SB409 SD1

Measure Title:
RELATING TO HEALTH.

Report Title:
Health Care Insurance Coverage; Medical Vigilance Services

Description:
Requires health insurance policies to cover medical vigilance services for subscribers who are receiving in-patient health care services at an acute care hospital. (SD1)

Introducer(s):
HOOSER

Current Referral:
HTH

STATE OF HAWAI'I
OFFICE OF THE AUDITOR
465 S. King Street, Room 500
Honolulu, Hawai'i 96813-2917

MARION M. HIGA
State Auditor

(808) 587-0800
FAX: (808) 587-0830

**TESTIMONY OF MARION M. HIGA, STATE AUDITOR,
ON SENATE BILL NO. 409, SENATE DRAFT 1, RELATING TO HEALTH**

Senate Committee on Health

February 25, 2008

Chair Ige and Members of the Committee:

Thank you for this opportunity to testify on Senate Bill No. 409, Senate Draft 1. This proposed bill amends Chapters 431 and 432, Hawai'i Revised Statutes (HRS), to require mandatory health insurance coverage for health plan subscribers who use intelligent medical vigilance services provided that: 1) the patient is receiving in-patient health care services at an acute care hospital; and 2) the patient's treating physician recommends the application of medical vigilance services as a precautionary measure due to the nature of the patient's illness or treatment.

Currently, the office has engaged a consultant to conduct a study of the social and financial impacts of mandatory health insurance coverage for use of intelligent medical vigilance services in acute care hospitals as required under Sections 23-51 and 23-52, HRS. A final draft report is pending comment by the Department of Health and the Department of Commerce and Consumer Affairs. We expect to submit a report to the Legislature within the next two weeks.

This bill ought to be considered further by the Legislature, but we ask that a defective date be put into section 6, before allowing it to move forward. I would be pleased to answer any questions you may have.

HMSA

Blue Cross Blue Shield of Hawaii

An Independent Licensee of the Blue Cross and Blue Shield Association

February 25, 2008

The Honorable David Ige, Chair
The Honorable Carol Fukunaga, Vice Chair
Senate Committee on Health

Re: SB 409 SD1 – Relating to Health

Dear Chair Ige, Vice Chair Fukunaga and Members of the Committee:

The Hawaii Medical Service Association (HMSA) appreciates the opportunity to testify on SB 409 SD1 which would require health plans cover the use of a certain patient monitoring technology. HMSA has concerns with this measure.

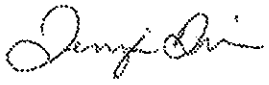
We believe that this type of mandate would be difficult to implement due to the current payment structure used by most health plans in the State. Currently hospitals are paid using Diagnosis Related Groups (DRGs) which provide a finance and patient classification system using diagnosis, type of treatment, age and other related factors as screening criteria. Since hospitals are paid a predetermined amount of money for treating patients from a given DRG, the type of mandated coverage outlined in SB 409 SD1 may be inappropriate and complicated to implement.

It is our understanding that the Employer Union Trust Fund (EUTF), as a self-insured entity, has made the decision to include the use of the Hoana Medical monitoring technology as a benefit for its members. This new benefit is scheduled to be included in the EUTF member's health plan in July. We believe that the EUTF's decision offers an opportunity to examine any challenges and benefits of implementing this particular mandate. The EUTF will have to sort through many of the issues that were discussed last legislative session including the reimbursement level for the benefit and how the benefit will be administered. We feel that prior to mandating that private employers across the State include this benefit in their health plan, waiting for the outcome of the EUTF pilot would be more prudent.

Additionally, last legislative session, the State Auditor was requested to perform a study on this issue as required by statute. When the Auditor's office was contacted last week, we were told that this study would not be completed for another two to three weeks. We would like the opportunity to review the Auditor's study and provide you with additional comments at that time.

Thank you for the opportunity to testify today.

Sincerely,



Jennifer Diesman
Director, Government Relations

Hawaii Medical Service Association | 818 Keeaumoku St. P.O. Box 860 Honolulu, HI 96808-0860 | (808) 948-5110 | Branch offices located on Hawaii, Kauai and Maui | Internet address www.HMSA.com

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Government Affairs

Testimony of
Phyllis Dendle
Director of Government Affairs

Senate Committee on Health
The Honorable David Y. Ige, Chair
The Honorable Carol Fukunaga, Vice Chair

February 25, 2008
1:15 PM
Conference Room 016

SB 409 SD1 RELATING TO HEALTH

Chair Ige and committee members, thank you for this opportunity to provide testimony on SB 409 requiring health plan coverage for medical vigilance services.

Kaiser Permanente Hawaii has concerns about this bill.

Kaiser Permanente's position on proposed legislative mandates of health coverage is that they are usually not a good idea, for several reasons:

1. First, because they generally tend to raise the cost of delivering health care, thereby resulting in higher premiums and increased cost to the purchasers and payors of health plan coverage, whether they be employer groups or individuals;
2. Second, because they often tend to dictate how medicine should be practiced, which sometimes results in medicine that is not evidence based and usurps the role and expertise of the practicing physician and other health care professionals who provide medical treatment and services; and
3. Finally, because they often lock in statutory requirements that become outdated and do not keep pace with the ever evolving and advancing fields of medicine and medical technology.

We also note that the impact assessment report, which was requested in SCR209 HD1CD1 of 2007, has not been published by the Legislative Auditor.

While there is no doubt value in a system that improves the monitoring of some patients in an acute care setting, mandating coverage for a method of providing a benefit rather than the benefit itself may not be valuable.

We urge further consideration of this matter prior to passage.

711 Kapiolani Blvd
Honolulu, Hawaii 96813
Telephone: 808-432-5210
Facsimile: 808-432-5906
Mobile: 808-754-7007
E-mail: phyllis.dendle@kp.org

TESTIMONY OF PATRICK SULLIVAN ON BEHALF OF HOANA MEDICAL, INC. IN SUPPORT OF S.B. NO. 409, SD 1, RELATING TO HEALTH

February 25, 2008

To: Chairman David Ige and Members of the Senate Committee on Health:

My name is Patrick Sullivan and I am the CEO and Founder of Hoana Medical, Inc. (Hoana), a Hawaii company, and am presenting this testimony in support of S. B. No. 409, SD 1. The specific purpose of this bill is to require primarily commercial health insurance plans to cover medical vigilance services for subscribers who are receiving in-patient health care services at an acute care hospital in Hawaii.

Hoana is a Hawaii-based company which developed an automated early alert system, referred to as the LG1 Intelligent Medical Vigilance System, also known as the "LifeBed™ patient vigilance system". This LifeBed identifies at-risk patients with an "invisible" device that provides accurate and continuous observation of heart and respiratory rates while the patient is in a hospital bed. It will immediately notify nursing staff upon detecting a life threatening condition.

Specifically, the LifeBed is comprised of two principal components. First, there is a collection of sensors that is under a coverlet (a regular hospital coverlet) placed on top of the mattress but below the sheets of a standard hospital bed to gather patient information without direct bodily contact. Second, there is an interpretive bedside device that is connected to this collection of sensors. The sensor is continuously measuring patient heart and respiratory rates. If the parameters extend beyond their normal physiologic range, the device interprets the variations and notifies caregivers (nurses)

using a hospital's existing nurse call system. The sensors also monitor bed departures and notify caregivers that a patient has left the bed and could be at risk of falling.

Hawaii has experienced a shortage of professional healthcare workers, including nurses, throughout the past several years. The LifeBed will provide a needed patient safety supplement to assist hospital personnel, and in particular, nurses, to monitor and observe 24 hours a day any problem that a patient may have. It is common knowledge that medical personnel cannot be at the bedside of a patient 24 hours a day because of its high cost. However, regular scheduled rounds are maintained in every hospital to check on the status of patients every 4-6 hours. Unfortunately, the lack of more frequent observations can and does result in negative patient outcomes thereby leading to higher health care costs.

In fact a recent study published in the *New England Journal of Medicine (NEJM)* ("Delayed Time to Defibrillation after In-Hospital Cardiac Arrest"), published Wednesday, January 3, 2008, *discusses this very problem.* If you have a heart attack in an airport, or even a casino, there is a 50% chance you survive, compared to just one third if your heart attack takes place at a US hospital. It seems that all too often patients do not get life-saving defibrillation within the crucial two minutes when in a hospital. Chances you are on your own when in a hospital and have a heart attack are much greater than if it took place in an airport or casino. People around you at a casino/airport will respond immediately, while a patient on his/her own in a hospital ward may not be so lucky. The two-minute window for defibrillation is critical for improving a patient's chances of survival. The researchers estimate that 370,000 to 750,000 people have a heart attack each year in the United States. Delays in the treatment of patients with defibrillators

increase by thousands the number of deaths each year in the United States. These delays occur often times in hospitals because of the time of day (most delays occur at night or on the weekends), the type of hospitals (smaller ones had more delays), the quality of hospital, the unavailability of doctors at the time of the heart attack, and the **lack of heart monitors in hospitals.** (See attached article)

We all recognize that health care products and services have both plus and minus aspects that contribute to their overall value. Generally, they comprise a balance between good medical outcome and the cost to achieve the outcome. The major perspectives that a policy making body such as the state legislature must consider that are relevant to healthcare interventions are the patient, the provider, the payer, and the benefit to society as a whole. We all recognize that society seeks the best outcome at the lowest price, and therefore it is important for the product or services to have a reasonable and attractive cost-benefit ratio.

Various articles, reports, and articles documented the extent of injuries and death that occur each year due to medical errors that occur in a hospital setting. There are a large number of incidents of medical harm that occur in American hospitals each year. The Institute of Medicine estimated that at least 44,000 and as many as 98,000 Americans die each year due to medical errors. The Institute for Healthcare Improvement estimated that there are between 40 and 50 incidents of harm that occur for every 100 hospital admissions. The LifeBed will clearly assist in reducing this incidence of harm that occurs in hospitals each year, including falls.

In April 2006 HealthGrade, Inc. released its Third Annual Patient Safety in American Hospitals Study. HealthGrade is an organization that ranks and rates hospitals

nationwide. One estimate was that the majority of deaths were preventable and failure to rescue was the most common cause of death and the most common patient safety issue. Hospitals in Hawaii ranked as a bottom performer for all hospitals in the rate of patient safety issues nationwide for Medicare patients, ranking 43rd of 50 states plus the District of Columbia. Further, the State of Hawaii scored very poorly in this analysis and ranked last in the two key mortality indicators, failure to rescue and death in low-mortality DRGs (diagnosis related groups). Hawaii ranked dead last or 51st out of 51 for each indicator separately.

Improving patient safety is one of the most highly publicized issues facing health care organizations. Regulatory, accreditation and performance improvements groups such as the Joint Commission (formerly known as The Joint Commission on Accreditation of Healthcare Organizations), the Center for Medicare and Medicaid Services (CMS), the Institute of Healthcare Improvement (IHI), the Institute for Safe Medical Practice (ISMP) and others have published a wide range of mandates and recommendations to improve patient safety.

Hoana believes that the LifeBed is a significant solution to increase patient safety. It is a patient vigilance system that is working. (See attached interventions) We know that this committee and the members of the Hawaii State Legislature are aware of the financial difficulties that face all of our hospitals in Hawaii. Hoana feels that it is reasonable and appropriate to request the legislature to be part of the solution by mandating this coverage. It will be of great benefit to the hospitals, and especially to members of our public who happen to be in the hospital because of health issues. Cost-

benefit aspects of the LifeBed have been studied and are attached as an exhibit to this testimony.

A concurrent resolution was passed last year to require an auditor's report as required by law. However, the report has not yet been submitted to the legislature in accordance with the time frame set out in the concurrent resolution. However, it is our understanding that the report is in its final stages. This being the situation we are asking this committee to pass this measure forward in order for the legislature to receive a copy of the report before making the ultimate decision on this bill.

Thank you very much for giving me the opportunity to testify on this measure and respectfully request that this committee passed this bill out of committee.

Patrick K Sullivan, PhD

The NEW ENGLAND JOURNAL of MEDICINE

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Delayed Time to Defibrillation after In-Hospital Cardiac Arrest

Paul S. Chan, M.D., Harlan M. Krumholz, M.D., Graham Nichol, M.D., M.P.H., Brahmajee K. Nallamothu, M.D., M.P.H., and the American Heart Association National Registry of Cardiopulmonary Resuscitation Investigators*

ABSTRACT

BACKGROUND

Expert guidelines advocate defibrillation within 2 minutes after an in-hospital cardiac arrest caused by ventricular arrhythmia. However, empirical data on the prevalence of delayed defibrillation in the United States and its effect on survival are limited.

METHODS

We identified 6789 patients who had cardiac arrest due to ventricular fibrillation or pulseless ventricular tachycardia at 369 hospitals participating in the National Registry of Cardiopulmonary Resuscitation. Using multivariable logistic regression, we identified characteristics associated with delayed defibrillation. We then examined the association between delayed defibrillation (more than 2 minutes) and survival to discharge after adjusting for differences in patient and hospital characteristics.

RESULTS

The overall median time to defibrillation was 1 minute (interquartile range, <1 to 3 minutes); delayed defibrillation occurred in 2045 patients (30.1%). Characteristics associated with delayed defibrillation included black race, noncardiac admitting diagnosis, and occurrence of cardiac arrest at a hospital with fewer than 250 beds, in an unmonitored hospital unit, and during after-hours periods (5 p.m. to 8 a.m. or weekends). Delayed defibrillation was associated with a significantly lower probability of surviving to hospital discharge (22.2%, vs. 39.3% when defibrillation was not delayed; adjusted odds ratio, 0.48; 95% confidence interval, 0.42 to 0.54; P<0.001). In addition, a graded association was seen between increasing time to defibrillation and lower rates of survival to hospital discharge for each minute of delay (P for trend <0.001).

CONCLUSIONS

Delayed defibrillation is common and is associated with lower rates of survival after in-hospital cardiac arrest.

From Saint Luke's Mid-America Heart Institute, Kansas City, MO (P.S.C.); the University of Michigan Division of Cardiovascular Medicine, Ann Arbor (P.S.C., B.K.N.); the Section of Cardiovascular Medicine and the Robert Wood Johnson Clinical Scholars Program, Department of Medicine, and the Section of Health Policy and Administration, Department of Epidemiology and Public Health, Yale University School of Medicine, and the Center for Outcomes Research and Evaluation, Yale–New Haven Hospital — all in New Haven, CT (H.M.K.); the University of Washington–Harborview Center for Prehospital Emergency Care, Seattle (G.N.); and the Veterans Affairs Ann Arbor Health Services Research and Development Center of Excellence, Ann Arbor, MI (B.K.N.). Address reprint requests to Dr. Chan at the Mid-America Heart Institute, 5th Fl., 4401 Wornall Rd., Kansas City, MO 64111, or at pchan@cc-pc.com.

*The American Heart Association National Registry of Cardiopulmonary Resuscitation Investigators are listed in the Appendix.

N Engl J Med 2008;358:9-17.

BETWEEN 370,000 AND 750,000 HOSPITALized patients have a cardiac arrest and undergo cardiopulmonary resuscitation each year in the United States, with less than 30% expected to survive to discharge.[1] Among the leading causes of cardiac arrest among adults during a hospitalization are ventricular fibrillation and pulseless ventricular tachycardia from primary electrical disturbances or cardiac ischemia.[2-4] In contrast to cardiac arrests due to asystole or pulseless mechanical activity, survival from cardiac arrests due to ventricular fibrillation or pulseless ventricular tachycardia is improved if defibrillation therapy is administered rapidly.[1,2,4]

Current recommendations are that hospitalized patients with ventricular fibrillation or pulseless ventricular tachycardia should receive defibrillation therapy within 2 minutes after recognition of cardiac arrest.[5,6] Previous studies have suggested an association between time to defibrillation and survival, but the inclusion of cardiac arrests not amenable to defibrillation in most studies remains a potential confounder of this association.[7-10] Moreover, the extent to which delayed defibrillation occurs in U.S. hospitals and its potential effect on survival are unclear.

