



Finding Top-Line Opportunities in a Bottom-Line
Healthcare Market:
*Revenue Generation Opportunities Created by an
Innovative Contact-Free Continuous Monitoring Solution*

A Frost & Sullivan White Paper

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EXECUTIVE SUMMARY

Contact-free continuous monitoring (CFCM) solutions have evidence of improving patient safety and providing clinicians with data that can enhance decision making. Continuous analytics are performed on patients' measured data and notifications are provided to a caregiver's mobile device of changes in the status of vital signs which might indicate the development of adverse conditions. Frost & Sullivan analyzed the economic viability of such CFCM solutions and found significant return on investment (ROI) upside potential for hospitals due to cost reductions as well as increased top-line revenues. Potential opportunities include approximately \$25,737 in additional revenue per monitored medical and/or surgical (Med/Surg) bed per year with additional cost savings of \$19,940 per monitored Med/Surg bed. If margins are assumed to be 2.5% in addition to the top-line revenues, this leads to \$26,250 greater bottom-line dollars per CFCM-monitored bed per year in the scenario described below.



GENERAL HOSPITAL USA – A HYPOTHETICAL USE CASE FOR CONTACT-FREE CONTINUOUS MONITORING

For the purpose of this paper, Frost & Sullivan consulted with a leading hospital to help create a realistic, hypothetical hospital which will showcase revenue opportunities both before and after the implementation of CFCM. General Hospital USA is a 200-bed hospital near Chicago, Illinois with 80 Med/Surg beds and an average occupancy rate of 85%, but which maxed out at 100% occupancy about once every five days, leading to lost revenue opportunities. The hospital billed the national average of \$13,354 for a Med/Surg hospital stay, and ranked in the sixth decile of the Centers for Medicare & Medicaid Services' (CMS') value-based purchasing (VBP) program (Figure 1).

Figure 1

General Hospital USA	
Total Number of Hospital Beds	200
Number of Med/Surg Beds	80
Med/Surg Occupancy Rate	85% but maxing out at 100% on 20% of days
Average Inpatient LOS	4.8 days
Average Med/Surg LOS	4 days
Annual Number of Admissions (2014)	17,237
Annual Number of Med/Surg Admissions (2014)	722
Average Billing for Med/Surg Stay (2014)	\$13,354
Medicare VBP dollars received (2014)	\$165,035 (Decile 6)

As hospitals strive to do more with less, using systems like CFCM will become increasingly important to reduce labor costs and meet clinical outcomes goals. Continually gathering data enables providers to better predict outcomes and ultimately save lives. Frost & Sullivan analysis shows that CFCM can create new revenue for hospitals in three ways: by allowing clinicians to detect adverse events and intervene earlier which results in lower length of stay (LOS), which frees capacity for new admissions; securing additional reimbursement by meeting goals in value-based payment programs; and identifying and properly coding conditions which could generate additional reimbursements, especially for sepsis, cardiac arrhythmias, and respiratory distress. Frost & Sullivan conducted a thorough review of the available clinical literature for CFCM and conducted interviews with clinicians and administrators using the technology. Our financial modeling indicates that a hospital with the hypothetical General Hospital profile, which adopts CFCM in its Med/Surg unit, could expect to generate more than \$2.1 million in additional revenue annually, save approximately \$1.6 million according to conservative analysis, and add more than \$2.3 million to their bottom line (Figure 2).

Figure 2

General Hospital USA (2014)		
Metric	Before CFCM	After CFCM (100% of Med/Surg Beds Adopted)
Admissions	17,237	17,381
Baseline Revenues	\$200 Million	\$200 Million
Additional Revenues Due to CFCM	\$0	\$2,059,563
1. 144 new Med/Surg admissions due to decreased LOS	\$0	\$1,928,259
2. VBP additional revenues moving from 6 th to 5 th decile	\$0	\$89,953 (Score improved 10%)
3. Undetected/ miscoded sepsis, arrhythmia, respiratory distress	\$0	\$41,351
Total Revenues	\$200.0 Million	\$202.1 Million
Operating Costs	\$195.0 Million	\$196.6 Million
Cost Savings Due to CFCM	\$0	\$1.59 Million ¹⁶
Total Operating Costs	\$195.0 Million	\$195.0 Million
Net Profit	\$5.0 Million	\$7.1 Million
Operating Margin	2.5%	3.5%

Contact-free continuous monitoring has a growing amount of supporting evidence for improved patient outcomes related to the reduction of falls, re-hospitalizations, code blue activations, mortality, alarm fatigue, pressure ulcers, and length of stay (Figure 3). A recent peer-reviewed study showed CFCM generated cost savings between \$658,000 and \$2,085,000 per year in the 33-bed Med/Surg unit of the California Hospital Medical Center over a 5-year period, depending on the formula used¹⁶. For the sake of this analysis, the most conservative result of that paper was used at \$658,000 per Med/Surg floor or \$19,940 per monitored bed. The technology is an excellent case study of a medical innovation that has demonstrated cost savings and presents opportunities for top-line revenue generation as well. In order to better describe this compelling value proposition, Frost & Sullivan interviewed clinicians and administrators familiar with the technology and conducted a thorough review of data about CFCM along with further secondary research and modeling.

