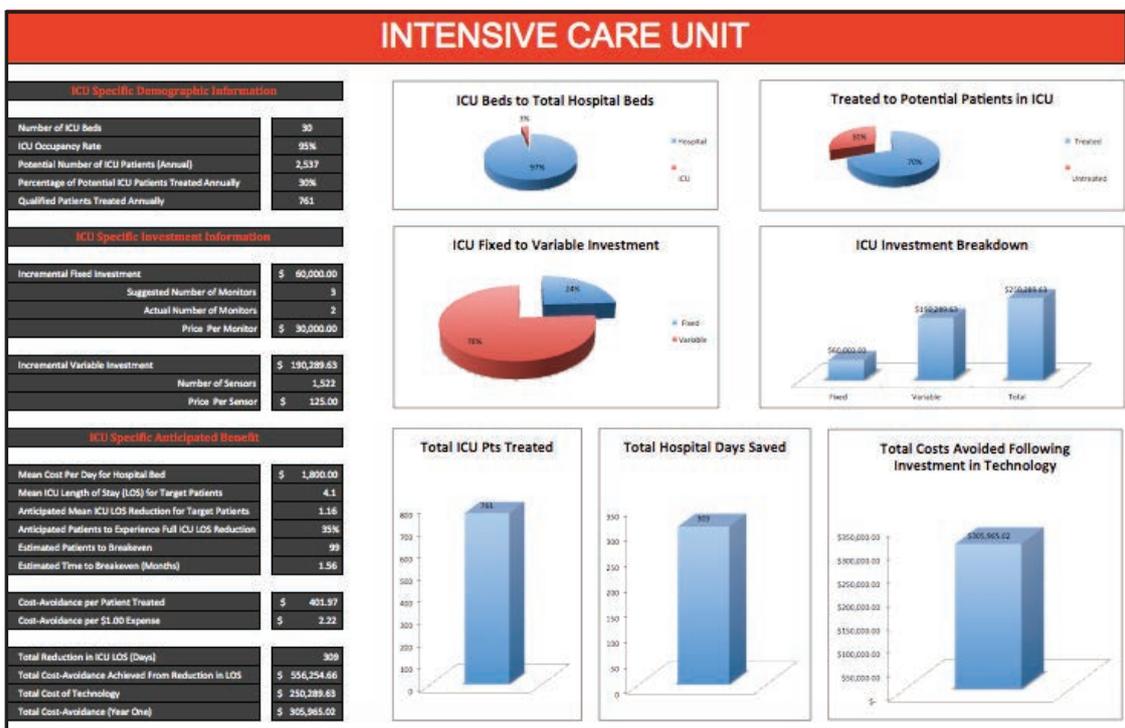
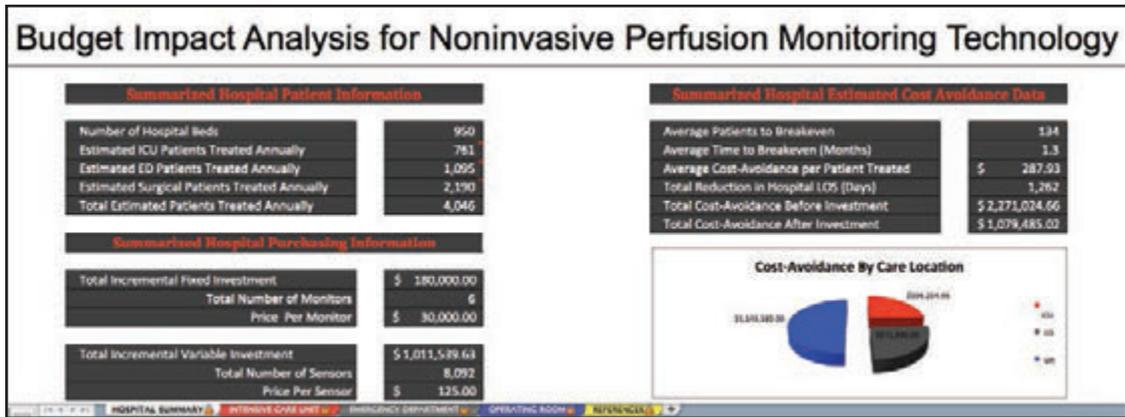
Results: Figure I illustrates the summary tab of the model that allows enterprise leadership to enter hospital demographic and commitment variables and provides predicted cost-avoidance data. Figure II depicts a breakdown by care area for the ED, OR and ICU. Figure III provides peer reviewed literature used to obtain data on LOS and LOS reduction for the model.