Accordingly, we examined how often delayed defibrillation occurred during in-hospital cardiac arrests caused by ventricular arrhythmias and investigated the relationship between delayed defibrillation and survival, using data from the National Registry of Cardiopulmonary Resuscitation (NRCPR). The NRCPR is a large registry of U.S. hospitals that uses standardized Utstein definitions (a template of uniform reporting guidelines developed by international experts) to assess both processes of care and outcomes during in-hospital cardiac arrests.[6,11-15] It provides a unique resource for exploring these questions as well as identifying key patient and hospital characteristics associated with delayed defibrillation.

METHODS

STUDY DESIGN

The study design of the NRCPR has been described in detail.[4] Briefly, the NRCPR is a prospective, multicenter registry of in-hospital cardiac arrests that collects data according to standardized Utstein definitions.[6,11-15] Cardiac arrest is defined as cessation of cardiac mechanical activity as determined by the absence of a palpable central pulse, apnea, and unresponsiveness. The NRCPR protocol specifies that all consecutive patients with cardiac arrests and without do-not-resuscitate orders be screened by dedicated staff at participating hospitals. Cases are identified by centralized collection of cardiac-arrest flow sheets, reviews of hospital paging-system logs, routine checks for use of code carts (carts stocked with emergency equipment), and screening for code-cart charges from hospital billing offices.

Accuracy of data in the NRCPR is ensured by certification of research staff, use of case-study methods for newly enrolled hospitals before submission of data, and a periodic reabstraction process, which has been demonstrated to have a mean error rate of 2.4% for all data.[4] All patients are assigned a unique code during a single hospitalization, and data are transmitted to a central repository (Digital Innovation) without identification of the patient. Oversight of data collection and analysis, integrity of the data, and research is provided by the American Heart Association. The institutional review board of the University of Michigan Medical School approved this study and waived the requirement for written informed consent.

PATIENT POPULATION

Our analysis included 369 acute care hospitals that provided data for at least 6 months between January 1, 2000, and July 31, 2005. In patients 18 years of age or older, we identified 14,190 cases of in-hospital cardiac arrest in which the first identifiable rhythm was ventricular fibrillation or pulseless ventricular tachycardia (Fig. 1). If a patient had multiple cardiac arrests during the same hospitalization, we excluded data from subsequent episodes (involving 1587 recurrent arrests) to focus on the index event. We also limited our study population to patients whose cardiac arrests occurred while they were in intensive care units (ICUs) or inpatient beds. Because of the distinctive clinical circumstances associated with other hospital environments, we excluded a total of 3291 patients who were in emergency departments, operating rooms, procedure areas (cardiac catheterization, electrophysiology, and angiography suites), and postprocedural areas at the time of their cardiac arrest. Finally, we excluded patients with implantable cardioverter–defibrillators (170 patients), those who were receiving intravenous infusions of acute cardiac life support protocol medications for pulseless ventricular tachycardia or ventricular fibrillation (epinephrine, amiodarone, lidocaine, or

procainamide) at the time of cardiac arrest (1565 patients), and patients for whom data on the time of the cardiac arrest or defibrillation were missing (766 patients) or inconsistent (22 patients). The patients who were excluded because of missing or inconsistent time data had baseline characteristics that were similar to those of patients in the final study cohort, except that the excluded patients had lower rates of previous myocardial infarction (21.2% vs. 27.5%, P<0.001) and higher rates of septicemia (13.6% vs. 11.2%, P=0.05). The final study sample consisted of 6789 patients (Fig. 1).

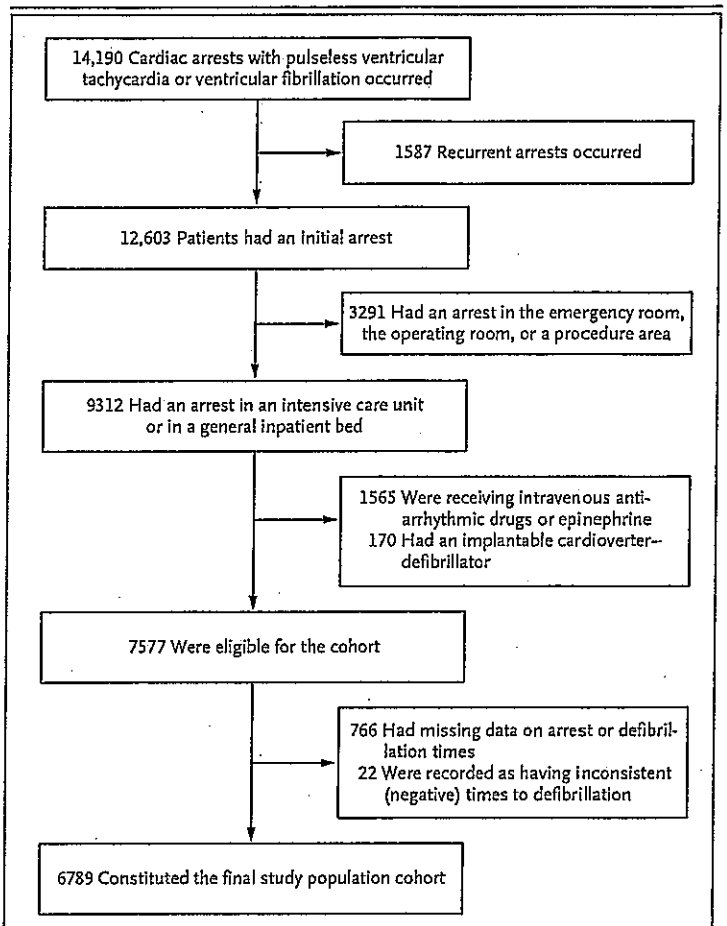


Figure 1. Study Cohort.
Of the initial 14,190 cases of in-hospital cardiac arrest due to pulseless ventricular tachycardia or ventricular fibrillation listed in the National Registry of Cardiopulmonary Resuscitation, 6789 eligible patients were included in the final study population.

TIME TO DEFIBRILLATION

The time to defibrillation was calculated as the interval from the reported time of initial recognition of the cardiac arrest to the reported time of the first attempted defibrillation. Both reported times were determined from cardiac-arrest documentation in the patient's medical records and recorded in minutes. In our primary analysis, we used these data to determine the proportion of study subjects with delayed defibrillation, which was defined as a time to defibrillation greater than 2 minutes. In addition, we classified the study subjects according to whether their defibrillation time was 1 minute or less, 2 minutes, 3 minutes, 4 minutes, 5 minutes, 6 minutes, or more than 6 minutes.

END POINTS

The primary outcome for our analysis was survival to hospital discharge. We also evaluated three secondary outcomes: return of spontaneous circulation for at least 20 minutes after onset of the cardiac arrest, survival at 24 hours after the cardiac arrest, and neurologic and functional status at discharge. Neurologic and functional status were assessed among survivors to discharge according to previously developed performance categories.[16] For both neurologic and functional status, outcomes were categorized as no major disability, moderate disability, severe disability, or coma or vegetative state; data on these outcomes were available for 84% of survivors to hospital discharge. Patients whose data were missing did not differ significantly from those without missing data with regard to likelihood of delayed defibrillation (19.5% vs. 19.1%, P=0.85).

STATISTICAL ANALYSIS

Unadjusted analyses evaluated baseline differences between patients with and without delayed defibrillation using Student's t-test for continuous variables and the chi-square test for categorical variables. Multivariable logistic-regression models were used to examine the relationship between individual baseline characteristics and delayed defibrillation.

Multivariable models were then created to investigate the relationship between delayed defibrillation and outcomes. All models included age, sex, race (white, black, Hispanic, Asian or Pacific Islander, or Native American), and time to defibrillation (delayed or not delayed) as covariates. Additional candidate variables were selected from the following list after they had been determined to have a significant univariate association (P<0.05) with survival: initial cardiac rhythm (ventricular fibrillation or pulseless ventricular tachycardia),

admitting diagnosis (medical, cardiac; medical, noncardiac; surgical, cardiac; or surgical, noncardiac), presence or absence of congestive heart failure or myocardial infarction at the time of admission, presence or absence of previous congestive heart failure or myocardial infarction, presence or absence of coexisting medical conditions at the time of cardiac arrest (respiratory, renal, or hepatic insufficiency; metabolic or electrolyte derangements; diabetes mellitus; baseline evidence of motor, cognitive, or functional deficits; acute stroke; acute nonstroke neurologic disorder; pneumonia; sepsis; major trauma; or cancer), the use or nonuse of therapeutic interventions at the time of cardiac arrest (intraaortic balloon pump, pulmonary-artery catheter, or hemodialysis), time of cardiac arrest (during work hours or during after-hours periods [i.e., 5 p.m. to 8 a.m. or weekend]), the use or nonuse of a hospital-wide cardiopulmonary-arrest (code blue) alert, type of hospital bed where the cardiac arrest occurred (ICU, inpatient bed monitored by telemetry, or unmonitored inpatient bed), and hospital size (<250, 250 to 499, or ≥500 inpatient beds). We also performed analyses to explore the relationship between time to defibrillation and survival to hospital discharge across a range of times.

All models used generalized estimating equations with an unstructured correlation matrix to account for the potential effects of clustering of

Table 1. Baseline Characteristics According to Time to Defibrillation.*

Characteristic	≤2 Minutes to Defibrillation (N=4744)	>2 Minutes to Defibrillation (N=2045)	P Value
Age — yr	67.9±13.9	67.6±14.8	0.49
Male sex — no. (%)	2876 (60.6)	1207 (59.0)	0.15
White race — no. (%)†	3608 (76.1)	1457 (71.2)	<0.001
Ventricular fibrillation — no. (%)	3276 (69.1)	1454 (71.1)	0.08
Hospital-wide code blue —no. (%)	4141 (87.3)	1889 (92.4)	<0.001
Type of hospital bed — no. (%)			<0.001
Intensive care	2910 (61.3)	816 (39.9)	
Inpatient, monitored by telemetry	1368 (28.8)	816 (39.9)	
Inpatient, unmonitored	466 (9.8)	413 (20.2)	
Hospital size — no. (%)			<0.001
<250 beds	1124 (23.7)	576 (28.2)	
250–499 beds	2178 (45.9)	886 (43.3)	
≥500 beds	1387 (29.2)	565 (27.6)	
Unknown	55 (1.2)	18 (0.9)	
Geographic region — no. (%)			0.38
Northeast	502 (10.6)	233 (11.4)	
Midwest	1352 (28.5)	550 (26.9)	
South	2135 (45.0)	920 (45.0)	
West	755 (15.9)	342 (16.7)	
Admitting diagnosis — no. (%)			<0.001
Medical, cardiac	2377 (50.1)	799 (39.1)	
Medical, noncardiac	1427 (30.1)	861 (42.1)	
Surgical, cardiac	508 (10.7)	145 (7.1)	
Surgical, noncardiac	432 (9.1)	240 (11.7)	
Time of cardiac arrest — no. (%)			
After hours‡	2650 (55.9)	1209 (59.1)	0.01
Weekend	1252 (26.4)	576 (28.2)	0.14

Table 1. (Continued.)

Characteristic	≤2 Minutes to Defibrillation (N=4744)	>2 Minutes to Defibrillation (N=2045)	P Value
Cardiac diagnosis — no. (%)			
Congestive heart failure at admission	1295 (27.3)	470 (23.0)	<0.001
Previous congestive heart failure	1404 (29.6)	623 (30.5)	0.44
Myocardial infarction at admission	1418 (29.9)	442 (21.6)	<0.001
Previous myocardial infarction	1252 (26.4)	503 (24.6)	0.16
Coexisting medical conditions — no. (%)			
Respiratory insufficiency	1703 (35.9)	712 (34.8)	0.39
Renal insufficiency	1542 (32.5)	679 (33.2)	0.69
Hepatic insufficiency	285 (6.0)	143 (7.0)	0.15
Metabolic or electrolyte derangement	792 (16.7)	346 (16.9)	0.95
Diabetes mellitus	1542 (32.5)	695 (34.0)	0.25
Baseline central nervous system deficits§	526 (11.1)	237 (11.6)	0.55
Acute stroke	176 (3.7)	90 (4.4)	0.21
Acute nonstroke neurologic disorder	318 (6.7)	131 (6.4)	0.51
Pneumonia	569 (12.0)	270 (13.2)	0.21
Sepsis	512 (10.8)	258 (12.6)	0.08
Major trauma	38 (0.8)	23 (1.1)	0.16
Cancer	432 (9.1)	219 (10.7)	0.05
Therapeutic interventions — no. (%)			
Intraaortic balloon pump	90 (1.9)	12 (0.6)	<0.001
Pulmonary-artery catheter	247 (5.2)	66 (3.2)	<0.001
Hemodialysis	161 (3.4)	72 (3.5)	0.83

* Plus–minus values are means ±SD.
† Race was determined by the hospital investigators.
‡ After hours was defined as before 8 a.m., after 5 p.m., or on weekends.
§ Central nervous system deficits included motor, cognitive, and functional deficits.

patients within hospitals. For all analyses, the null hypothesis was evaluated at a two-sided significance level of 0.05, with calculation of 95% confidence intervals. All analyses were performed with SAS software, version 9.1.

RESULTS

We identified 6789 patients from 369 hospitals who had in-hospital cardiac arrests due to ventricular fibrillation (69.7%) or pulseless ventricular tachycardia (30.3%). Overall, the median time to defibrillation was 1 minute (interquartile range, <1 to 3 minutes), with 2045 patients (30.1%) noted as having had delayed defibrillation according to our definition (a time to defibrillation greater than 2 minutes). Table 1 displays baseline characteristics of patients with and of those without delayed defibrillation.

Table 2 lists characteristics significantly associated with delayed defibrillation in multivariate analysis. Patient factors associated with delayed defibrillation included black race and a noncardiac admitting diagnosis. Significant hospital-related factors included small hospital size (<250 beds), occurrence of cardiac arrest in an unmonitored inpatient bed, and occurrence of cardiac arrest after hours.

Return of spontaneous circulation occurred in 4168 patients (61.4%), 3372 patients (49.7%) survived to 24 hours after their cardiac arrest, and 2318 (34.1%) survived to hospital discharge. The unadjusted survival outcomes were significantly lower for patients with delayed defibrillation

Table 2. Factors Associated with Delayed Time to Defibrillation in Multivariable Analysis.*

Variable	Adjusted Odds Ratio (95% CI)	P Value†
Race or ethnic group‡		
White	Reference	Reference
Black	1.23 (1.05–1.43)	0.009
Hispanic	1.09 (0.83–1.43)	0.56
Asian or Pacific Islander	0.99 (0.83–1.43)	0.98
Native American	1.25 (0.61–2.57)	0.54
Unknown	1.02 (0.78–1.34)	0.11
After-hours cardiac arrest§	1.18 (1.05–1.33)	0.005
Type of hospital bed		
Intensive care unit	0.39 (0.33–0.46)	<0.001
Inpatient, monitored by telemetry	0.47 (0.41–0.53)	<0.001
Inpatient, unmonitored	Reference	Reference
Hospital size		
<250 beds	1.27 (1.08–1.47)	0.001
250–499 beds	1.02 (0.90–1.17)	0.72
≥500 beds	Reference	Reference
Admitting diagnosis		
Medical, cardiac	0.67 (0.55–0.82)	<0.001
Surgical, cardiac	0.67 (0.51–0.86)	0.002
Noncardiac	Reference	Reference

* Patient- and hospital-level variables that independently predicted a time to defibrillation of more than 2 minutes are shown. CI denotes confidence interval.
† P<0.01 for inclusion in the model.
‡ Race and ethnic group were determined by the hospital investigators.
§ After hours was defined as before 8 a.m., after 5 p.m., or on weekends.

(49.0% vs. 66.7% for return of spontaneous circulation, 37.4% vs. 55.0% for survival to 24 hours, and 22.2% vs. 39.3% for survival to hospital discharge) (Table 3). A graded inverse association was found between time to defibrillation and unadjusted survival across a broad range of time thresholds (Fig. 2).

After adjustment for patient- and hospital-related characteristics, delayed defibrillation was found to be associated with a significantly lower likelihood of survival to hospital discharge (adjusted odds ratio, 0.48; 95% confidence interval [CI], 0.42 to 0.54; P<0.001) (Table 3). When time to defibrillation was evaluated in discrete intervals, a graded inverse association was found between longer delays and survival, with a significantly lower likelihood of survival to hospital discharge with increased time to defibrillation (Fig. 2).