Figure 3

Metric	Percentage Reduction with CFCM
LOS in Med/Surg (days) ¹	9%
LOS in ICU for patients coming from Med/Surg unit with CFCM (days) ¹	45%
LOS in Telemetry for patients coming from Med/Surg unit with CFCM ²	42.8%
Code blue events ²¹	50%
Pressure ulcers ²	64%
Alarms per 100 hours of monitoring ¹⁹	98.1%
Falls ²	43%

FROST & SULLIVAN'S INTEREST IN INNOVATIVE MEDICAL TECHNOLOGIES

Frost & Sullivan has been tracking innovations in medical technologies for decades, and we believe that future breakthroughs will not gain widespread adoption unless they make economic sense. In a complex industry that is continuously evolving under new payment incentives, Frost & Sullivan focuses on the intersection of technology adoption and economics.

Hospital executives and technology developers understand that medical technologies have the potential to save money, but that savings can be hard to measure and realize. Administrators would like to know how technology can impact their bottom line and their top-line growth strategies. Frost & Sullivan is interested in medical technologies which can influence both top and bottom lines because both are under pressure in the challenging US healthcare environment. This is a particular challenge for any technology that is not directly reimbursed. In an increasingly capitated and bundled payment environment, hospitals must be able to validate an investment in any new technology with a detailed financial justification.

Changes in the healthcare landscape are expected to result in declining hospital reimbursements, even as procedural volumes grow. Transformation from a volume focus to a value focus has pushed providers to achieve better outcomes with the same or fewer resources. The most forward-thinking and capable medical technologies have aligned their value proposition around the institutional goals of cost-savings, outcomes, and efficiency, as well as new revenue creation.



**New Revenue Opportunity #1:
CFCM Can Shorten LOS, Improve Bed Availability, and Allow
Hospitals to Potentially Generate more Revenue**

The most significant revenue generation opportunity from CFCM is due to expanding current bed availability. At General Hospital USA, the Med/Surg unit has 80 beds, with an average of 85% capacity and an average patient LOS of 4 days, and a per admission charge of \$13,354. On about 20% of the days, the unit reaches full capacity and has to delay or turn away admissions and transfers. According to a study from the American Journal of Medicine, CFCM has shown a 9% reduction in LOS within the Med/Surg unit and a 45% reduction in the intensive care unit (ICU) load (measured in days) with transferred patients¹. By reducing LOS for its Med/Surg patients by just 9%, General Hospital can free up available beds for new patients, bringing in incremental revenue. Frost & Sullivan estimates that the hospital could create more than \$1.9 million by increasing the annual Med/Surg patient throughput in this way.

Figure 4

General Hospital USA – Length of Stay									
	CFCM % Decrease	Avg. LOS	Patients in Bed/ Year	Beds in General Hospital USA	Total Patients Med/Surg/ Year*	Average Med/ Surg Bed Occupancy*	Average Billable Amount Per Admission	Annual Revenues	CFCM Revenue Generation
Med/Surg without CFCM		4.0	91	80	6,205	85%	\$13,354	\$82,861,570	\$0
Med/Surg with CFCM	9%	3.6	100	80	6,349	79%	\$13,354	\$84,789,829	\$1,928,259
*Assumes 100% capacity on 20% of days									

Contact-free continuous monitoring offers various hospital departments a unique opportunity to increase bed utilization by reducing patient LOS. As available bed spaces open up, hospitals have new capacity that can be applied to new revenue-generating patients. Assuming a hospital is at capacity and has sufficient demand for bed space in those units, these departments could potentially see their revenues grow by that same amount. However, in many cases, hospitals end up turning away additional patients on the days they reach full capacity. Most hospitals are not constantly under this degree of capacity pressure, but freeing bed space would still be a revenue-generation opportunity to support any degree of patient volume growth without any corresponding investments in additional beds, essentially allowing more efficient capital utilization. The aforementioned revenue opportunities are driven by the increased number of patients that are able to be seen within the corresponding units without any additional capital investment. Continuous monitoring has the ability to reduce LOS, ultimately freeing up bed space for new patients. *For this paper, Frost & Sullivan interviewed clinicians with experience with the CFCM system.* SueLane Hughes at the Coffee Regional Medical Center agrees, “CFCM has the potential to reduce resources and costs, impacting anything that deals with patient volume, such as bed turnover in the MedSurg, Trauma, and ICU.”

Dr. Robert Wachter, Professor and Interim Chairman of the Department of Medicine at the University of California, San Francisco, who is widely considered the founder of the hospitalist specialty states, “As more hospital consolidation occurs, those beds that are left will tend to be full. The empty bed will be unusual, and the premium on efficiency will grow.” According to American Hospital Association (AHA) data, the number of community hospitals has been decreasing in recent years as the number of merger and acquisition (M&A) deals have increased (Figure 5). Hospital consolidation, the shift to capitated/bundled payments, demand for bed space, and the corresponding shortage of critical care workers are key drivers of increased bed utilization within the healthcare system.