Conclusion: To be successfully deployed within a hospital system, novel health technology must provide value in terms of device quality, patient safety, clinical efficacy and cost effectiveness. In this abstract, we describe an innovative method for evaluating the cost-effectiveness of the fixed and variable investment necessary to support adding a noninvasive cerebral perfusion monitoring device to a hospital's service offering. This model is flexible enough to accommodate similar technology in other clinical areas or can be redesigned and customized for a different technology.

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Setting	Unit Measured	Value	Study Design and Statistics	Champion	Application to NPM
ICU	LOS - Days	3.0	322 patients. Randomized controlled trial. Study group: 11 (7-15 days range); Control: 14 (13-27 days range); p=005	Pearns, Dawson, et al. Early goal-directed therapy after major surgery reduces complications and duration of hospital stay. A randomized, controlled trial. Critical Care 2005, 9:R687-R693.	Primary objective of goal-directed therapy is optimization of oxygen delivery to tissues, which is directly measured by NPM
ED	LOS - Days	3.0 (SD=1.5)	270 consecutive trauma activation patients with 1,568 observations. Prospective observational study. Study group: 55*+15 \$0.5. Control group: 65+15 14. p=005.	Dunham, Chirchella, Gruber, et al. Emergency department non-invasive (NCOM) cardiac outputs are associated with trauma activation, patient injury severity and host conditions and mortality. J Trauma Acute Care Surg 2013, 75(2):479-485. * Iqbal Injury Severity Score (ISS) score is virtually the only anatomical scoring system in use and correlates linearly with mortality, morbidity, hospital stay and other measures of severity. >15 denotes severe injury. Baker SP et al. "The Injury Severity Score: a method for describing patients with multiple injuries and evaluating emergency care". J Trauma 14:187-196,1974.	Noninvasive hemodynamic monitors measure stroke volume, with the primary objective of providing data to facilitate optimization of perfusion and oxygen delivery to tissues, which is directly measured by NPM
OR	LOS - Days	1.0 - 2.0	100 patients. Randomized controlled trial. Study group: 3+/- 3 days vs. 7+/- 3 days. Mean LOS 6 vs. 7 days (p=003)	Gao TL, et al. Goal-directed intraoperative Fluid Administration Reduces Length of Hospital Stay after Major Surgery. Anesthesiology 2002;97:820-6	Primary objective of goal-directed therapy is optimization of oxygen delivery to tissues, which is directly measured by NPM
	LOS - Days	1.5	142 consecutive colorectal surgery patients. Retrospective Review. (43% open vs. 57% laparoscopic). LAFARGOSOPIC, ERAS 3.9 (3-5.5 days); Control group: 6.5 (4.25-7 days); (p=005)	Miller, T., et al. An Enhanced Recovery after Surgery (ERAS) Program Reduces Length of Stay and Complications after Colorectal Surgery. Abstract presented at Anesthesia Society of America, October 15, 2011.	Nursing protocols found in ERAS initiatives are analogous to NPM nurse driven protocols in the ICU
	LOS - Days	4.0	80 patients. Randomized Controlled Trial. Study group: 15 (12-17.75 days); Control group: 19 (14-23.5 days); (p=006)	Mayer, L, et al. Goal-directed intraoperative therapy based on auto calibrated arterial pressure waveform analysis reduces hospital stay in high-risk surgical patients: a randomized, controlled trial. Critical Care 2010, 14:R18.	Primary objective of goal-directed therapy is optimization of oxygen delivery to tissues, which is directly measured by NPM
	LOS - Days	8.0	142 Consecutive colorectal surgery patients. Retrospective Review. (43% open vs. 57% laparoscopic). OPIN: ERAS 7.2 (4.5-8.5 days); Control group: 13.8 (6-14 days); (p=004)	Miller, T., et al. An Enhanced Recovery after Surgery (ERAS) Program Reduces Length of Stay and Complications after Colorectal Surgery. Abstract presented at Anesthesia Society of America, October 15, 2011.	Nursing protocols found in ERAS initiatives are analogous to NPM nurse driven protocols in the ICU