Delayed defibrillation was also associated with a significantly lower likelihood of return of spontaneous circulation (adjusted odds ratio, 0.55; 95% CI, 0.49 to 0.62; P<0.001) and survival at 24 hours after the cardiac arrest (adjusted odds ratio, 0.52; 95% CI, 0.46 to 0.58; P<0.001) (Table 3). These results remained robust when examined separately according to type of hospital bed (ICU, monitored inpatient, or unmonitored inpatient) (see the Supplementary Appendix, available with the full text of this article at www.nejm.org). Finally, among those surviving to discharge, delayed defibrillation was associated with a significantly lower likelihood of having no major disabilities in neurologic status (adjusted odds ratio, 0.74; 95% CI, 0.57 to 0.95; P=0.02) or functional status (adjusted odds ratio, 0.74; 95% CI, 0.56 to 0.96; P=0.02) (Table 3).

DISCUSSION

We found that 30.1% of patients with cardiac arrests due to ventricular arrhythmia underwent defibrillation more than 2 minutes after initial recognition of their cardiac arrest, a delay that exceeds guidelines-based recommendations.[5,6] Patients with delayed defibrillation were significantly less likely to survive to hospital discharge. Among survivors, patients with delayed defibrillation were less likely to have no major disabilities in neurologic or functional status. These findings support the conclusion that rapid defibrillation is associated with sizable survival gains in these high-risk patients. Furthermore, we found a graded association between poorer survival and longer times to defibrillation, even for times beyond 2 minutes. These observations reinforce the rationale for efforts to shorten the time to defibrillation as much as possible to maximize the effectiveness of resuscitation of patients with ventricular fibrillation or pulseless ventricular tachycardia.

Our work confirms and extends the findings of other investigations that have shown a relationship between defibrillation time and survival. Although earlier studies linked delayed defibrillation to poorer survival in hospitalized patients, most of these reports included heterogeneous study populations (i.e., both patients with "shockable" and those with "unshockable" rhythms, such as asystole, at the time of cardiac arrest).[7,9,10] Moreover, these studies were generally small and involved a limited number of hospitals. In contrast, our analysis focused only on patients with cardiac

Table 3. Summary of Study End Points and Adjusted Survival Rates with Delayed Defibrillation.*

End Point	≤2 Minutes to Defibrillation (N=4744)	>2 Minutes to Defibrillation (N=2045)	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)†	P Value
Survival outcomes — no./total no. (%)					
Return of spontaneous circulation	3165/4744 (66.7)	1003/2045 (49.0)	0.48 (0.43–0.53)	0.55 (0.49–0.62)	<0.001
Survival to 24 hr	2607/4744 (55.0)	765/2045 (37.4)	0.48 (0.43–0.54)	0.52 (0.46–0.58)	<0.001
Survival to discharge	1863/4744 (39.3)	455/2045 (22.2)	0.44 (0.39–0.50)	0.48 (0.42–0.54)	<0.001
Neurologic outcomes — no./total no. (%)‡			0.71 (0.57–0.89)	0.74 (0.57–0.95)	0.02
No major disability	931/1549 (60.1)	197/381 (51.7)			
Moderate disability	437/1549 (28.2)	134/381 (35.2)			
Severe disability	152/1549 (9.8)	36/381 (9.4)			
Coma or vegetative state	29/1549 (1.9)	14/381 (3.7)			
Functional outcomes — no./total no. (%)‡			0.67 (0.52–0.87)	0.74 (0.56–0.96)	0.02
No major disability	533/1542 (34.6)	100/381 (26.2)			
Moderate disability	638/1542 (41.4)	164/381 (43.0)			
Severe disability	342/1542 (22.2)	103/381 (27.0)			
Coma or vegetative state	29/1542 (1.9)	14/381 (3.7)			

* Patients for whom the time to defibrillation was more than 2 minutes had lower unadjusted and adjusted survival rates, as well as lower rates of survival to discharge with intact neurologic and functional status, than those for whom the time was 2 minutes or less. CI denotes confidence interval.

† Odds ratios are adjusted for age, sex, race, initial cardiac rhythm, admitting diagnosis, presence or absence of congestive heart failure and myocardial infarction at admission, presence or absence of previous congestive heart failure and myocardial infarction, presence or absence of coexisting medical conditions at the time of cardiac arrest, use or nonuse of a hospital-wide code blue, use or nonuse of treatment interventions (intraaortic balloon pump, pulmonary-artery catheter, and hemodialysis), type of hospital bed, and hospital size.

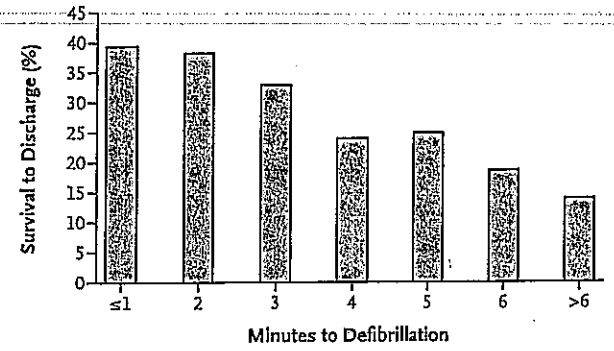
‡ Neurologic and functional outcomes are given only for those who survived until hospital discharge. Model comparisons were made between survivors discharged with no major disability and those with a moderate degree of disability or worse.

arrest due to ventricular fibrillation or pulseless ventricular tachycardia and excluded other potentially inappropriate patients, such as those receiving concomitant treatment with intravenous antiarrhythmic or vasoactive infusions or those with preexisting implantable cardioverter–defibrillators. The large size of the NRCPR and its use of standardized definitions were instrumental in this regard.

Several factors related to the hospital setting were associated with delayed defibrillation, including the occurrence of a cardiac arrest after hours or in an unmonitored inpatient bed. These findings imply that response times may be related, in part, to the emergent availability of trained medical personnel, access to defibrillation equipment, and delays in recognition of a ventricular arrhythmia.

In addition to hospital-related factors, certain patient characteristics were found to be associated with a greater likelihood of delayed defibrillation. The relationship between a cardiac admitting diagnosis and shorter time to defibrillation is probably due to earlier recognition of the ventricular arrhythmia. However, the association of black race with delayed defibrillation is not intuitively obvious and raises potential issues of disparities in care. Further studies are warranted to determine whether such variations are due to geographic differences in access to hospitals with more resources (such as more monitored beds) or whether they reflect actual differences in practice patterns according to race.

Our study should be interpreted in the context of the following limitations. First, although data available in the NRCPR allowed us to adjust for key variables that have been linked to survival after cardiac arrest, our study used an observational design, and there are variables that we did not or could not capture (for example, a physician's a priori assessment of the likelihood of survival or good neurologic outcome in an arrest). These additional factors may influence time to defibrillation, leading to residual confounding.



Minutes to Defibrillation	No. of Patients	Survived to Discharge	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	P Value
≤1	3994	1577	Reference	Reference	—
2	750	286	0.94 (0.81–1.10)	1.02 (0.85–1.21)	0.85
3	472	160	0.78 (0.64–0.96)	0.84 (0.67–1.05)	0.12
4	291	67	0.46 (0.35–0.61)	0.50 (0.37–0.67)	<0.001
5	394	98	0.51 (0.40–0.64)	0.54 (0.42–0.70)	<0.001
6	145	27	0.35 (0.23–0.54)	0.39 (0.25–0.61)	<0.001
>6	743	103	0.25 (0.20–0.31)	0.27 (0.21–0.34)	<0.001

Figure 2. Unadjusted and Adjusted Rates of Survival to Hospital Discharge According to Time to Defibrillation.

A graded inverse association was seen between time to defibrillation and survival rate (P for trend <0.001). CI denotes confidence interval.

Second, data on time to defibrillation relied on reported times of cardiac arrest and defibrillation from hospital records. The use of multiple clocks and the lack of synchronization between the timing of cardiac monitors and defibrillators within a hospital may lead to variability and discrepancies in calculating time to defibrillation.[17,18] This variability in measurement would be expected to bias our findings toward the null hypothesis, suggesting that we may be underestimating the association between delayed defibrillation and survival. In addition, because time to defibrillation was recorded in minutes, our analysis primarily explored its association with survival at the skewed upper end of this variable's distribution. The effect of time to defibrillation within short intervals of less than a minute could not be assessed.

Third, the results related to neurologic and functional status should be interpreted with caution, since these data were missing for 16% of patients surviving to hospital discharge. Finally, although hospitals in the NRCPR represent nearly 15% of the large hospitals (>250 beds) in the United States, their participation is voluntary. Performance characteristics, quality of care, and survival outcomes may be different in nonparticipating hospitals.

In conclusion, we found that delays in the time to defibrillation are common in hospitalized patients with cardiac arrest due to a ventricular arrhythmia, and we identified several patient- and hospital-related factors associated with delayed time to defibrillation. In our analysis, such delays were associated with substantially worse clinical outcomes, with each additional minute of delay resulting in worse survival.

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APPENDIX

The American Heart Association National Registry of Cardiopulmonary Resuscitation investigators are as follows: G. Nichol, M. Mancini, R. Berg, M.A. Peberdy, E. Allen, S. Braithwaite, J. Gosbee, B. Hunt, G.L. Larkin, G. Mears, V. Nadkarni, T. Truitt, J. Potts, B. Abella, R. Geocadin, K. Kern, B. Bigel, and J. Ornato.

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HOANA™

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LifeBed™Interventions

Updated October 13, 2007

The following are examples of interventions that resulted from alerts or information provided by the Hoana patient vigilance system. The names of the individuals have been omitted for privacy. However these are actual cases reported by nurses on the med/surge floors where the systems were installed. The clinical notes contain the information provided by the hospital nurses in their own words.

Case number 1

System alert or indication	Respiration Rate High—11/26/2006
Situation prior to intervention	72 year old male patient with stage 3 lung cancer admitted two days earlier for fever, dehydration, and pneumonia.
Description of intervention	Patient was found to have a high respiration rate in the 40's and labored breathing. Hospitalist and crisis nurse called in for tests and treatment.
Outcome	Condition stabilized and patient transferred to ICU

Clinical Notes

Clinical Scenario Pt is a 72 yo male that is diagnosed with stage 3 lung cancer. Pt came in with fever, dehydration, and pneumonia two days before the incident happened.

Clinical Course Event Pt's LG1 was alarming at about 2330 when the patient was found with a high resp rate at 40's and the patient was found to have labored breathing. Pt last seen at 2300, due for next visit at 0000 (midnite). Pts HR also was elevated in the 120's-130's. Pt however denied any problems and stated that he was fine. Patient had previously been running with a HR of 100's and a RR of 20's -30's. When the patient's VS were taken the patient's O2 sats were 82% on 6L O2, the patient was then placed on a NRM where his O2 sats were increased to 90's then eventually the 100%. ABG's were done, Chest XRay were done, EKG done, and the hospitalist and crisis nurse were called and then assisted at the bedside.

Outcome Within about 2 hours from when the LG1 alarmed, the patient was transferred to ICU where he currently is stable at this moment.

Case number 2

System alert or indication	Heart Rate High—11/27/2006
Situation prior to intervention	Middle aged female with leukemia was admitted for dehydration, nausea, and vomiting. Patient had a CT scan and vital signs were stable. Family was with patient at all times.
Description of intervention	Three nurses responded and a doctor and crisis nurse were also summoned. Adult emergency protocols were activated immediately. Patient given nitroglycerin and oxygen treatment.
Outcome	By responding to the alert, the nurses were able to stabilize the patient and avoid a worsening condition that may have occurred if they had waited until the next scheduled vital sign assessment. Patient transferred to ICU.

Clinical Notes

Clinical Scenario This was middle age female with ALL and was admitted for dehydration, nausea/vomiting. She had finished 1 course of chemotherapy a few weeks ago. On this day, the patient went to CT scan to abdomen/pelvis in the late afternoon and return at approx 1645. Prior to leaving, she was assessed thoroughly and assessment was unremarkable, and had no complaints. Vitals signs where stable. When the patient returned from CT scan she ate dinner brought from home and informed the nurse that she was feeling tired because she got little sleep during the night and wanted to take a nap. She had no other complaints and slept until the LG1 alarm was activated at (approx 1800) and indicated that her heart rate was elevated. A family member was at the bedside at all times.

Clinical Course Event Two nurses responded one after the other, to the alert and found that LG1 indicated that the patient's HR was 170's. One nurse went to call the attending physician, while the other nurse took an acutal HR reading manually, which was 170's-180's. A thrid nurse came to the room to assist and called the crisis nurse and retirived the code cart. The patient stated that she was woken to the nurses coming into her room and by the sound of "beeping " in the room. Initially, she stated that she was fine, but a minute later she began to c/o slight SOB, chest "pressure" to the left side of her chest and radiated to her.neck. Her blood pressure was 180's-200's/100's, O2 sat 90 on room air. The adult emergency protocols was activated immdeiately and orders were carried out per protocol, and as instructed by the attending. The patient remained responsive throughout the situation.

Outcome The EKG showed some kind of abnormality which was different from her previous EKG the was NSR. She had no hx of cardiac problems. Her stat KCL that was done had decreased from the morning results which were already low (3.3 ?). The patient was replaced with 40 mEq potassium during the day and was to get another dose in the later evening. All other labs was WNL or not significantly changed. The patient responded to the treatments (nitroglycerin, O2) provided. The patient was transfered to a telemetry unit.

Other After the patient and family had learned how the nurse's knew that "something" was going on with the patient because of the LG-1, they were thankful for having the device and for the rapid response and treatment provided by the nurse's and doctor's. I too, am grateful for this product because we probably would not of known that there was changes in her HR/BP until at next scheduled VS assessment, or if and when the patient began to c/o of any abnormalities. At this point, the patient's condtion could have taken a turn for the worse. This

I believe that this product is useful to us because it enhances positive outcomes. Moreover, it is like a 'big brother" watching over the patient while in bed because caregivers cannot be in the patient's room physically at all times. It is required that the patient is checked every 1-2 hours, but due to unforeseen circumstances, that is not always the case.

Case number 3

System alert or indication	Respiration Rate Low—11/30/2006
Situation prior to intervention	Newly diagnosed male oncology patient in mid-60's. Patient had pain and was receiving analgesics.
Description of intervention	Alert sounded for low respiration rate. Patient was sleeping and could not stay awake. It was determined that the patient was overly sedated and receiving narcotic medication by patch as well as orally. The doctor was notified and orders adjusted, discontinuing one of the narcotics.
Outcome	No reversal medications were needed and the patient became less sedated a few hours after removal of one of the medications.

Clinical Notes

Clinical Scenario Pt in his mid 60's on the oncology floor, newly diagnosed. Pt having pain and was receiving analgesics. LG-1 sounded alert for low RR, 7. Pt seen sleeping at the time, easily arouseable but falls right back to sleep when spoken to.

Clinical Course Event Due to the alert, reason for sedation was further investigated and it was found that the patient was receiving fentanyl patch per hour dosage as well as a scheduled by mouth narcotic. MD was notified and orders adjusted.

One of the narcotics were discontinued.

Outcome Luckily, no reversal meds were needed and pt became less sedated within the next few hours after removal of one of the analgesics.

Case number 4

System alert or indication	Respiration Rate Low—1/3/2007
Situation prior to intervention	Cancer patient transferred from ICU. Unable to verbalize.
Description of intervention	After responding to a second alert, the nurse determined that the patient was aspirating from the feeding tube. She immediately applied a syringe and removed 450 cc of liquid.
Outcome	The patient's normal breathing and oxygen levels were restored. The patient was saved from respiratory distress and possible death.

Clinical Notes

Clinical Scenario I received a patient from the ICU who previously aspirated from his old PEG tube. The old PEG was pulled out and was replaced by a G-J tube. He is a cancer patient with generalized mets. Unable to verbalize needs/concerns due to decreased neuro status and having a tracheostomy in place.