Figure 5

	Number of Community Hospitals	Percentage of Hospitals In a Health System (%)	Number of Hospital M&A Deals	Number of Hospitals Acquired in M&A Deals
2005	4,919	54.2%	59	236
2006	4,936	55.0%	51	88
2007	4,927	55.9%	57	249
2008	4,897	55.7%	58	149
2009	5,010	57.2%	60	78
2010	5,008	58.3%	52	80
2011	4,985	59.0%	72	125
2012	4,973	60.5%	90	156
2013	4,999	62.0%	107	244
2014	4,974	63.2%	88	296

Source: American Hospital Association

The unit with one of the highest demands for bed space in most hospitals is the Emergency Department (ED). According to the Center for Disease Control and Prevention (CDC), ED visits have been steadily rising due to increases in both the aging and insured populations with over 136 million visits and 16 million admissions, respectively, in 2011. One of the keys to increasing ED efficiency is improving bed turnover and being able to admit patients to Med/Surg and ICU units more quickly. A study published in the Academy of Emergency Medicine stated that neither the ICU nor ED LOS has changed significantly; thus, the average ICU patient spends over 5 hours in the ED prior to being transferred¹⁵. Problems can arise from increased wait times including patient frustration or the deterioration of a patient's condition, driving the need for earlier admittance. CFCM in Med/Surg units reduces the ICU load by an average of 2.5 days per ICU transfer, ultimately allowing more patients from the ED or Med/Surg, which are waiting for transfer, into the ICU. CFCM has the potential to increase ED efficiency and to reduce the number of ambulances that are diverted from EDs every year due to overcrowding. This offers hospitals opportunities to treat more patients per year and, accordingly, increase their top line⁵. Every ambulance diverted from a hospital equals lost revenue.

CONTINUOUS PATIENT MONITORING AS A LOW-COST WAY TO CREATE NEW CAPACITY

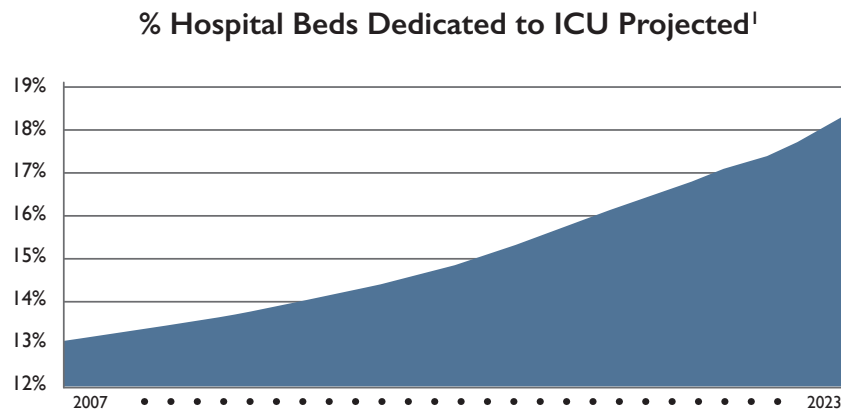
A former hospital CEO interviewed by Frost & Sullivan describes an example of how simple changes to clinical practice can have a major impact on capacity:

“When our hospital reduced central line infections and pneumonia, ICU LOS dropped from 5 to 4 days. With this small drop in LOS, we were able to increase volume and ultimately avoid the build out of an ICU to create additional capacity. We were able to avoid costs and handle more patients. There is a similar argument to be made with CFCM. While capacity crunch is highly variable, every hospital has it at some time during the week. CFCM can create new capacity.”

As the number of hospital beds dedicated to ICU use grows, hospitals can strive to reduce LOS and increase the number of patients seen within their current capacity (Figure 6). Dr. Eyal Zimlichman—from the Center for Patient Safety Research and Practice at Brigham and Women's Hospital, and of the Harvard Medical School—stated that,

“Reducing LOS is not only in the patient's best interest, but also supports future payment models. Reducing LOS and ICU days are all going to be rewarded from the financial perspective as the models evolve.”

Figure 6



Source: I. Halpern, *Critical Care Med.* 2004; 32(6): 1254-9

Unit expansions cost healthcare systems a significant amount of money and time; yet recent reports show an increasing number of hospitals expanding their ICU and ED units to meet growing capacity needs. In addition to construction and equipment costs, a highly qualified critical care workforce is required to staff these specialized units. An ICU team may consist of critical care nurses, intensivists, nurse practitioners, pharmacists, physician assistants, physician specialists, primary care physicians, respiratory therapists, and other professionals with average base salaries ranging from \$56,000 to \$260,000 per year⁴. A review by Harvard's Silverman Institute for Healthcare Quality and Safety found that the strategy of meeting capacity demands by building more ICU units is not likely to be sustainable⁹. One suggestion to better manage increased ICU patient numbers was to improve monitoring and increase throughput. CFCM offers additional capacity by decreasing the length of stay, ultimately reducing the need for ED and ICU expansion. The key notion is to deliver the appropriate level of care while incurring lower costs.

According to a recent study, the ICU is one of the most-expensive units to maintain within a hospital with average daily costs of \$4,004 and an average LOS around 4.5 days^{2,20}. CFCM has the potential to allow clinicians to reduce LOS by 45%, increasing patient volumes by 1,300 annually for an average 20-bed ICU unit.

**New Revenue Opportunity #2:
CFCM Helps Providers Capture Revenue in New Value-Based Payment
Models that Reward Better Outcomes and Lower Costs**

General Hospital USA was in the fifth decile of Medicare's VBP program in 2014 and received \$165,035 in reimbursements. After CFCM, it was able to move up one decile, bringing in an additional \$89,953. This makes the grand total of annual reimbursements from the VBP program \$254,988 (Figure 3).

The transition from a fee-for-service (FFS) system to a fee-for-value system has resulted in increased bundled and capitated payments for healthcare systems and payers. Clinical processes that were once a source of revenue are now cost-prohibitive, thus encouraging providers and institutions to focus on reducing costs and improving outcomes. With more emphasis being placed on patient experiences and outcomes, healthcare systems are looking to technology to bridge the gap between their current levels and where they need to be to remain competitive.

VALUE-BASED PURCHASING PROGRAM

The Hospital Value-Based Purchasing Program (VBP) used by the Center for Medicare & Medicaid Services (CMS) ties hospital performance and patient outcomes to the payments provided by CMS. This reimbursement model is no longer unique to Medicare as similar programs are being developed with private payers. The concept of rewarding providers for better care can be seen at Blue Cross Blue Shield of Michigan, which has instituted its Physician Group Incentive Program (PGIP) with physician organizations, and its Organized Systems of Care for the performance, improvement, and accomplishment of goals. Similarly, Humana's Provider Quality Rewards Program offers various levels of incentives for provider practices that support value-based reimbursements focusing on cost, quality, and outcomes.



According to a 2014 survey commissioned by McKesson, mixed VBP and FFS reimbursement models were used by 90% of payers and 81% of hospitals. To encourage quality outcomes, payers are expecting FFS to decrease from 56% to 32% over the next five years. This is the third year for VBP incentives and the policies for 2017 have already been set to include new performance measures, standards, and periods that result in better patient outcomes, quality, safety, and lower-cost Medicare payments (CMS). A recent Frost & Sullivan survey of 70 hospital executives found that all but one respondent believed that in the next five years, it will be more important to the economic health of hospitals to deliver improved clinical and financial outcomes than in the past. Another 49% believed it would be significantly more important to deliver outcomes better than what they are presently offering. Over the next five years, 82% believed that the US healthcare system would transition further away from the traditional FFS billing to more capitated, bundled-payment approaches.

Edward Prunchunas, senior vice president and CFO of Cedars-Sinai Medical Center noted:

“As bundled payments become more prevalent, I believe that how providers evaluate the ROI for medical technology will change, with more pressure on physician preference items and greater interest in those that can improve efficiency and outcomes. In addition, as hospitals become part of Accountable Care Organizations (ACOs) there will be greater demand for telehealth and other types of technologies that can help keep patients out of the hospital and prevent readmission.”

In the VBP program, hospitals are ranked according to scores in four categories: Clinical Process of Care, Patient Experience, Outcomes, and Efficiency. According to the US Department of Health and Human Services (HHS), half

of Medicare provider payments are expected to switch to alternative payment models, such as bundled payments, by 2018. Capitated and bundled payments offer a lump-sum reimbursement for the patient's entire event. This model was created to encourage healthcare providers to deliver the best care in an efficient manner. Another goal is for 85% of providers who are still in the FFS model to tie their services to quality or value by 2016. All providers who receive Medicare reimbursements will be impacted by the growing list of value metrics and CFCM has the ability to influence a significant portion of the VBP score based on Frost & Sullivan's assessment (Figure 7).

Figure 7

CMS VBP Category	Weight	Degree of Potential Benefit from CFCM	VBP Metrics Frost & Sullivan Believes CFCM Can Address
Outcomes	30%	High	Acute myocardial infarction (AMI) 30-day mortality rate Heart failure (HF) 30-day mortality rate Pneumonia (PN) 30-day mortality rate PSI 03 – Pressure Ulcer PSI 08 – Post-operative Hip Fracture PSI 12 – Post-operative Pulmonary Embolism or Deep Vein Thrombosis PSI 13 – Post-operative Sepsis PSI 14 – Post-operative Wound Dehiscence
Patient Experience	30%	Moderate	Communication with nurses Communication with doctors Responsiveness of hospital staff Pain management Cleanliness and quietness of hospital environment Overall rating of hospital
Efficiency	20%	High	Medicare spending per beneficiary (MSPB-1) measure
Clinical Process	20%	Low	SCIP-VTE-2: Patients who got treatment at the right time (within 24 hours before or after their surgery) to help prevent blood clots after certain types of surgery
Total	100%	High	–

Patient Experience, Outcomes, Efficiency, and Clinical Process are all used to determine VBP payments. However, a growing number of supporting initiatives use these metrics to benchmark institutions. The Joint Commission aligns with VBP metrics providing proactive approaches to improve patient safety, reduce labor costs, and decrease LOS. These programs were designed to benefit the patient. CMS and other payers reward participating healthcare systems on the top line for reducing costs on the bottom line.