Immediately after he was transferred to our bed from the ICU bed, the LG1 was powered on. I also placed a continuous pulse ox on him. Assessment was done and vital signs appears to be stable. I came back to the nurses' station to check for his new orders and consequently start his treatment. After a moment, the call light from his room is going off, it was activated by the LG1. I went to his room right away to see what's going on. He seems to be ok when I checked on him so I came back to the nurses' station. After a few moments later his call light is on again. So, I went back to his room and the LG1 screen is now alerting me that patient's respiratory rate is only 8 per minute. At this time the pulse ox machine starts to beep and showing that patient is gradually desating despite receiving O2 via T-collar at 60% FIO2. Previous report from the ICU stated that patient has a bolus feeding of 1 can of Jevity via the new feeding tube. I then thought that patient might be aspirating again from his new feeding tube. Even on a semi-fowler's position (upright positon) the patient starts to cough out some Jevity from his trach. His O2 saturation is now 72%. I immediately grabbed a toomey syringe and opened the G port of his G-J tube, hoping that I will be able to pull out what was given to him. Luckily, I started pulling out the feeding. I pulled out a total of 450cc. LG1 stopped alarming and the pulse ox machine now reveals an O2 saturation of 95%. Patient is now breathing better, Respiratory rate at 18 per minute.

Clinical Course Event LG1 continuously alerted the caregiver for low respiratory rate secondary to aspiration.

Outcome With the help of the LG1, the patient was saved from respiratory distress and aspirating which might have been the cause of death.

Case number 5

System alert or indication	Respiration Rate Low—1/5/2007
Situation prior to intervention	Patient condition not reported.
Description of intervention	Responding to the alert, the nurse called for an MD who ordered oxygen and a series of other tests.
Outcome	The doctor found an underlying problem that was previously unknown.

Clinical Notes

Other RR alert for resps at 6. Called MD, ordered O2 and a series of other tests. Found an underlying problem with this pt that was previously unknown.

Case number 6

System alert or indication	Heart Rate Low—1/13/2007
Situation prior to intervention	Two patients with bigeminy, but only one previously diagnosed.
Description of intervention	After receiving alerts for these two patients, rapid response teams were brought in.
Outcome	Patient with no previous history was now properly diagnosed and transferred to a monitored bed.

Clinical Notes

I just got a call from Pam, who is working 3-11 today. She has been crazy, busy with LG1 alerts tonite---that ultimately caused the nurses to call in the Rapid Response team (for 2 patients who have bigeminy--one had not been previously diagnosed). One patient transferred to monitored bed.

Case number 7

System alert or indication	Heart Rate Low—1/13/2007
Situation prior to intervention	Patient was scheduled to receive lopressor (medication to slow heart rate).
Description of intervention	By viewing the Vigilance System screen and noticing the patient's heart rate was already low, the nurse determined that the lopressor was not appropriate.
Outcome	The information on the system screen stopped the nurse from administering medicine that could have harmed the patient.

Clinical Notes

No alert, but nurse noted low HR on LG1, checked pulse, and held giving lopressor (med that slows HR)

Case number 8

System alert or indication	Heart Rate Low—1/13/2007
Situation prior to intervention	An 81 year old female patient with a urinary tract infection and fever was admitted and placed on surveillance. She was also being treated for a low heart rate.
Description of intervention	When the alert indicated the patient's heart rate had dropped again, the rapid response team was called and the patient sent to telemetry.
Outcome	The patient was transferred to telemetry for closer monitoring.

Clinical Notes

Clinical Scenario On 1/13 3-7 I received an 81 y.o. female with dx of UTI + fever. On admission placed on surveillence monitor. HR dropped into the 30's. Primary MD notified + decreased lopressor to 25mg P.O. BID Hold if HR <55 or SBP<100.

Clinical Course Event Pt HR dropped into 30's again. Primary notified + RRT level I called. Pt placed on monitor + PVC's with bigeminey noticed by RRT nurse. Hospitalist identified pattern + pt remained on floor; on 11-7 and RRT called for low HR + pt sent to telemetry. Pt had hx of CHF; HTN.

Outcome Pt to telemetry

Other Pulse oximetry HR on finger + picks up HR into 70's. Surveillence reading 37/min. Surveillence not picking up pt HR. Pt HR 60's but only perfusing 30's.

Case number 9

System alert or indication	Respiration Rate Low—1/17/2007
Situation prior to intervention	Patient was scheduled to receive a scheduled dose of medication.
Description of intervention	Responding to the alert, the nurse realized that the patient's respiration rate was low and that the patient was already too sedated and difficult to awaken.
Outcome	The medicine was not administered.

Clinical Notes

Other On a recent evening shift, Jo Ann observed an unconsented nurse respond to an LG1 alert while passing this pt their meds. The LG1 showed slow RR and she was about to give this pt their pain or sleep med. She walked out of the pt's room to her RN team leader and asked the RN to "waste" the med because this pt was already too sedated and she was already having difficulty waking the pt.

Case number 10

System alert or indication	Heart Rate Low—1/18/2007
Situation prior to intervention	Patient was scheduled to receive a scheduled dose of beta blocker medication.
Description of intervention	Responding to the alert, the nurse administered an ECG to verify clinically that the heart rate was low.
Outcome	The alert stopped the nurse from administering medicine that could have harmed the patient. Patient recovered and was discharged.

Clinical Notes

Other Patient Y in PIMA 2 study. Shortly after midnite, low HR alert brought nurse to pt. room. Verified clinically and with ECG. Scheduled dose of beta blocker held. Patient went on to recover and be discharged. Written up as case report white paper.

Case number 11

System alert or indication	Respiration Rate High—1/23/2007
Situation prior to intervention	Patient should have been connected to oxygen but wasn't.
Description of intervention	Responding to the alert, the nurse noticed the patient had removed the oxygen mask.
Outcome	Oxygen was reapplied and the patient's condition stabilized.

Clinical Notes

Other RR rate alerting high, nurse went to check pt. Pt not wearing O2. O2 put on and alerts resolved.

Case number 12

System alert or indication	Bed Exit Alert—1/25/2007
Situation prior to intervention	Patient had metastatic bone cancer and could have suffered fractures if he fell.
Description of intervention	Responding to the alert, the nurse noticed the patient standing unsteadily by the bed. The nurse put the patient back in bed.
Outcome	The nurse prevented a fall and possible multiple fractures by returning him to bed.

Clinical Notes

Other Nurse excitedly reported "we prevented a fall". The pt had metastatic bone cancer. Bed exit was on low sensitivity. Pt got out of bed to urinate. Alert went off. Nurse went to the room and saw pt standing at bedside unsteadily. Nurse put pt back in bed. Nurse stated that if pt fell, he would have fractured several bones due to his condition. The nurse felt this pt most likely would have fallen because he was extremely unsteady, and if he stayed up much longer he probably would have fallen.

Case number 13

System alert or indication	Heart Rate High—2/2/2007
Situation prior to intervention	Female patient had a history of atrial fibrillation.
Description of intervention	When the alert appeared, a rapid response team was dispatched and it was determined that the patient had rapid atrial fibrillation. She was treated with IV medication.
Outcome	The patient was transferred to telemetry for closer monitoring.

Clinical Notes

Internal Use From nurse manager Cindy Fiocchi RN C.

Other this morning we had an RRT that resulted from the vigilance system alerting the nurse to a heart rate in the 140s and when assessed she in fact was in rapid AF. She has a history and was on the unit postop. she was treated with IV lopressor and moved to telemetry for more monitoring

Case number 14

System alert or indication	Heart Rate High—2/6/2007
Situation prior to intervention	Female patient had a chest tube. After accidentally tugging on the tube, the patient experienced considerable pain and fear and was unable to speak freely or press the nurse call button.
Description of intervention	Responding to the alert, the nurse noticed an extremely high heart rate of 181 and the tube out of place. The nurse repositioned the tube.
Outcome	The patient calmed down and her heart rate returned to normal.

Clinical Notes

Other Pts heart rate was 181...apparently she had a chest tube placement this afternoon. Late this evening, she was reaching for some clothing at the end of her bed, which most likely tugged at the chest tube, causing pain and "fear". When we arrived in the room, shortly after the alert, she could barely speak due to the pain and her apparent "splinting" of her ribs/breathing. After a few minutes, she calmed down and her heart rate went down to 84. Her comment was: "Wow! This machine works...it brought you (the patient's nurse) into my room."

Case number 15

System alert or indication	Heart Rate Low—2/6/2007
Situation prior to intervention	Patient was transferred from telemetry unit.
Description of intervention	Responding to the alert, the nurse noticed a low heart rate and woke the patient to raise the heart rate. Although it rose, it would fall again whenever the patient fell asleep.
Outcome	The patient appeared to be okay with the low heart rate but was checked regularly.

Clinical Notes

Other Patient was transferred from telemetry unit early on shift. The NA noticed that the LG1 was not on and turned it on (without trouble). Five minutes later, the lo HR alerted = 38. Patient was asleep. The nurse woke the patient, and his heart rate went up to 83. Fifteen minutes later, the lo HR alerted again at 39. Patient was asleep. The nurse woke the patient, and his heart rate went up. Forty-five minutes later, the lo HR alerted at 39. Same routine, but the nurse decreased the lo HR setting to 36 and said that she would report to the day shift nurse, who should alert the MD to the lo HR when patient was sleeping. The charge nurse (Heidi) commented: "This machine is GREAT!"

Case number 16

System alert or indication	Heart Rate High—2/12/2007
Situation prior to intervention	Patient already had an elevated heart rate that was expected to go down on its own. Patient was to be discharged within a few hours.
Description of intervention	After the alert indicated that the heart rate was still high, the nurse called the MD who ordered medication to lower the heart rate.
Outcome	The patient's heart rate returned to normal and the patient was able to go home that evening.

Clinical Notes

Clinical Scenario Pt had elevated HR. --Pt had been anxious, nurse thought might go down. However, HR remained elevated. Pt was to be discharged within the next few hours.

Clinical Course Event: Nurse called MD to notify of the increased HR. Received an order from the MD for medication, metoprolol. Outcome Pt's HR went back to normal and was able to go home that evening.

Case number 17

System alert or indication	Heart Rate High—2/14/2007
Situation prior to intervention	Patient was paraplegic and asymptomatic
Description of intervention	After responding to the alert, the nurse determined the patient had signs of dysreflexia and had not had a bowel movement in two days. The nurse intervened and resolved the problem.
Outcome	The nurse's quick response avoided the need for IV medication and a possible transfer to the ICU.

Clinical Notes

Clinical Scenario Pt is a paraplegic. HR 140-150's when device alerted. Pt asymptomatic.

Clinical Course Event Nurse was able to assess the patient and determine he was having signs of dysreflexia---with the elevated HR. Pt. had no other symptoms.

Outcome Nurse identified patient had not had a bowel movement in 2 days..which was the cause of the increased HR...able to provide nursing interventions and resolve the problem. Without early ID, this patient could have required IV medications and possibly transfer to ICU.

Case number 18

System alert or indication	Heart Rate High—2/23/2007
Situation prior to intervention	Patient was recovering from a hip repair operation.
Description of intervention	Responding to the alert, the nurse noticed an elevated heart rate even though there were no other symptoms. She activated the rapid response team.
Outcome	The patient received medication and went to another floor for observation.

Clinical Notes

Clinical Course Event Stefanie was across the room. he had no other symptoms, no CP. she activated an RRT. Outcome he did need to receive meds and went to P5N

Case number 19

System alert or indication	Heart Rate Low—3/12/2007
Situation prior to intervention	Patient was on telemetry for low heart rate monitoring. Telemetry reading was normal.
Description of intervention	Responding to the alert, the nurse noticed the heart rate was low even though the telemetry unit reading was normal. She called the attending cardiologist.
Outcome	The cardiologist determined that the patient's pacemaker was not functioning. It was also determined that the telemetry unit had a disconnected wire resulting in false reading. The patient was transferred to the ICU.

Clinical Notes

Clinical Course Event Telemetry reading normal. Double checked leads and discovered one lead disconnected. Checked patient's pulse, which was indeed low. Outcome Nurse contacted attending MD (cardiologist) who determined patient's pacemaker not functioning. Patient transferred to ICU.

Case number 20

System alert or indication	Heart Rate Low—3/22/2007
Situation prior to intervention	A 24 year old Hispanic female was admitted for a craniotomy to relieve cerebral pressure resulting from a neoplasm of the ventricles. She has a history of obstructive hydrocephalus, was overweight and smoked 1-2 packs of cigarettes daily. Her sister, with whom she lives, also reported a decrease in her short-term memory over the month prior to admission. She was assessed as being moderately at risk for a fall (20-30 out of 100).
Description of intervention	In the early morning of the second day of her stay, the vigilance system alerted as a result of a low heart rate (60-65bpm. This low heart rate continued for 5 hours. Treatment related to the bradycardia involved a chest CT scan and chest XR to determine if a pulmonary emboli (PE) was present. After confirming no PE was present the date of her planned surgery was moved forward, since it was assumed that the malignancy may be impinging on her brain stem, thus affecting heart rate.
Outcome	Because the vigilance system was in place, the patient avoided a transfer to a telemetry unit (cost savings), while her condition was still being continuously evaluated. In addition, the ability to detect changes in her heart rate enabled her care to be escalated than it would have otherwise. Patient was transferred to a rehab unit 10 days post-op.

Clinical Notes

Clinical Scenario:
A.F. a 24 year old Hispanic female, was admitted for a craniotomy to relieve cerebral pressure resulting from a neoplasm of the ventricles. She has a history of obstructive hydrocephalus, is overweight and smokes 1-2 packs of cigarettes. Her sister, with whom she lives, also reported a decrease in her short-term memory over the month prior to admission. She was assessed as being moderately at risk for a fall (20-30 out of 100).

Clinical Course Event:
In the early morning of the 2nd day of her stay, the vigilance system alerted as a result of a low HR (60-65bpm. This low heart rate continued for 5 hours. Treatment related to the bradycardia involved a chest CT scan and chest XR to determine if a pulmonary emboli (PE) was present. After confirming no PE was present the date of her planned surgery was moved forward, since it was assumed that the malignancy may be impinging on her brain stem, thus affecting HR.

Outcome:
Because the vigilance system was in place, the patient avoided a transfer to a telemetry unit (cost savings), while her condition was still being continuously evaluated. In addition, the ability to detect changes in her heart rate enabled her care to be escalated than it would have otherwise. Patient was transferred to a rehab unit 10 days post-op. linical scenario: Patient asleep, receiving oxygen therapy.

Case number 21

System alert or indication	Heart Rate High—3/23/2007
Situation prior to intervention	Patient had no symptoms and was asleep.
Description of intervention	After responding to the alert, the nurse administered an EKG and determined the patient was in atrial fibrillation. The nurse called an MD for an examination.
Outcome	The patient's normal heart rate restored on its own.

Clinical Notes

Clinical Scenario HR 175. Pt had no symptoms, sleeping.

Clinical Course Event Nurse did EKG. Pt in Atrial Fibrillation.

Outcome MD called and came to see patient. Patient ended up converting back to sinus rhythm on own.

Case number 22

System alert or indication	Respiration Rate High—3/28/2007
Situation prior to intervention	Patient had vital signs checked earlier and was not scheduled for another assessment for another 6-7 hours. The patient was unable to use the call light.
Description of intervention	As a result of the alert, an MD was called to the patient's room and the patient was given a chest X-ray and 4L of Oxygen.
Outcome	The patient's breathing stabilized. However if the alert did not sound, the patient would not have been given an assessment until many hours later.

Clinical Notes

Clinical Scenario Pt RR 34. Biox 77%. Pt. can't use call light. Respiratory distress. Pt had vital signs and assessment done 1.5 hours before the event, it would've been another 6-7 hours before vital signs would've been done again.

Clinical Course Event Pt able to stay on unit as issue resolved.

Outcome MD called to patient's room. Pt had CXR and placed on 4 L of oxygen. Issue resolved.

Case number 23

System alert or indication	Heart Rate High—3/29/2007
Situation prior to intervention	Patient was asymptomatic and had vital signs checked earlier in the day.
Description of intervention	Responding to the alert, the nurse called the doctor to check on the patient. After a number of tests, the doctor changed the patient's medication.
Outcome	After receiving the proper medication, the patient's heart rate stabilized.

Clinical Notes

Clinical Scenario LG1 device alerted HR in 150's. VS had been done for the day shift. Pt was asypmtomatic. MD called. ABG (blood gases done); EKG done. MD came to patient's room and physically assessed patient. MD changed the patient's medications and included a Beta Blocker to help alleviate patient's increased HR.