OUTCOMES

Outcomes, or quality, became a VBP metric in 2014 and the current weighted score of 30% increased in 2015. CFCM can help improve patient outcomes by monitoring conditions more accurately and in real-time giving clinicians time to respond before patient's status worsens. Continuous monitoring delivers trend analysis to the provider, encouraging a proactive approach to diagnosis and treatment. The key areas where continuous monitoring can impact VBP outcomes are fall reduction, cardiac events, pneumonia prevention, pressure ulcers, post-operative hip fractures, and post-operative sepsis.

Approximately 3% to 20% of patients fall at least once during their hospital stay, resulting in injury, increased LOS, and malpractice lawsuits¹⁰. CMS classifies falls as an hospital-acquired condition (HAC) and no longer pays for the events that occur within a hospital setting. CFCM has shown a 47% reduction in falls at the Hebrew Home at Riverdale in New York as well as an 87.2% reduction in falls related to bed exits at Florida Hospital Tampa.^{22,23} Fall prevention also positively impacts the new outcome metrics on post-operative hip and knee fracture prevention.

Hip fractures are among the top-20 most expensive conditions, and reimbursement dollars will be increasingly tied to post-operative complications and readmissions.

Acute myocardial infarctions (AMI) are the fifth most-expensive condition treated in US hospitals, totaling \$11.5 billion or 3% of the national healthcare costs in 2011. Pneumonia is ranked seventh nationally, totaling \$10.57 billion or 2.3% of national healthcare costs¹⁷. Congestive heart failure (CHF) is close behind as the eighth most-expensive condition, totaling \$10.53 billion or 2.7% of national healthcare costs¹⁷. CMS measures the 30-day mortality rate, readmissions, and payment for these three conditions when determining payment measures. CFCM has a strong ability to support the management of each of these conditions, demonstrating a 90.9% reduction in cardiac arrest events and 84.1% reduction in mortality at Florida Hospital Tampa.²²

Pressure ulcers are preventable conditions that can develop quickly but become difficult, time-consuming, and expensive to treat once present. Individuals who develop pressure ulcers have nearly twice the LOS, averaging 13 days, and are more than three-times as likely to die during hospitalization and within 30 days of discharge¹³. The average cost for pressure ulcers is approximately \$10,845 with the average amount billed of \$39,100 being to Medicaid^{6,17}. The overall impact of CFCM in one study studies showed a 64% reduction in the number of pressure ulcers².



Reducing readmissions is an important mandate for hospitals since there is now a maximum penalty of 3% for readmissions, up from 2% last year. If a patient is readmitted to the hospital for AMI, heart failure, or pneumonia within 30 days of discharge, hospitals are subjected to penalties. CMS estimates from January 2012 to December 2013 already show significant improvements as a result of the program; hospital Medicare readmissions declined by a total of 150,000 in this time. Preliminary findings at a pilot hospital showed that CFCM delivered a 42.65% reduction in readmissions.

Code blue events are a costly and frequently fatal scenario that hospitals actively look to prevent. Within 24 hours, approximately 46% of patients who were resuscitated died before discharge. For patients who were resuscitated but survived, only 55% were alive after 24 months¹⁸. CFCM has shown a 50% reduction in code blues, with and an 83% decrease in mortality following code blue activations²¹. Mortality and readmissions are critical metrics monitored among the majority of condition-specific situations, and avoiding code blues could have a positive impact on those scores.

PATIENT EXPERIENCE

Patient Experience has a 30% weight of the overall VBP score. The Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) is the national standard for collecting and reporting this information through a 27-question survey. CFCM facilitates improved communication with nurses and doctors, increases staff responsiveness, helps with pain management, and reduces alarms, leading to a quieter hospital environment. Hughes at the Coffee Regional Medical Center found the system improved communication between the providers and patients, “With CFCM, our patients and families understand something is continuously monitoring their care, leaving them with a better sense of security and satisfaction.”

Dr. Zimlichman cited the importance of experience and safety when patients choose a hospital for an elective procedure:

“Hospitals are competing to attract patients for elective procedures as they can have an impact on revenues. For example, let’s say I need to choose a hospital for hip replacement surgery, and I know that a certain hospital is investing in patient safety with the CFCM devices. Their increased confidence knowing there will be continuous monitoring post-operatively on the general floors could have an impact on drawing patients.”

Nurses at Florida Hospital Tampa found that pain management improved when they used CFCM with their patients. Kelle Whitman, RN, explained, “I know that this was not a matter of life and death, but it was able to turn my patient’s suffering into a visible measurement that he was actually in pain. I was able to intervene and make his night more comfortable. As a nurse, my patients’ comfort means as much to me as their health.”

Contact-free continuous monitoring can also make stays more comfortable by reducing the number of alarms within the Med/Surg and telemetry units. Dr. Perry An at Newton-Wellesley Hospital in Massachusetts found that their telemetry unit registered 140 alarms per hour, translating to over 23,600 alarms per day. Studies in other hospitals found that while many of these alarms indicate significant events, an average telemetry unit can have up to 82 alarms per 100 hours of monitoring¹². These additional and sometimes unnecessary alerts can cause patient anxiety and alarm fatigue for the staff. In an 8-hour shift, a nurse would typically expect 91 alarms in the telemetry unit and 120 alarms from pulse oximetry measured on all patients across the department. With CFCM, a nurse would experience only 1.7 alarms throughout an 8-hour shift¹⁹. Dr. Wachter explains, “CFCM offers a seamless and less intrusive way to monitor patients, which may lead to improved satisfaction and better outcomes.”

EFFICIENCY

The third area where CFCM can positively impact a hospital’s VBP program is Efficiency. This category has a 20% weight that includes lowering LOS and improving outcomes to ultimately reduce costs. Effectively, hospitals are rewarded for providing the most cost-efficient care without sacrificing outcomes. If CFCM is able to improve outcomes and lower costs at the same time, a natural by-product would be improvements in how the VBP program measures Efficiency. Continuous monitoring holds real potential for helping hospitals improve their scores in a number of ways, allowing them to reclaim withheld reimbursement dollars. This can be especially important for

hospitals that have scores lower and are actively seeking new ways to improve. While this may not offer significant savings for hospitals in the top 90% to improve their scores, hospitals in the bottom 10% could be significantly impacted. According to CMS estimates, the total amount available for value-based incentive payments in fiscal year 2015 was approximately \$1.4 billion. In the proposed 2015 file, there are 1,253 hospitals that will receive a bonus (average of 0.3) and 1,475 hospitals with a penalty. New measures under the VBP program include additional outcome measures and an efficiency measure.” Hospitals that are penalized and not receiving bonuses are essentially forfeiting available money.

CLINICAL PROCESS

Clinical Process of Care measures fall within five main clinical areas, including acute myocardial infarction, heart failure, pneumonia, healthcare associate infections, and surgical care improvement. A few of the detailed measures within these categories consist of receiving medication within 30 minutes of arrival if a heart attack is suspected, providing discharge and antibiotic instructions, and pharmaceutical-related actions. While important in the overall VBP scoring, Clinical Process as defined does not align well with the benefits of continuous monitoring.

New Revenue Opportunity #3: CFCM Can Support Appropriate Coding through the Identification of Undetected Patient Conditions

Frost & Sullivan conducted research with a large hospital piloting CFCM to understand what percentage of selected conditions went unrecognized, misdiagnosed, or miscoded. The calculations suggest that CFCM can be used to deliver better care for “sleeper patients” with conditions related to sepsis, arrhythmias, and respiratory distress, whose detection could deliver additional revenues.

General Hospital USA could use CFCM to identify conditions among in-patients that would otherwise go undetected or been miscoded. Focusing on sepsis alone, utilizing the technology to pick up on diagnosis-related group (DRG) billing for an additional 1.2 sepsis patients per year would allow the hospital to generate an additional \$32,123.50 in revenue. While sepsis is generally a life-threatening condition, it is relatively easy to spot. However, of the nearly 18,000 admissions of sepsis patients per year, it is likely that one to two patients escape identification. In addition, CFCM can be used to properly diagnose sepsis in patients who have already been admitted.

Figure 8

General Hospital USA (2014)				
Condition	DRG Code	Admissions	Charges	Mean Charge Per Admission
Total 2014 Admissions		17,237	\$200.0	\$11,602.95
Streptococcal Sepsis	IP (870/871/872) ; ED OBS (871/872)	121	\$3,212,354.7	\$26,500.0
Assumes 1% of Patients as Sleepers		1.2	\$32,123.5	\$18,058.04

Contact-free continuous monitoring could be used to an even greater degree in assessing patients in observation. The General Hospital model assumes a 5% increase in the number of observational patients admitted with DRGs for sepsis, cardiac arrhythmia, and respiratory distress thanks to CFCM. This incremental increase in revenue adds another \$9,227.11 to the hospital’s top line. In total, \$41,350 in new revenue was created thanks to using CFCM to properly assess and code patients with these serious conditions. In addition, by providing better care, these patients are significantly less likely to face complications and be readmitted (Figure 8).