Clinical Course Event Unsure results of ABGs. EKG --tachycardia only, no abnormal rhythms.

Outcome Pt's medications changed. HR stabilized.

Case number 24

System alert or indication	Heart Rate High—3/30/2007
Situation prior to intervention	Not available
Description of intervention	Leading into the morning, a nurse received a high heart rate alert from the LifeBed system. Upon checking the patient the nurse confirmed that the patient's HR was 143 and called the MD for new orders.
Outcome	The MD arrived shortly and prescribed new medications and an hourly assessment of the patient.

Clinical Notes

Patient HR 143. MD called. Put on new meds, recheck in 1 hour.

Case number 25

System alert or indication	Respiration Rate Low—3/30/2007
Situation prior to intervention	No information available.
Description of intervention	Responding to the alert, the nurse checked the patient's vital signs and discovered the patient had died.
Outcome	The Vigilance System alerted the nurse to the patient's unexpected passing.

Clinical Notes

Clinical Course Event Nurse checked patient's vitals. Patient's RR were zero. Patient had died. MD called. Outcome LG1 alerted nurse to patient's unexpected passing.

Case number 26

System alert or indication	Unable to Measure—4/2/2007
Situation prior to intervention	Patient was admitted for shortness of breath and (non-cardiac) chest pains.
Description of intervention	The respiratory therapist entered the room and found the patient non-responsive. Seconds later the device sent the UTM alert. There was a pulse but no respiration. The patient apparently pulled off his oxygen and Bi-pap mask while sleeping.
Outcome	The patient was stabilized and transferred to the ICU. He was later extubated and doing much better the following day. By coincidence the RT was already in the room when the alert went off. However if he had not been there, the Vigilance System alert would have summoned the nurse.

Clinical Notes

Clinical Scenario Pt admitted with shortness of breath/chest pain (ruled out cardiac). Pt on oxygen and BI-pap while sleeping.

Clinical Course Event Respiratory therapist entered room and found pt non-responsive. She yelled for others to call code. Within 15-30 seconds of RT yelling out, device alerted Unable To Measure. If RT had not walked in, the device would have alerted staff to patient's condition. Pt had no respirations, but had a pulse. RT found the patient with his oxygen and Bi-pap mask wrapped around his arm. Appears pt pulled these items off while sleeping.

Outcome Pt was stabilized enough to transfer to the ICU. Pt was extubated and doing better on 4/3/07.

Case number 27

System alert or indication	Bed Exit Alert—4/4/2007
Situation prior to intervention	Patient was very confused and at a high risk of falling. A posey restraint was used to keep him from getting out of bed. The Vigilance System bed exit alert feature was enabled to notify nurses if he was attempting a bed exit.
Description of intervention	Alert brought in the nurse immediately who found the patient almost between the side rails.
Outcome	The nurse returned the patient to the bed preventing an almost certain falling incident.

Clinical Notes

Clinical Scenario Patient very confused. Pt in a posey restraint to prevent patient from getting out of bed. Pt HIGH fall risk.

Clinical Course Event Device alerted. Patient's nurse went into room and found patient almost between siderails. Pt had wiggled out of restraint. If device had not alerted, patient would have fallen.

Outcome: A fall was prevented.

Case number 28

System alert or indication	Unable to Measure—4/11/2007
Situation prior to intervention	Not available
Description of intervention	A nurse responding to an alert from the LifeBed system discovered the patient was not showing any vital signs (the LifeBed alert indication was Unable to Measure or UTM). The nurse immediately issued a code call.
Outcome	When help arrived, the patient was quickly revived and transferred immediately to ICU.

Clinical Notes

Unable to measure. Code called. Pt. revived and sent to ICU.

Case number 29

System alert or indication	Bed Exit Alert—4/15/2007
Situation prior to intervention	Patient was very confused and at a high risk of falling. A posey restraint was used to keep him from getting out of bed. The Vigilance System bed exit alert feature was enabled to notify nurses if he was attempting a bed exit..
Description of intervention	The alert brought in the nurse immediately who found the patient hanging out of the bed with part of the restraint removed.
Outcome	The nurse returned the patient to the bed preventing an almost certain falling incident and also prevented the patient from pulling out his IV.

Clinical Notes

Clinical Scenario Pt confused, fall risk. Pt in posey restraint. Bed Exit on, high sensitivty.

Clinical Course Event Nurse heard device alerting at nurses' station through call light system. Nurse went immediately to patient's room because she knew patient was trying to get out of bed. Pt had pulled posey restraint off from one side and was hanging out of bed.

Outcome Pt did not fall. Pt repositioned and educated. Pt did not pull out his IV site.

Case number 30

System alert or indication	Heart Rate High—4/16/2007
Situation prior to intervention	Not available
Description of intervention	A nurse responded to an alert from the LifeBed and discovered a high respiration rate of 32. She called for the MD who arrived soon afterwards and gave insulin to the patient. Shortly after this, the patient's respiration dropped to the 20 range. Patient went through episodes of tachypnea all night but oxygen saturation levels were fine.
Outcome	MD arrived and gave insulin to the patient. Shortly after this, the patient's respiration dropped to the 20 range. Patient went through episodes of tachypnea all night but oxygen saturation levels were fine.

Clinical Notes

Dr_____ notified, FS checked 505 insulin given. Respirations go back to 20's and had episodes of tachypnea all might but O2 sats WNL.

Case number 31

System alert or indication	Heart Rate High—4/16/2007
Situation prior to intervention	Patient was sitting up eating lunch and was asymptomatic.
Description of intervention	The nurse responded to a high heart rate alert and confirmed manually that the rate was high and irregular. A pulse ox check revealed lower sats in the 80 range. The physician was called and an EKG performed.
Outcome	The patient was diagnosed with new atrial fibrillation and transferred to a telemetry unit for monitoring.

Clinical Notes

Clinical Scenario Alerted by alarm to check patient due to change in pulse rate. Patient was sitting up in bed eating lunch. The alarm noted a pulse of 156. The patient was asymptomatic.

Clinical Course Event Upon checking her apical pulse, she was tachy in the 130's, and with an irregular rate. Her pulse ox check revealed lower sats, in the 80's. She denied chest pain or shortness of breath.

Outcome The physician was notified, a stat ekg done. She was diagnosed with new atrial fib and transferred off our med surg floor to a telemetry unit.

Case number 32

System alert or indication	Heart Rate High—4/17/2007
Situation prior to intervention	Patient was in bed while nurse was on a lunch break. Next scheduled assessment was in three to four hours.
Description of intervention	An alert brought in another floor nurse who discovered the irregular high heart rate. There was no indication that the patient had a history of this condition. An EKG was administered which confirmed the Vigilance System readings. The patient was transferred to a telemetry floor for monitoring.
Outcome	Because the next schedule assessment was several hours away, the patient may not have received treatment in time if the nurse on duty was not alerted by the Vigilance system.

Clinical Notes

Clinical Scenario hoana alarm sounding, pt's nurse at lunch. i went to see why it was alarming, heart rate on the monitor was 156-165. i checked the pt's pulse and it was indeed in that ballpark and very irregular. i checked the pt's chart, and there was no mention of the pt having an irregular heartrate or a history of a-fib. dr. was called and ekg was done and it showed a-b and ect. pt. was transffered to a tele floor so that medications and closer mointoring would be done to get the pt's condition under control.

Clinical Course Event see above it was caught before something bad happened. pt. denied any problems. the next time vitals woulld of been done or assessment would of been 1500-1600. this case all happened over the lunch hour. 1130 a.m.

Outcome pt. alive!

Case number 33

System alert or indication	Respiration Rate Low—4/17/2007
Situation prior to intervention	Patient was transferred from a post anesthesia unit to the med surge floor.
Description of intervention	The nurse noticed a low respiration rate on the Vigilance System screen and confirmed that the patient was down to about eight breaths per minute. The patient was lethargic and could not stay awake. The nurse summoned a doctor who ordered medication to stabilize the breathing.
Outcome	The patient awoke and responded to requests to cough and breathe deeply. The respiration rate stabilized as the new medication took effect and the anesthesia wore off.

Clinical Notes

Clinical Scenario pt. came to me from pacu. pt. put in bed and the hoana system turned on. pt.'s respirations on the ,hoana screen was reading 7,8,9 respirations. watching the pt. he was only breathing 8 breaths a minute. pt. would not wake up and stay awake. the machine did not alarm because it was set at 5 per minute, which i think is way to low and i changed it to 8 a minute. the doctor was called and orders for narcan to be given was reciecved. during all this process i felt more comfortable knowing that the hoana was on this pt.'s bed. after narcan was given pt. woke up and was encouraged to cough and deep breath and use the insentive spirometer. pt. remained on the floor and was fine after the narcan took effect and all the narcs and anesthesia was out of the pt's body. i was worried that the same thing would happen with the pt. having the pca, but i was thankful that the hoana system was on the bed to alert me to any changes along with my assessments.

Clinical Course Event very very helpful i have learned to listen to the alarms.

Outcome the pt. did fine and went home the next day.

Case number 34

System alert or indication	Bed Exit Alert—5/2/2007
Situation prior to intervention	This patient was in hospital since 3/27/07 after a tractor accident resulting in major facial fractures. His jaws were wired shut and he was unable to speak and had been treated extensively with pain medication. He also required a sitter to prevent unauthorized bed exit. The nurse began caring for the patient on 4/24/07 was weaning the patient off from pain medication.
Description of intervention	The bed exit feature alerted the nurse whenever the patient was trying to get out of bed without assistance.
Outcome	The bed exit feature helped the patient remember to stay in bed and to use the nurse call button to request help instead. This also enabled the sitter to leave the room while still ensuring the patient would not leave the bed without supervision.

Clinical Notes

Clinical Scenario: pt had been in hospital care since 3/27/07. he had been involved in a tractor accident in which the tire rolled over the right side of his body. Fortunately his only major injury was facial fractures in which he needed to have his jaw wired shut. because of this he had a trach for airway access and a peg for feeding. Upn coming to med-surg he was on q6hr haldol, lortab and q12hr ativan, in addition to having a sitter present 24hr/day. My first day caring for him was 4/24/07, my first intervention was to start weaning him off haldol and lortab. He was not expressing pain and seemed to only experience symptoms of psychosis after taking the haldol. He had a sitter present to maintain his lines in which he pulled at- I felt he only did this d/t lack of ability to communicate and overmedication.

LG1 Indication: Bed Exit

Clinical Course Event: On 4/27/07 after weaning off the narcotics for a few days and observing patient improved behavior, cognition and memory I set the bed exit system for patient and had the sitter step out.

Outcome: The bed exit system was able to assist patient in remembering to stay in bed and alert me of the need to go assist patient when he would forget to use his call light. This enabled the sitter to leave the room and for us to continue to care for patient.

Case number 35

System alert or indication	Heart Rate High—5/2/2007
Situation prior to intervention	Not available
Description of intervention	Late in the afternoon, a nurse received an alert from a LifeBed system triggered by a high respiratory rate of 32. Upon entering the patient's room the nurse noticed that the patient had removed his oxygen mask. This resulted in the patient having a shortness of breath.
Outcome	The nurse replaced the oxygen mask and proceeded to educate the patient on the need to remain on oxygen while in the hospital.

Clinical Notes

RR 32 Pt. had taken off oxygen and became SOB. RN notified, pt given education on oxygen needs.

Case number 36

System alert or indication	Heart Rate High—5/10/2007
Situation prior to intervention	49 year old male patient was admitted from the recovery room after a rotator cuff repair. Patient was healthy with no previous medical history and was on no medications at home.
Description of intervention	The Vigilance System detected a high, irregular heart rate so the nurse called an internal medicine doctor who ordered a STAT EKG. The EKG showed the patient was in atrial fibrillation.
Outcome	The doctor consulted with a cardiologist who ordered additional tests and had the patient transferred to a telemetry unit for cardiac monitoring.

Clinical Notes

Clinical Scenario I admitted a patient from the recovery room status post rotator cuff repair. He was a 49 yr. old healthy male with no medical history and he was on no medications at home. When the patient walked from the recovery room bed to our bed with a hoana mattress, the hoana vigilance system was turned on immediately. While doing the patient's head to toe assessment I auscultated a slight irregular heart beat and noticed his heart was beating quickly. I looked up at the vigilance to see what it was calculating for a heart rate and it was bouncing back and forth from the 120s to the 130s.

LG1 Indication Heart Rate - High

Clinical Course Event The vigilance alarmed me that his heart rate was above 130 bpm. I immediately called a consult to an internal medicine doctor who ordered a STAT EKG. The EKG showed the pt. was in atrial fib, which was new onset for him. The internal med doctor then consulted a cardiologist. The cardiologist ordered some pertinent labs and had the pt. transferred off the floor to a telemetry unit.

Outcome The patient was transferred to a telemetry unit where he could be more closely monitored cardiac wise.

Case number 37

System alert or indication	Respiration Rate Low—5/14/2007
Situation prior to intervention	Patient was receiving a scheduled dose of morphine.
Description of intervention	The nurse received an alert that the patient's respiration rate was low (5). .
Outcome	The scheduled morphine dose was discontinued and replaced with PRN (as needed) morphine.

Clinical Notes

Clinical Scenario Pt receiving scheduled morphine. Device alerted to low respirations (5).

LG1 Indication Respiration Rate - Low

Clinical Course Event Nurse called and notified MD of low respirations.

Outcome New order received to discontinue current scheduled morphine. Pt put on PRN (as needed) morphine.

Case number 38

System alert or indication	Bed Exit Alert—5/30/2007
Situation prior to intervention	Several patients on the floor at risk of falling we put on beds equipped with Hoana vigilance systems.
Description of intervention	The nurse received several bed exit alerts that night from two rooms.
Outcome	Two patients who were very confused attempted to leave their beds. The nurses appreciated the alerts indicated that they needed them to help them care prevent the patients from leaving their beds.

Clinical Notes

Clinical Scenario Asked night nurse if she had any alerts during the night.

Clinical Course Event Nurse stated device went off several times during night in 2 rooms.

Outcome But she said, we needed it! The 2 patients were very confused and trying to get out of bed.

Case number 39

System alert or indication	Respiration Rate High—5/31/2007
Situation prior to intervention	A patient was in post-op for six days following a hip fracture. A nurse who had cared for the patient for the last two days was concerned about an increase in the abdominal girth, shortness of breath, and overall appearance that did not "look good."
Description of intervention	The vigilance system sent a call system alert in response to a high respiration rate of 38 despite the fact the patient was receiving breathing treatment. The patient coughed up a red/black fluid so the nurse called for the doctor. About an hour later and before the doctor arrived, the patient felt short of breath and became unresponsive, so the nurse called a code. At this time the doctor arrived to check on the patient.
Outcome	The patient died soon afterwards of internal bleeding. The shortness of breath was felt to be the result of the blood building up in the abdomen and pushing on the lungs as opposed to an actual problem with the lungs themselves. In this incident, the nurse responded quickly and appropriately to save the patient. However it cannot be determined if the patient could have been saved if the doctor had arrived earlier.

Clinical Notes

Clinical Scenario Pt. post-op day 6 after hip fracture. Nurse had cared for patient for 2 days..concerned about patient status due to increase abdominal girth, increased shortness of breath, and not looking "good".

Clinical Course Event RR alert 38. Pt receiving breathing tx. Pt coughed up red/blackish stuff. Nurse called MD. MD didn't come immediately. Within 1 hour, pt c/o feeling short of breath qgain and became unresponsive, code callled. MD showed up at this time.

Outcome Pt did die due to internal bleeding and was feeling SOB due to build up of blood in abdomen.

Case number 40

System alert or indication	Heart Rate High—6/1/2007
Situation prior to intervention	The patient was an isolation patient.
Description of intervention	The nurse received a high heart rate alert from the vigilance system and performed a manual assessment on the patient that indicated a heart rate of 141, a respiration rate in the 30s and a temperature of 102. A doctor was called who ordered a chest X-ray, blood cultures, and urinalysis. In the meantime, the patient's respiration rate rose from 30 to 35 and approximately 1.5 hours later had risen even higher to 44. The patient's heart rate also rose to 154 so a doctor was called again, arterial blood gas tests ordered, and a rapid response team brought in.
Outcome	The rapid response team assessed the patient and after discussions with the nurse transferred the patient to ICU for more intensive monitoring and possible treatment.