Figure 9

General Hospital USA (2014)								
	DRG	Admissions		Charges		Difference (EDOBS vs. In-patient)		
		EDOBS	In-patient	EDOBS	In-patient		5% of EDOBS Admissions Converted to In-patient	Incremental Revenue Converting those 5% EDOBS to In-patient Value
Sepsis	870	0	12	\$0	\$51,072	N/A	0	0
	871	0	83	\$4,307	\$15,545	\$11,238	0.0	\$163.34
	872	1	25	\$2,772	\$8,504	\$5,731	0.0	\$249.90
Cardiac Arrhythmia	308	2	24	\$2,942	\$14,989	\$12,047	0.1	\$1,225.74
	309	5	24	\$3,841	\$6,403	\$2,562	0.2	\$633.07
	310	20	23	\$2,813	\$4,322	\$1,509	1.0	\$1,491.15
Respiratory Distress	204	30	23	\$2,682	\$6,296	\$3,615	1.5	\$5,463.92
							Total	\$9,227.11
*EDOBS (Emergency Department Observation Only)								

Andrei Soran, Chief Operating Officer of the Detroit Medical Center noted that, “With ICD-10, specificity is key. Those details [captured by CFCM] will drive reimbursement. If you recognize conditions that improve documentation it will impact the revenue stream.”

Conditions that go undetected within the hospital are rare, but there are revenue implications for hospitals that inappropriately code a patient whose condition is more complex and acute than initially recognized. With the growing use of bundled payments, hospitals need to capture the revenues they are entitled to in order to cover incurred expenses. While more technologically advanced monitoring systems are better able to catch these sleeper conditions, proper clinician training and familiarity with new coding and billing procedures are also critical. An important component of improving long-term outcomes is not just diagnosing and treating the most obvious clinical problems, but holistically assessing the patient and intervening on conditions which might otherwise go undetected.

The most commonly undetected conditions may be caused by alarm fatigue, inaccurate monitoring, or incorrect coding. Undiagnosed conditions such as sepsis, arrhythmias, and respiratory distress can negatively affect patient outcomes and ultimately become life-threatening. Sepsis and arrhythmias are commonly missed because symptoms are sometimes misleading and can often be attributed to other co-morbidities. These conditions also tend to be costly in their later stages and, therefore, a common source of revenue leakage. Inaccurate coding and billing can be a source of lost revenue because many hospitals do not have an accurate idea of their forgone revenue opportunities due to untreated, discharged patients. According to a study by the Department of Health and Human Services, 42% of claims for evaluation and management services were incorrectly coded, with 19% lacking appropriate documentation. Medicare payments for downcoded claims for evaluation and management services were \$1.76 billion in 2014¹¹. An article from 2009 by coding consultant Stephanie Albright shows how a missed diagnosis of sepsis, which is billed incorrectly as a urinary tract infection (UTI), could result in \$2,830 in lost revenue, not including additional penalties if the patient is readmitted (Figure 10). Experts state that one of the greatest charge capture risks exists in areas with complex coding requirements which could include critical care patients and units.

Figure 10

	Urinary Tract Infection	Sepsis	Potential Revenue Gained for Correctly Diagnosing Sepsis vs. UTI
Code (ICD-9)	599.0	038.9	
Description	Urinary tract infection, site not specified	Unspecified septicemia	
Potential Reimbursement	\$3,914	\$6,744	\$2,830

SEPSIS

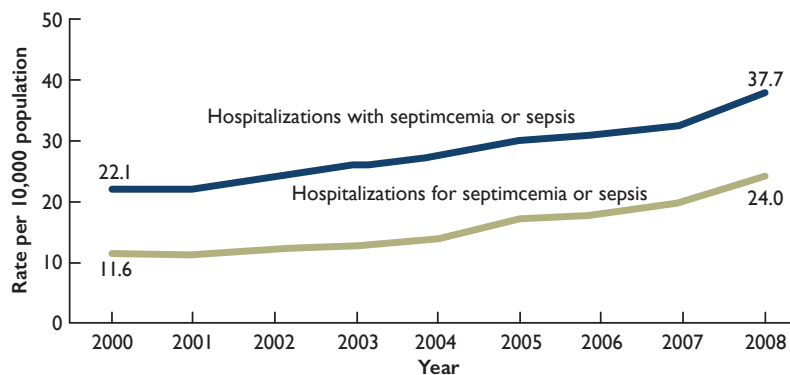
Contact-free continuous monitoring has the unique ability to detect “sleeper” conditions, such as sepsis. As Dr. Brown, a Clinical Professor of Medicine at UCLA explains:

“It acts as an ‘early warning system’ by detecting changes in key vital signs that are predictors of clinical deterioration. An abnormally high respiratory rate, for example, is one of the best early indicators of sepsis, where timely identification and treatment are essential to reduce mortality. We have identified patients with newly diagnosed arrhythmias, such as atrial fibrillation with rapid ventricular response, detected by high heart-rate alerts, enabling prompt recognition and treatment. The CFCM system also helps prevent falls and pressure ulcers, reinforcing bedside care by proactively keeping patients out of harm’s way.”

Providers closely monitor sepsis symptoms including fever, respiratory secretions, and impaired oxygen availability. CFCM is able to perform trend indications for patients’ heart and respiratory rates to help physicians determine underlying symptoms of sepsis that may have been overlooked. Coffee Regional Medical Hospital has seen positive results with early diagnosis. According to Hughes, “CFCM offers potential for early intervention and long-term cost savings on conditions such as sepsis and respiratory distress. We are ultimately able to send our patients home earlier.”

Beginning in 2018, CMS will begin adjusting hospital payments on outcomes and quality of sepsis care. Diagnosing sepsis can be difficult as it is one of the most-complicated and expensive conditions that can mirror the signs and symptoms caused by other disorders. Across all payers in the United States, sepsis is the most-expensive condition with costs totaling \$20.3 billion or 5.2% of all hospitalizations¹⁷. Sepsis is a sleeper condition that must be caught as early as possible because up to 51% of patients will develop acute renal failure, up to 18% will have acute respiratory failure, and up to 80% will develop a myopathy or polyneuropathy⁴. According to the CDC, individuals hospitalized with sepsis had a 75% longer LOS, and the number of diagnoses has more than doubled from 2000 to 2008⁵ (Figure 11).

Figure 11



Note: Significant linear trend from 2000 through 2008 for both categories.
Source: CDC/NCHS. National Hospital Discharge Survey. 2000-2008

ARRHYTHMIAS & RESPIRATORY DISTRESS

Conditions such as arrhythmias are not always symptomatic, but they can be predictors of serious conditions such as stroke and heart disease. Hughes at the Coffee Regional Medical Hospital reported that with CFCM, “We have found an increasing number of atrial fibrillations raising our overall case mix and improving the accuracy of our coding.” Respiratory distress is another condition that can be a predictor of serious cardiac events, succeeded only by arrhythmias². Undiagnosed respiratory distress can lead to respiratory failure—one of the top-10 most-expensive conditions treated in hospitals¹⁷. In-hospital mortality has also been tied to abnormal respiratory rates³. Southeast Rural Hospital uses CFCM and saw a 68.4% reduction in mortality due to the detection of respiration distress.

CONTACT-FREE CONTINUOUS MONITORING SUPPORTS A COMPLETE FINANCIAL ARGUMENT

Hospitals are becoming increasingly integrated across departments and are seeking cohesive technology solutions. According to the AHA, 30.5% of hospitals have negative operating margins (Figure 12). Many institutions are too busy and financially strapped to adopt new technologies that only deliver benefits to one department or to one aspect of the hospital’s operations. Emphasis on solutions that offer both sound clinical and financial justification will continue to be more valuable to institutions.

Figure 12

Year	Aggregate Total Hospital Margins	Aggregate Operating Margins	Aggregate Non-Operating Gains as a Percentage of Total Net Revenue	Percent of Hospitals with Negative Total Margins	Percent of Hospitals with Negative Operating Margins
2009	5.0%	4.4%	0.6%	27.5%	30.1%
2010	7.2%	5.5%	1.8%	22.8%	28.3%
2011	7.0%	5.5%	1.6%	24.0%	28.4%
2012	7.8%	6.5%	1.4%	21.3%	25.9%
2013	7.9%	5.7%	2.3%	24.0%	30.5%







Source: American Hospital Association (AHA)

In order to be competitive, hospitals must commit to innovation that provides them the flexibility to grow within current constraints and reduce unnecessary capital investments. Remaining profitable in an environment that is shifting to a fee-for-value system means capturing every dollar that hospitals are entitled to for the conditions that they diagnose and treat. Contact-free continuous monitoring solutions have the potential to transform a hospital into a smarter institution with benefits for both patient care and across the complete income statement. One hospital CEO stated:

“CFOs always like a top line [argument for medical technology] better than a bottom line one. [Medical technology companies] are always saying they can save hospitals money, so CFOs are very skeptical and will not budge unless they are really sure. But a top-line benefit is easier to isolate and identify. It feels more real since hospitals can measure it without seeing it filtered all the way through the income statement.”

In summary, hospitals that are able to deliver superior outcomes, save costs and, at the same time, generate incremental revenue to support staff and technology investments will become more competitive in the current economic climate (Figure 13). CFCM, as described above, is a technology that clearly contributes to hospitals' top and bottom lines.

Figure 13

The Clinical and Financial Case for CFCM (Annual Impact)		
Improved Outcomes	Lower Costs	Revenue Generation
		
 <ol style="list-style-type: none"> 1. Med/Surg LOS: 9% 2. ICU LOS: 45% 3. Telemetry LOS: 42.8% 	<ol style="list-style-type: none"> 1. Med/Surg: \$541,000 2. ICU: \$137,000 	Creates new bed capacity by reducing ambulance diversions and capacity limitations with no additional capital investment
 <ol style="list-style-type: none"> 1. Pressure Ulcers: 64% 2. Patient Falls: 43% 3. Code Blue Events: 86% 	<ol style="list-style-type: none"> 1. Pressure Ulcers: \$124,000 	Helps to achieve value-based payment goals and recover reimbursements and bonuses
 <ol style="list-style-type: none"> 1. Alarms per 100 hours of monitoring: 98.1% 	<ol style="list-style-type: none"> 1. Labor Savings 	Appropriate coding to capture sleeper conditions
= A Clear ROI for Hospitals		

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