Clinical Notes

Clinical Scenario This was an isolation patient whose LG1 alerted for a high HR. Manual assessment indicated HR 141, RR 30s and T 102

Clinical Course Event MD was called and order for chest xray, blood cultures and urinalysis obtained. RR parameter on LG1 was changed from 30 to 35. Approximately 1.5 hours later, the LG1 alerted once again. Patient's HR 154 and RR 44. MD called, ABGs ordered and RRT called.

Outcome RRT arrived at patient's bedside, assessed patient and spoke with nurse. Eventually, this patient was transferred to the ICU.

Case number 41

System alert or indication	Heart Rate High—6/7/2007
Situation prior to intervention	A patient with metastatic cancer was scheduled to be discharged on June 8, 2007 which would have been one day following the actual event. The patient was up and alert. A "do not intubate" order was in effect for this patient.
Description of intervention	The vigilance system sent an alert and when the nurse went to answer it, she noticed a high heart rate of 111 and a respiration rate of 0. The nurse called for a code. It was difficult to determine what had actually happened because the event was so abrupt. The patient vomited a dark fluid—presumably blood or possible a herniation of some sort. Because of the "do not intubate" order, the options for rescuing the patient, if it was even possible, were limited.
Outcome	The patient died shortly after the alert. However the attending nurse acknowledged that "Your device did what it was supposed to! It worked!"

Clinical Notes

Clinical Scenario Pt had metastatic cancer. Pt to be discharged 6/8/07. Pt had do not intubate order. Pt up ad lib, alert, oriented during day.

Clinical Course Event Nurse went to answer alert, found HR 111, RR 0. She called for a code. Nurse is not sure what happened with patient, but it was something abrupt --perhaps aspiration because pt had vomited and when they turned patient it came out, it was dark (likely blood)--or even a herniation of some sort could have happened. But do to no intubation order, it limited what could be done.

Outcome Unfortunately, patient died. Nurse stated, "Your device did what it was supposed to! It worked!"

Case number 42

System alert or indication	Heart Rate High—6/15/2007
Situation prior to intervention	Nurse was in patient's room to administer medication.
Description of intervention	Nurse had responded to an alert that was resulting in a reading of HR 156-158 and RR 32-34. While assisting the patient the nurse noticed that he had a temperature at 101.5. Nurse had intervened by calling the MD and rechecking the reading on the patient's HR and RR.
Outcome	When the MD had arrived, he ordered bloodwork and antibiotics for the patient. With this early intervention triggered by the LifeBed system and subsequent treatment, the patient's condition remained stable for the rest of the night.

Clinical Notes

HR 156-158, RR 32-34. Alarm alerted. Patient was assessed temp@ 101.5. MD ordered blood work, antibiotics. Subject (nurse)____ stated "good catch" about the LG1 (LifeBed). Subject stated patient was fine throughout the night.

Case number 43

System alert or indication	Respiration Rate High—6/16/2007
Situation prior to intervention	Nurse was in patient's room to administer medication.
Description of intervention	A patient had been on a vent for the last seven months and was weaned off it about two to three weeks prior to this event. The nurse was alerted by the LifeBed system to a high respiration rate of 32. The nurse also noted that the patient's heart rate was 145.
Outcome	The nurse called an MD who ordered new medications and tests for the patient.

Clinical Notes

Vitals machine HR 146/RR 30. Nurse assessed patient. System shoed HR@145 but did not alert because the parameters were changed on earlier shift to 155/40. New meds and tests were ordered.

Comments: This patient had been on o vent fo the last 7 months and was weaned off about 2 or 3 weeks ago.

Case number 44

System alert or indication	Unable to Measure—6/16/2007
Situation prior to intervention	The patient was admitted for gastrointestinal bleeding. When the nurse last checked the patient, he appeared to be fine so she left the room not expecting to return until later during her regularly scheduled rounds.
Description of intervention	Just a few minutes after she left the room, the vigilance system sent an alert calling the nurse back into the room. The display provided an unable to measure indication. The nurse noticed that the patient stopped breathing so she called a code.
Outcome	The patient died suddenly and unexpectedly. The staff suspected a pulmonary embolism and that there was nothing that could have been done to reverse the outcome. However, the vigilance system performed well and the nurse was able to reach the patient quickly.

Clinical Notes

Clinical Scenario Pt in for GI bleed. It was 8:30 PM. Pt had been up, sitting on side of bed.

Clinical Course Event Nurse was just in room a few minutes before and pt was "fine". She would have not gone in to room again anytime soon. Device alerting, nurse went in to see pt. Device read UTM. Pt not breathing. Code called.

Outcome Unfortunately, patient died. However, it was unexpected and the device alerted staff much sooner for them to intervene and try to save him. They believe pt had pulmonary embolism.

Case number 45

System alert or indication	Respiration Rate High—6/18/2007
Situation prior to intervention	A patient was transferred from ICU to the medical unit and was on oxygen via a nasal cannula.
Description of intervention	The nurse was alerted by the vigilance system. Upon checking the patient, the nurse discovered a respiration rate in the 30-33 range. The patient was asleep and not complaining of any distress. The nurse checked the patient's feed of oxygen from the wall and discovered it was not set up properly and the patient was not receiving any. The nurse fixed the supply to the patient.
Outcome	When the oxygen flow was restored, the patient's respiration rate and oxygen saturation both returned to normal. By discovering and resolving the problem early, the nurse was able to avert a more serious situation such as transfer back to ICU or CPR.

Clinical Notes

Clinical Scenario Pt. lying in bed asleep. Pt on oxygen via nasal cannula. Pt had been transferred from the ICU to medical unit over weekend.

Clinical Course Event Nurse went into room, pt RR 30-33. Pt not complaining of distress. Nurse checked patient's oxygen on wall and it was not set up appropriately, so patient was not getting oxygen. Nurse fixed oxygen on wall.

Outcome Pt breathing okay, oxygen saturations okay, able to avert potential problem.

Case number 46

System alert or indication	Heart Rate High—6/25/2007
Situation prior to intervention	A patient who was on remote telemetry and taking medications at home for high heart rate was admitted to the hospital. However the doctors did not order this or any other medication to reduce heart rate for the patient.
Description of intervention	The nurse was alerted by the vigilance system. Upon checking the patient, the nurse discovered a heart rate in the 140 range. Shortly afterwards, the telemetry monitor room called and informed the nurse that the patient's telemetry monitor had also detected the high heart rate. She took vital signs and performed an assessment and an EKG before calling the physician. The physician who examined the patient ordered IV metoprolol to reduce the heart rate. The patient's heart rate returned to a normal range for about an hour but rose again causing the Hoana system to alert the nurse to the same symptoms. Again the telemetry monitor sent a delayed second alert after the nurse had already entered the room.
Outcome	The patient's heart rate rose several times that night as the medication wore off, and it returned to normal when medication was re-administered. In the morning, the patient's own doctor came in and prescribed the same medication the patient was using at home. The heart rate returned to and remained at a normal level since.

Clinical Notes

Clinical Scenario Pt. on remote telemetry. Pt takes medicine at home to help keep his heart WNL (within normal limits).--his HR runs high. When pt admitted to hospital, this medicine was not ordered by the doctors.

Clinical Course Event
Nurse heard call light/device. Went to check on patient--HR 140s. While in room, telemetry monitor room called to notify nurse of patient's high HR. Nurse took Vital signs, assessed patient and did EKG. She then called the on-call MD. MD came to see patient. Ordered IV metoprolol. Nurse gave medicine to patient. HR went WNL for about 1 hour and then his HR went back up again. Device alerted nurse. Again, while nurse in room with patient, telemetry called. MD called again. Another order for IV metoprolol given.--pt received second dose. HR returned WNL

Outcome
This event happened during the night. The next morning when the patient's own doctor came to see pt, pt's home medicine was continued and his HR has stayed WNL since.

In these situations, our device brought the nurse to the bedside more quickly than the remote telemetry system. Nurse stated when she waiting on pharmacy to deliver IV metoprolol, device alerted her several times because patient's HR continued to be high. Even though it was taking her away from her other tasks, she didn't want to increase the HR parameter, because she wanted to be able to know exactly what was going with this patient's HR and didn't want to know when it might be too late for this patient. She was relying on the LG1 to be her "eyes" when she had to be in another room.

Case number 47

System alert or indication	Respiration Rate Low—6/26/2007
Situation prior to intervention	The patient, who had severe liver disease, was extremely sedated from a procedure the day before. Due to his liver condition he was not able to metabolize the medication at a normal rate so the effects were still strong.
Description of intervention	The nurse was alerted by the vigilance system and upon checking the patient, she discovered an extremely low respiration rate of 4. She was about to call a code but was able to arouse the patient and remind him to breathe. Now awake, the patient's respiration rate returned to normal. A physician was called to assess the patient, and no further orders were made.
Outcome	The patient remained in the bed without additional treatment. The vigilance system alerted the nurse to extremely low respiration rates several more times throughout the night. Each time the nurse was able to awaken the patient and remind him to breathe. The patient's condition improved gradually as his sedation slowly wore off.

Clinical Notes

Clinical Scenario
Pt has severe liver disease. Pt had procedure in the afternoon of 6/25/07. When he came back, he was extremely sedated and it was complicated by the fact his liver is not working properly--which means his body is not able to metabolize/get rid of the medicine in his body as quickly and/or normally.

Clinical Course Event
Nurse heard device/call light. Went into room, RR 4! She started to say call a code, but then was able to arouse patient and tol him to breathe. The patient woke up and his RR increased. Nurse then called the on-call MD. He came to the room to check on the patient. Patient was awake at that time and RR WNL. MD assessed patient, but did not write new orders.

Outcome
Device alerted nurses several times throughout night about patient not breathing --enough. They were able to arouse patient and remind him to breathe. Currently, patient remains on the floor and is continuing to improve--and his sedation is decreasing.

Case number 48

System alert or indication	Heart Rate High—7/1/2007
Situation prior to intervention	Not specified
Description of intervention	The nurse was alerted by the vigilance system and upon checking the patient, she noticed a high heart rate of 125. The nurse checked the patient manually which confirmed the high heart rate. She then notified the MD.
Outcome	The MD came in and ordered and EKG and an IV fluid bolus. The heart rate eventually dropped to a normal level later in the day.

Clinical Notes

Clinical Scenario
July 11, Hoana monitor was beeping and walk in room _____ and monitor was indicate heart rate of 125. Check it manually and Patient was still very tachy. Notified doctor and EKG done & IV Fluid Bolus given. Heart rate eventually came down later in the day.

System alert or indication	Irregular Heart Rate—7/8/2007
Situation prior to intervention	A patient was admitted to the hospital for a bilateral ankle fracture and no significant co-morbid conditions were indicated. The patient was awake and alert and voiding in large amounts.
Description of intervention	Although the patient's heart rate was fluctuating rapidly in the 64-145 range, he denied having any chest pains. The vigilance system sent alerts every 15-30 minutes and at 4 am, the patient began complaining of mild pain to the left side of his chest. The MD who was called in to check on the patient ordered an EKG that revealed that the patient was having atrial fibrillation and rapid ventricular response. The Troponin reading was negative.
Outcome	A Rapid Response Team (RRT) was called in and they administered a Lopressor IV and digoxin and had the patient transferred to telemetry for further monitoring. The patient eventually had surgery and returned to the med surge unit in less than a week.

Clinical Notes

Clinical Scenario:
A patient was admitted to the hospital for a bilateral ankle fracture and no significant co-morbid conditions were indicated. The patient was awake and alert and voiding in large amounts.

The patient's heart rate was fluctuating rapidly in the 64-145 range, he denied having any chest pains.The LifeBed system sent alerts every 15-30 minutes and at 4am, the patient began complaining of mild pain in the left side of his chest. The MD was called in to check on patient. An EKG was ordered and revealed atrial fibrillation and rapid ventricular response. Troponin reading was negative. The RRT was called in and they administered Lopressor IV and Digoxin.

Outcome:
The patient was transferred to telemetry unit for further monitoring. The patient eventually had surgery and returned to the med/surg unit in less than a week.

Case number 50

System alert or indication	Heart Rate Low—7/9/2007
Situation prior to intervention	A patient was admitted to the hospital for dizziness and was on remote telemetry. The patient was assessed and checked as normal only 30 minutes prior to the alert.
Description of intervention	The nurse responded to the Hoana system alert to find an apical heart rate of 35. The patient was feeling chest pains but did not want to call the nurse to report this. Oxygen saturation was in the 80 range. The telemetry monitor did not call the nurse about this condition.
Outcome	The nurse gave the patient oxygen and called for an MD. The MD ordered an EKG which indicated right sided ischema which was causing the dizziness.. The MD ordered medications for the patient. The patient stabilized but was not transferred due to the DNR status. The nurse stated it would have been hours before he would have checked on the patient because he had just done his assessment 30 minutes earlier. The nurse said the patient would have been in pain for a longer time and could have ultimately died. The nurse also commented: "It is like getting from A to B. No matter what you are going to get to B eventually. Without the device, you are on a bicycle. With the device, you are in a Cadillac. I love the devices. They are awesome."

Clinical Notes

Clinical scenario:
Pt admitted with dizziness.

Nurse answered alert, HR 35. Checked apical heart rate--35. Pt on remote telemetry. Telemetry monitor tech didn't call. Pt did admit some chest pain. Nurse stated patient would not have called to tell him of this chest pain. Oxygen saturation was in the 80's. Oxygen via nasal cannula started. Nurse called MD. MD ordered EKG. EKG showed right sided ischemia which was causing the dizziness. MD ordered medications for patient.

Outcome Pt stabilized, doing okay at this time. Pt not transferred due to pt is DNR. Nurse stated it would've been hours until he went back into see patient because he had just done his assessment 30 minutes before. Patient would've been in pain for a longer time and could've ultimately died.

Internal Use

Other Nurse comment: "It is like getting from A to B. No matter what you are going to get to B eventually. Without the device, you are on a bicycle. With the device, you are in a cadillac."

"I love the devices. They are awesome."

Case number 51

System alert or indication	Heart Rate High—7/24/2007
Situation prior to intervention	Not specified
Description of intervention	The nurse responded to the Hoana vigilance system alert to find the patient's heart rate was elevated in the 120 range. The nurse called an MD who then ordered an EKG.
Outcome	The MD determined that the EKG showed sinus tachycardia but no orders were given except to continue observing the patient.

Clinical Notes

Patient in room____ alarm went off. Went in to assess patient and her heart rate had elevated into the 120's. Paged M.D. order was given to do an EKG. EKG showed pt to be sinus tachycardia no other orders were given, but just to monitor patient.

Case number 52

System alert or indication	Heart Rate High—7/26/2007
Situation prior to intervention	Not specified
Description of intervention	The LifeBed system produced an alert for a patient who had a normal respiratory rate during previous nurse visits. Responding to the alert, the nurse and nurse aid checked the respiration manually to confirm that it was at 34. They notified the MD who detected lungs with crackles and ordered a chest x ray.
Outcome	No additional orders were given. However the vigilance system sent another respiratory rate alert the following day so as a precaution, additional tests were ordered for the patient.

Clinical Notes

Received high RR alert. Patient's respiratory rate was normal on previous visits. Nurse and nurse aid confirmed manually that RR was at 34. Called MD. Crackles in chest. MD ordered chest x ray. No additional orders were given. Received another alert the following day so additional tests were ordered as a precaution.

Case number 53

System alert or indication	Heart Rate High—8/3/2007
Situation prior to intervention	Nurse was in patient's room to administer medication.
Description of intervention	The vigilance system alert sounded while the nurse was in the room. The nurse saw that the heart rate was elevated at 139 and the respiratory rate was 44. The nurse paused the system and performed a manual assessment. She realized the patient was coding so she had the clerk call for a rapid response team and to make a "Code Blue" announcement.
Outcome	The rapid response team placed a tube down the patient's trhout and blood work was drawn. The patient was transferred to MICU in less than 30 minutes from the initial alert. After the event, the nurse returned to the room to review the trend on the vigilance system display. She felt that the heart rate parameter of 135 on the system should have been set to a lower setting for this patient. Overall she was pleased with the system and felt confident that even if she had not been in the room at the time of the alert, she would have been able to achieve the same outcome.

Clinical Notes

Clinical course event:
At approximately 9:37 a.m. today, August 3, nurse walked in to give patient his medication when she heard the alert and saw message of HR 139 / RR 44. Since she was in the room, she immediately paused the LG1 and assessed the patient and realized he was coding. She had clerk call for Rapid Response Team and make "Code Blue" announcement.

Tube was placed down patient's throat and blood work was drawn.

Outcome:
Patient was transferred to MICU at approximately 10:00 a.m.

Other:
At approximately 10:15 a.m., nurse asked me to go into room with her to check/review the trend because she was curious to know how patient was doing an hour prior to alert. She commented that she feels parameter of 135 is too high. Overall, she was extremely pleased because she felt confident that had the scenario been different (her not walking in at that moment), she still would have been alerted to come into the room

Case number 54

System alert or indication	Heart Rate High—8/28/2007
Situation prior to intervention	A patient was recovering in Post-op a day after surgery for a hip fracture.
Description of intervention	The nurse responded to the Hoana patient system alert to find a high heart rate in the 140 range. The nurse paged the MD (surgical team). The patient's heart rate dropped after 10 am medication was administered.
Outcome	The surgeons requested a medical consult so an internist evaluated patient. The internist determined that the medications were not keeping his HR within normal limits for a full 24 hours. The patient's medication dosage was adjusted to resolve this issue.

Clinical Notes

Clinical scenario:
Patient in for hip fracture. Had surgery. Post-op day 1.

Clinical course event
Patient's HR alerting 140's . Nurse paged MD (surgical team) in the early morning. Patient's HR continued to be elevated all morning until after 10 AM medications given.

Outcome:
Surgeons requested a medical consult. An internist evaluated patient. Determined once patient took his AM medications, issue resolved. They were able to determine his medicines were not keeping his HR within normal limits for a full 24 hours. Medication dosage adjusted.

Case number 55

System alert or indication	Respiration Rate Low—9/7/2007
Situation prior to intervention	The patient had cancer and was taking morphine for pain.
Description of intervention	The nurse responded to the Hoana patient system alert to find a very low respiratory rate of 5. The patient was overly sedated and the nurse had great difficulty arousing the patient.
Outcome	The nurse called an MD who ordered Narcan to reverse the effects of the morphine. Upon receiving the Narcan, the patient's breathing returned to a normal rate and the patient was also more alert.

Clinical Notes

Clinical scenario:
Pt has cancer. Pt taking morphine for pain.

Clinical Course Event:
Device alerted, RR 5. Nurse tried to arouse patient. Patient slow to arouse. Extremely lethargic, oversedated. Nurse called MD. Received order to give Narcan to reverse morphine.

Outcome:
Pt received Narcan. Respirations WNL and pt more alert.

Case number 56

System alert or indication	Heart Rate High—9/14/2007
Situation prior to intervention	Patient was recovering two days after lumbar spinal fusion surgery. Vital signs were stable that morning.
Description of intervention	At 4 pm, the Hoana vigilance system sent an alert and indicated a high heart rate in the 120-130 range. The nurse checked the patient with a Dinamap monitor as well as the continuing feedback from the vigilance system. The vigilance system alerted the nurse two additional times so she contacted an MD to check on the patient who had a fever at this time.
Outcome	The MD came in and ordered Tylenol and additional monitoring for the patient.

Clinical Notes

RN had pt s/p LS fusion – pt PO days #2 – VSS in am @ 1600 bed alerted RN – pt HR@120-130-s – RN monitored patient by Dynamap & bed unit. Bed alarm alerted RN 2 additional times. RN contacted MD to see pt – Pt febrile at that time. <D ordered Tylenol and monitoring.

Case number 57

System alert or indication	Heart Rate High—9/20/2007
Situation prior to intervention	Elderly female patient who was blind, hard of hearing, and confused
Description of intervention	The nurse who responded saw that the alert was for a high heart rate. The nurse called the MD who assessed the patient and diagnosed ventricular fibrillation.
Outcome	A rapid response team was called and the patient was transferred to a telemetry unit for continuous monitoring.

Clinical Notes

Elderly female patient was blind, hard of hearing, and confused. System alerted for high heart rate. Called MD. Ventricular fibrillation. RRT called. Patient transferred to telemetry.

Case number 58

System alert or indication	Heart Rate High—9/20/2007
Situation prior to intervention	Not specified
Description of intervention	A nurse responded to an alert from a LifeBed system and upon assessing the patient confirmed that the patient's heart rate was higher than normal. The nurse began closer observations and more frequent assessments. Later in the day, the LifeBed system sent another alert because the patient's heart rate had risen even more and was now extremely high.
Outcome	The nurse called an MD who ordered an EKG. The doctor determined that no immediate treatment was needed but ordered closer observation and even more frequent checking of the patient's vital signs.

Clinical Notes

Received alert and found patient's heart rate higher than normal. Began closer observation and more assessments. Later received another alert. Patient's HR had risen even more and was extremely high. Called an MD. EKG ordered. No immediate treatment given but ordered closer observation and even more frequent checking of the patient's vital signs.

Case number 59

System alert or indication	Respiration Rate Low—9/20/2007
Situation prior to intervention	Patient was asleep and was receiving oxygen therapy
Description of intervention	The nurse responded to the Hoana patient system alert to find the patient had pulled out the oxygen tube. The indication from the display was a low respiratory rate.
Outcome	The nurse reconnected the oxygen tube and the patient's respiration rate returned to normal without further incident.

Clinical Notes

Clinical scenario:
Patient asleep, receiving oxygen therapy.

Clinical course event:
Pt had fallen asleep and pulled oxygen off. Device alerted low RR.

Outcome:
Nurse replaced patient's oxygen. Patient recovered without incident.

Case number 60

System alert or indication	Heart Rate High—(event date not available—event submitted 10/1/2007)
Situation prior to intervention	Not available.
Description of intervention	Patient was having a stroke. Since it was the middle of the night the nurse would not have known about it without the system.
Outcome	Patient treated for stroke

Clinical Notes
2 AM --High HR alert, patient having stroke. Wouldn't have known for awhile since middle of night

Case number 61

System alert or indication	Respiration Rate Low—(event date not available—event submitted 10/1/2007)
Situation prior to intervention	Patient was on fentanyl patch and patient controlled anesthesia (PCA).
Description of intervention	Patient was overmedicated with pain medication from a fentanyl patch as well as PCA.
Outcome	Medication was adjusted to a lower level

Clinical Notes
Low RR, patient on long term fentanyl patch/oxycontin--getting too much; medication adjusted

Case number 62

System alert or indication	Heart Rate High—(event submitted 10/13/2007)
Situation prior to intervention	84 year old female patient was admitted to the hospital for dehydration and a urinary tract infection.
Description of intervention	The nurse responded to an alert from the Hoana LifeBed vigilance system and discovered a high heart rate. The patient was experiencing rapid atrial fibrillation that was not diagnosed previously. An MD was called and an EKG ordered. It took two doses of an IV medication, Amiodarone, before the patient returned to an NSR (normal sinus rhythm).
Outcome	The patient decided not to receive a pacemaker or additional medication and was ordered "comfort measures only." The patient was able to make end of life decisions and to say goodbye to family and friends over the next few days. The patient died peacefully a few days later.

Clinical Notes

84 yr old admitted with dehydration and UTI.

This afternoon the patient went into rapid atrial fibrillation (a new diagnosis). We would not have been immediatelly aware of the situation if it wasn't for the LG1(LifeBed) Vigilance system. MD was notified and an EKG was ordered. Patient was given IV Amiodarone without any change. Was given a second dose and patient went back to NSR (normal sinus rhythm).

Outcome Patient decided she did not want other medications nor did she want a pacemaker. She was ordered "comfort measures only" and she died several days later.

Without the LG1, we wouldn't have known the patient was in rapid atrial fib a life threatening dysrhythmia if left untreated). Fortunately, because of the LG1, we notified the MD immediately, meds were given and the patient responded. She and her famil were able to make end of life decisions and were given ample time to say good-bye. The patient had a wonderful last few days with plenty of family and friends surrounding her and was able to pass away peacefully.

Other Situations avoided: Failure to recognize a deteriorating condition.

Calling a code or performing CPR.

Transfer to a higher level of care.

LG1 created a safer environment for the patient.

the LG1 was instrumental in changing my patients outcome for the better.

I don't think the outcome would have been quite as pleasant if we didn't have the LG1s. Thank you.

Clinical and Economic Benefits of Vigilant Surveillance for the State of Hawai'i

Hospitals today face unprecedented fiscal challenges. The cost to provide care to uninsured patients continues to increase while Medicare and Medicaid reimbursements fall. In 2004, for two consecutive years, financial challenges were the highest concern of hospital CEOs surveyed by the American College of Healthcare Executives (ACHE, 2004). For the health care system at large, costs continue to spiral. Medicare's recent decision to stop paying for certain medical errors such as falls, makes it even more critical for hospitals to reduce costs from preventable medical errors (Pear, 2007). In 2008, three additional hospital errors yet to be named will not be reimbursed. Medicare's decision is particularly worrisome for the members of Hawaii Medical Assurance Association (HMAA). ***Instead of the hospitals being at risk, Medicare now puts the members of HMAA directly at economic risk for these complications.*** Initiatives that couple cost savings with improved patient safety and clinical outcomes must be adopted.

The economic benefit of vigilant surveillance can be separated into ***immediate effects*** and ***long-term effects***. The immediate effects are due to early recognition and management, which reduces complications and improves outcomes, thereby reducing cost of care. The long-term effect is due to improved utilization of intensive care (ICU) and telemetry units with better throughput, now that the general care floor has increased its ability to safely observe patients through vigilant surveillance. Other indirect costs will be positively impacted by reducing legal claims for safety errors, improving nursing satisfaction and thus retention, and improving patient satisfaction. A reduction in the use of bed sitters to prevent patient falls is also likely over time.

Both direct and indirect factors influence return-on-investment (ROI) for new hospital safety technologies. Rates of serious falls and cardiopulmonary resuscitation (CPR) events vary widely, as do other factors such as patient throughput, efficiency of ICU bed utilization, litigation costs, and nursing retention. To illustrate the economic value of the system and the potential ROI for patient vigilance, we've chosen 6 factors from the medical literature for which we have sufficient data for analysis, affecting both immediate and long-term effects. The four immediate factors are:

- CPR avoidance
- Timely transfer of patients back to the ICU when necessary
- Prevention of transfer to the ICU
- Reduced patient falls

The two long-term factors are:

- Improved ICU throughput
- Improved Telemetry throughput

In addition, there are out-of-hospital costs for serious falls, and indirect benefits that have not been added to the calculations.

State of Hawai'i Analysis

Through this analysis, we estimate the improvement in clinical outcomes and cost savings through LifeBed™ for the State of Hawai'i. The actual ROI will also depend on local conditions within each hospital. State of Hawai'i data is based upon the Healthcare Utilization Report prepared by the Hawaii State Health Planning and Development Agency ("SHPDA") for 2005, (Table 5 - Bed Utilization by Bed Type), issued on May 4, 2007.

Table 1. Hawai'i Hospitals Aggregated Data

Characteristic	*Hospital Values*	*Instructions/Description*
Infrastructure		
ICU beds (number)	239	Hawaii SHPDA for 2005
Telemetry beds (number)	300	*Estimated – data not available*
Med / surg beds (number)	1,427	Total GCF beds – Telemetry
Occupancy / admissions		
# of Med / Surg admissions per year	74,846	Hawaii SHPDA for 2005
ICU occupancy (percent)	62%	Hawaii SHPDA for 2005
Average ICU length of stay (days)	5.8	Hawaii SHPDA for 2005
Telemetry occupancy (percent)	62%	*Estimated-data not available*
Average Telemetry length of stay (days)	3.5	*Estimated-data not available*
Med / surg occupancy (percent)	70%	Hawaii SHPDA for 2005
Average Med / surg length of stay (days)	5.9	Hawaii SHPDA for 2005
Costs / revenue		
ICU day charge ($)	$5,000	*Estimated*
Telemetry day charge ($)	$3,000	*Estimated*
Med/surg day charge ($)	$2,000	*Estimated*

LifeBed™ Immediate Effects

The immediate effect can be quantified through reduction in CPR events, increase in earlier (rapid) transfers to ICU, reduction in transfers to ICU, and reduction in falls.

I. ***Avoiding preventable cardiopulmonary arrest reduces patient mortality and hospitalization costs.*** Treatment of cardiopulmonary arrest is a significant cost for acute care hospitals. Approximately 0.3% to 0.4% of patients in medical/surgical units require CPR (Gage et al, 2002; Galhotra et al, 2007). Mortality following the CPR event is highest in patients on the general care floor (GCF), and lowest in patients on monitored beds, even with a mature rapid response system (Galhotra et al, 2007). CPR events on the GCF ward can be reduced by 27% with mature rapid response teams (RRTs; Galhotra et al, 2007), with estimates greater than 50% when RRTs have not been instituted (Dhar et al, 1996; Dacey et al, 2007; Offner et al, 2007). The additional hospitalization cost has been estimated at more than $31,000 per resuscitated patient (Dhar et al, 1996). The cost for a surviving patient to discharge using today's cost is estimated at $65,000 (Berger and Kelley, 1994). Overall, looking at the additional cost after the CPR event for all patients, whether surviving or not, costs can be summed for all event survivors and then divided by all CPR events to obtain a cost per CPR event of $21,700 (Berger and Kelley, 1994).

Table 2. I. CPR Avoidance

Number of CPR events	292	(a)
Cost of CPR events	*$6,334,217*	(b)
Number CPR events with LifeBed™	213	(c)
Cost of CPR events with LifeBed™	*$4,623,978*	(b)
ECONOMIC BENEFIT	**$1,710,239**	(d)

(a) (# Med-surg patients per year x 0.39%), Gage et al, 2002.

(b) (# events x $21,700 per event);$21,700 = (event survivor costs / all CPR events), Berger and Kelly, 1994.

(c) (73% x # of CPR events); 27% of patients on GCF preventable CPR events with mature RRT, Galhotra et al, 2007.

(d) (Cost without LifeBed™) - (Cost with LifeBed™)

II. Early identification and rapid transfer of deteriorating patients to the ICU reduces patient mortality and hospitalization costs. Early identification and intervention are critical to reduce patient morbidity and mortality, which reduces costs. The incidence of unplanned ICU transfers ranges from 1.4% to 3.3% (Jacques et al, 2006; Dacey et al, 2007). In a recent study, a delay of four hours (61.5% of patients) in the transfer of physiologically defined high-risk patients from the medical/surgical ward to the ICU increased the risk of mortality by four times (Young et al, 2003). Slow transfer was associated with increased length of stay and hospitalization costs. The $13,000 cost difference between rapid transfer ($21,000) and delayed transfer ($35,000) is the amount that would be saved per patient as delayed transfers are converted to rapid transfers through LifeBed.

Table 2. II. Earlier transfer to the ICU

Number of Med-surg patients for ICU transfer	1,759	(a)
Number of Med-surg patients transferred >4 hours	1,082	(b)
Cost of delayed ICU Transfer	*$50,998,755*	(c)
Number of Med-surg patients transferred >4 hours after onset	541	(d)
Cost of delayed ICU transfer with LifeBed™	*$43,967,628*	(c)
ECONOMIC BENEFIT	**$7,031,127**	(e)

(a) (# Med-surg patients per year x 2.3%); 2.3% is average of range 1.4% (Jacques et al, 2006) to 3.3% (Dacey et al, 2007)

(b) 61.5% of patients are transferred >4 hours, Young et al, 2003

(c) "Rapid transfer" costs $21,000; "delayed transfer" costs $34,000, Young et al, 2003

(d) 50% improvement, Hoana estimate

(e) (Cost without LifeBed™) - (Cost with LifeBed™)

III. Early identification prevents transfer of patients to ICU and reduces hospitalization costs. While there are patients who will be transferred sooner to ICU (see II above), early identification will enable other patients to be observed and treated in the Med-Surg bed instead. Hospitals who have been using LifeBed™ reported that 66% of patients who had LifeBed™ interventions were treated and remained in Med-Surg. Because the ultimate outcome of these patients cannot be determined if LifeBed™ was not present (it depends upon when the Hospital would have manually identified the patient's worsening condition), we have estimated the reduction in patient transfers to be only 10% of the number of patients transferred to ICU (see II above).

Table 2.III. Prevent transfer to the ICU

Number of Med-surg patients for ICU transfer	1,759	(a)
Estimated reduction in patient transfers – 10%	176	(b)
Average length of stay in ICU in addition to Med-Surg stay	5.8	
ICU daily charge	$5,000	
ECONOMIC BENEFIT	**$5,100,755**	(c)

(a) (# Med-surg patients per year x 2.3%); 2.3% is average of range 1.4% (Jacques et al, 2006) to 3.3% (Dacey et al, 2007)

(b) 10% of patients are not transferred to ICU, Hoana estimate

(c) $5,000 x 5.8 x 176 patients

IV. Reducing patient falls improves patient outcomes and reduces hospitalization costs. Fall prevention can be undertaken by multiple methodologies, and LifeBed™ provides this feature in addition to HR/RR vigilant surveillance. LifeBed™ can anchor a device related program alone, or supplement existing fall prevention programs utilized on the general care floor. Falls occur with a frequency of approximately 2.7 to 7 falls per 1000 patient bed days, with 30% of these resulting in injury and 5 to 6% of falls resulting in serious injury (Hitcho et al, 2004; Bates et al, 1995). Approximately 85% of these are in the room, with 80% being falls with the patient unassisted (Hitcho et al, 2004). This data indicates that 80% of falls will likely be impacted by LifeBed.

Our data in hospitals indicates that LifeBed™ can significantly reduce fall rates, but results will depend on the comprehensiveness of existing fall programs. In a two-month study with LifeBed, falls were reduced by 40% from 3.2% to 1.9% on a neurosurgical ward that had an existing program utilizing sitters as needed (Spetz et al, 2007).

In looking at all falls with injury, there is a longer length of stay (7.5 days) with additional cost of $5,317 per fall (Bates et al, 1995). Those cases with serious injury have an even longer length of stay (10 days), with a cost of $10,421 per fall. Others provide similar cost data from different sources using different methodologies, and also estimate the total cost of care including physician fees and nursing home costs, which are not included in the previous study. For serious falls, Rizzo et al (1998) estimates costs of $11,042 for hospital, $5,325 for nursing home, and $3,073 other costs (office visits) for a total of $19,440. More recently, Haumschild et al (2003) reports that one health plan estimates the total cost for serious falls to be $22,000.

Table 2. IV. Fall prevention

Number of Med-surg occupied bed days	364,599	(a)
Number of patient falls each year	1,823	(b)
Number of patient falls at the bedside	1,458	(c)
Number of bedside falls with injury	437	(d)
Cost of bedside falls with injury	*$2,329,784*	(e)
Number of falls with injury with LifeBed™	263	(f)
Cost of bedside falls with injury with LifeBed™	*$1,397,871*	(e)
ECONOMIC BENEFIT	**$931,914**	(g)

(a) (# Med-surg beds) x 365 days x (Med-surg % occupancy)

(b) Assumes average patient fall rate is 5% (range 2.7-7) per 1000 bed occupied days, Hitcho et al, 2004

(c) Assumes ~ 80 percent of falls occur at the bedside, Hitcho et al, 2004

(d) Assumes ~ 30 percent of falls cause some injury, Hitcho et al, 2004

(e) Cost per fall with injury (minor and severe) $5,325, Bates et al, 1995

(f) (# falls x 60%); LifeBed™ reduces bedside falls by 40%, Spetz et al, 2007

(g) (Cost without LifeBed™) - (Cost with LifeBed™)

LifeBed™ Long-Term Effects

The long-term effects from vigilant surveillance are due to the new capability on the general care floor to provide safe and effective vigilant surveillance. This can result in the ability to move some patients more quickly through ICU and telemetry with better throughput. Currently, with periodic vital signs being the only monitoring capability on the general ward, physician interviews indicate that some patients are currently managed a day or two longer in ICU and telemetry, and that many would not qualify if published standards were utilized (Bonvissuto, 1994). For our model, we will conservatively estimate that 15% of ICU and telemetry patients could be transferred to medical/surgical units 1 day earlier if the general care wards were equipped for better patient vigilance. ***The large gap between monitoring capabilities between the general ward and ICU/telemetry is now bridged with LifeBed.***

V. Increase in ICU Throughput reduces length of stay and maximizes use of this important resource. ICU beds are the gateway to the hospital's critical care infrastructure, and decreased patient flow here can lead to bottlenecks in the Emergency Department and Operating Rooms. This can result in divert status or cancelled OR cases, with a significant loss in revenue (Falvo et al, 2007; McConnell et al, 2007). Regardless of whether the hospital is in a managed care or a payor-reimbursement model, these types of patient flow problems lead to a reduced number of patients that can be cared for with these largely fixed resources, and can also result in expensive out-of-network care. This eventually affects the bottom line for both economics and quality, as capacity has to be expanded to address the demand, or quality is impacted as patient care and patient satisfaction suffers. Increased efficiency and throughput will be realized over time, as the new capability for vigilance on the general care floor is realized. For our calculator, we estimate that 15% of patients will stay one less day in the ICU.

Table 2.V. Earlier transfer from the ICU

Number of ICU patient stays	9,325	(a)
Number of ICU patient days	54,086	(b)
Cost of ICU patient days	*$270,428,500*	(c)
Number of ICU patient stays with LifeBed™	9,325	(a)
Number of ICU patient days with LifeBed™	52,687	(d)
Cost of ICU patient days with LifeBed™	*$263,434,659*	(c)
ECONOMIC BENEFIT	**$6,993,841**	(e)

(a) (365 days / ICU average LOS) x (# ICU beds) x (% ICU occupancy)

(b) (Average ICU length of stay) x (number of ICU patient stays)

(c) (Cost of ICU day) x (number of ICU patient days)

(d) Assumes with LifeBed™, 15% of ICU stays will result in 1 fewer ICU day, Bonvissuto, 1994

(e) (Cost without LifeBed™) - (Cost with LifeBed™)

VI. Increase in Telemetry Throughput reduces length of stay and maximizes use of this important resource. Telemetry units are particularly valuable for the Emergency Department, as admissions frequently require a higher level of monitoring acuity and a lack of telemetry beds creates backlogs. Likewise, telemetry is important as throughput for ICU, to make room for additional patients. Typically, hospitals are frequently looking to expand the number of beds on telemetry to meet the above needs. However, with the institution of LifeBed™, expansion may not be required with vigilant surveillance on the general care floor as a safe alternative for patients that no longer meet telemetry admission criteria. For our calculator, we estimate that 15% of patients will stay one less day in telemetry.

Table 2. VI. Earlier transfer from Telemetry

Number of Telemetry patient stays	19,397	(a)
Number of Telemetry patient days	67,890	(b)
Cost of Telemetry days	*$203,670,000*	(c)
Number of Telemetry patient stays with LifeBed™	19,397	(a)
Number of Telemetry patient days with LifeBed™	64,980	(d)
Cost of Telemetry days with LifeBed™	*$194,941,286*	(c)
ECONOMIC BENEFIT	**$8,728,714**	(e)

(a) (365 days / Telemetry average LOS) x (# Telemetry beds) x (% Telemetry occupancy)

(b) (Average Telemetry length of stay from previous worksheet) x (number of Telemetry patient stays)

(c) (Cost of Telemetry day) x (number of Telemetry patient days)

(d) Assumes with LifeBed™ 15% of Telemetry stays will result in 1 fewer day, Bonvissuto, 1994

(e) (Cost without LifeBed™) - (Cost with LifeBed™)

Other Health System Costs

Some complications have been evaluated after discharge. Falls in particular have significant costs after discharge for serious falls, which comprise 5% of all falls (Hitcho et al, 2004). Serious falls have inpatient costs of approximately $12,000, and outpatient costs of $10,000 (Haumschild et al, 2003; Rizzo et al, 1998). The costs for all falls with injury were averaged for the in-hospital analysis, so only the downstream costs are calculated here.

Table 2. VII. Patient falls, serious injury

Number of serious falls	73	(a)
Cost of serious patient falls	*$729,197*	(b)
Number of serious falls with LifeBed	44	(c)
Cost of serious patient falls with LifeBed™	*$437,518*	(b)
ECONOMIC BENEFIT	**$291,679**	(d)

(a) (# bedside falls x 5%); 5% of falls have serious injury (Hitcho et al, 2004; Bates et al, 1995)

(b)(# of serious falls x $10,000); nursing home and physician fees, Haumschild et al, 2003, Rizzo et al, 1998

(c) (# serious falls x 60%); LifeBed™ reduces bedside falls by 40%, Spetz et al, 2007

(d) (Cost of serious fall without LifeBed™) - (cost of serious fall with LifeBed™)

LifeBed™ Effects on Indirect Costs

A vigilant surveillance system like LifeBed™ may provide additional indirect savings in terms of reduced litigation costs, improved nurse retention and improved patient satisfaction. Bed sitters should also be able to be reduced over time. Preventable adverse events not only cause patient distress and incur treatment costs; they also expose the hospital to litigation. Falls and risks of failure-to-rescue expose hospitals to numerous lawsuits each year. Litigation expenses begin at $100,000 per suit and can escalate into the millions, costing the hospital both capital and reputation.

Nurse retention and recruitment are the most critical staffing issues facing hospital administrators (ACHE, 2004). The increase in patient acuity and a shortage of nurses have forced nurses to spend less quality time with their patients and perform a wider range of duties. These factors lead to job dissatisfaction, burn-out, turnover, and early retirement (Aiken et al, 2002). The direct and indirect costs of nurse turnover are considerable. The cost to replace a single nurse has been estimated at 1.2 to 1.3 times the nurse's salary, easily reaching $75,000 to $100,000 depending on the region (Jones, 2004). With such high recruitment costs and continuing attrition, a typical mid-size hospital experiences turnover costs of at least $1 million and in some cases as high as $6.4 million, annually (Jones, 2005). Patient vigilance provided by the LifeBed™ system is an additional set of eyes that may take some of the load off a nurse's shoulders, reducing job stress and providing additional flexibility in how caregivers manage their time and responsibilities.

Patient satisfaction is improved, as nurses are called into the room by LifeBed™ to care for the patient. Patients can sense the added security that vigilance provides, when they realize that their nurse is connected to them through LifeBed™, even though the nurse is not in the room. Patient satisfaction translates into many positive returns for the institution.

Return on Investment Analysis

Vigilant surveillance through LifeBed™ can improve clinical outcomes while being immediately cost-effective. Immediate cost savings are due to earlier recognition and treatment that results in a reduction of CPR events, falls, and transfers to ICU and an increase in timely transfers to ICU. The immediate downstream costs for the health system include savings for serious falls. Long-term effects of ICU/telemetry throughput and bed sitter reduction can increase the ROI, but these trends will develop gradually with recognition of the new capability of vigilance on the general care floor. Other downstream rehabilitation costs would also be reduced with early recognition, but are not included in this analysis.

In reviewing the annualized cost/savings summary, ***LifeBed™ immediately reduces costs for the health care system while helping to save lives. Long-term effects will reduce costs further as ICU and telemetry throughput becomes evident.*** The actual ROI of each hospital will depend on local conditions and can include additional cost savings (e.g., reduced litigation costs, potentially lower nursing retention costs, etc.).

Table 3. Annualized Cost / Savings Summary

Savings and revenue potential	
I. CPR Avoidance	$ 1,710,239
II. Earlier transfer to the ICU	7,031,127
III. Prevent transfer to the ICU	5,100,755
IV. Fall prevention, Falls with injury	931,914
Subtotal LifeBed™ Immediate Effects	**14,774,034**
V. Earlier transfer from the ICU	6,993,841
VI. Earlier transfer from Telemetry	8,728,714
Subtotal LifeBed™ Long-Term Effects	**15,722,555**
Hospital Subtotal	**30,496,589**
VII. Fall prevention, Falls with serious injury	291,679
Other Health System Subtotal	**291,679**
Health System Cost Savings	**$30,788,268**
Cost of LifeBed™ - $18 per day	**9,375,390**
NET ECONOMIC BENEFIT	**$21,412,878**
RETURN ON INVESTMENT (ROI)	***228%***

Since Hospitals have different payor arrangements, for every 5% adjustment in charge rates, the effect would be a reduction in the above net economic benefit by $1,539,413 or a reduction in the ROI by 16%.

LifeBed™ and Reduction of Mortality

Early recognition of patient deterioration leads to lives being saved. With the State of Hawai'i being last in the nation in mortality from the key Patient Safety indicators, Failure to Rescue and Death in Low-mortality DRGs (Health Grades, Inc, 2006), vigilant surveillance through LifeBed™ provides an immediate solution to improve patient safety and reduce mortality. With state-wide implementation of LifeBed™, Hawai'i can strive to reach and exceed the levels that are seen within the top 10% of all states in the nation. It is estimated that this would save over 2000 lives annually in Hawai'i (Table 4).

Table 4. Mortality Reduction through LifeBed™

Failure to Rescue Death Rate per 1000 admissions	175.36	(a)
Deaths from low-mortality DRGs per 1000 admissions	4.62	(a)
TOTAL Death rate for Patient Safety Mortality Indicators	*179.98*	(b)
TOTAL PATIENT SAFETY DEATHS, State of Hawai'i	***5,062***	(c)
Top 10% of Nation, Goal with LifeBed™: Failure to Rescue Rate per 1000 admissions	100	(d)
Top 10% Goal with LifeBed™: Death from Low-Mortality DRGs Rate per 1000 admissions	2	(d)
Top 10% Goal with LifeBed™: TOTAL Death Rate for Patient Safety Mortality Indicators	*102*	(e)
MORTALITY PATIENT SAFETY GOAL with LifeBed™	2,869	(d)
LIVES SAVED ANNUALLY,	***2,193***	(d)

(a) Rate from published data for states (Health Grades, Inc., 2006)

(b) Sum of Failure to Rescue + Death from low-mortality DRGs

(c) 28,125 Medicare admissions annually in State of Hawai'i (Social Security Bulletin, 2006). Rate applied to all Medicare admissions, as estimate for both Medicare and non-Medicare admissions

(d) LifeBed™ can assist in being in the top 10% of Nation's Hospitals (Health Grades, Inc., 2006), Hoana estimate

(e) Sum of Failure to Rescue + Death from low-mortality DRGs at Top 10% level for Nation

Conclusion

With ever increasing demands and scarcer resources, patient safety has become a prominent national issue. Vigilant surveillance can improve patient safety while being economically feasible. Hoana's LifeBed™ patient vigilance system has been shown to provide an important safety net on the general care floor, reducing risk to the patient while maximizing the efficient use of resources. The economic analysis demonstrates that LifeBed™ immediately reduces costs through patient safety factors alone. Significant cost savings can be obtained once the full effects of continuous vigilant observation become evident on the GCF ward.

The State of Hawai'i can no longer tolerate being last in the nation in patient safety and related mortality. An economically viable alternative, vigilant surveillance, can immediately improve the safety climate in our hospitals and save lives. The LifeBed™ patient vigilance system has proven itself in this arena. The people of Hawai'i, our family, our friends, ourselves, only deserve the safest health care. Nearly all of us know about a friend or relative who went to the hospital, and for some reason, was lost on the GCF ward when they were apparently doing fine.

Unfortunately, this will happen, as the system of periodic vital sign checks allows patient worsening to go unanswered. In its place, vigilant surveillance will provide continuous observation of patients on the GCF ward, serving as the final safety net for the patient, whether deterioration is due to complications of disease or due to hospital errors.

We are last in the nation for death surrounding patient safety. We cannot expect the private health care system to bail us out of this condition, as it is this very system, although unintended, which has placed us in this situation. We must partner with the Legislature to provide a solution, if we are to provide for patient safety in Hawai'i's hospitals. ***LifeBed™ will provide an important cost-effective safety net, saving lives and protecting against complications, while protecting our residents economically against some of the catastrophic costs surrounding certain patient safety complications.***

SB409 SD1

Measure Title:
RELATING TO HEALTH.

Report Title:
Health Care Insurance Coverage; Medical Vigilance Services

Description:
Requires health insurance policies to cover medical vigilance services for subscribers who are receiving in-patient health care services at an acute care hospital. (SD1)

Introducer(s):
HOOSER

Current Referral:
HTH

WRITTEN