

Reducing Hospital-Acquired Pressure Ulcers

A Quality Improvement Project Across 21 Hospitals

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A quality improvement initiative across 21 hospitals incorporated a multidisciplinary approach, breakthrough collaborative methods, evidence-based improvement methods and care guidelines, front-line rapid improvement cycles, consistent process-of-care documentation, and real-time incidence data. Statistically significant decreases in both all-stage and stages III, IV, and unstageable hospital-acquired pressure ulcers rates have been sustained for 5 years. **Key words:** *breakthrough collaborative methods, pressure ulcer, pressure ulcer/prevention and control, quality improvement*

HOSPITAL-ACQUIRED PRESSURE ULCERS (HAPUs) are a costly and largely preventable condition. All-stage HAPU prevalence among hospitalized patients in the United States is approximately 5%, and estimated prevalence of full-thickness HAPUs is approximately 1.4%.¹⁻⁵ An estimated 3 million US inpatients are affected by HAPUs of

all stages each year at an estimated aggregate annual cost of \$11 billion.⁶

Patient-level risk factors associated with HAPUs are documented, as are evidence-based practice guidelines for their prevention.^{4,7-12} Preventing HAPUs improves quality and reduces costs. Evidence-based care resulted in cost savings in more than 99.99% of Markov simulations, in which statistical modeling of the probabilities of different health statuses related to HAPUs (eg, HAPUs of various stages with related impacts on outcomes and costs) captured the effects that society incurs when inpatient nursing care does not include a specific investment in their prevention. The expected cost of prevention was approximately \$2700 less than the expected cost of standard care.⁶ In the same study, the expected effectiveness of HAPU prevention exceeded that of standard care by approximately 2 quality-adjusted life years, a measure of the quantity and quality of life added by an intervention.

Financial incentives and the availability of practice guidelines have led to improvement in HAPU rates in many locations.¹³ However, few reports exist of substantial, sustained reduction in HAPU rates in large multihospital systems.¹⁴

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THE PROBLEM

Within Kaiser Permanente Northern California (KPNC), regional quality improvement (QI) efforts to reduce HAPU rates had met with limited success, failing to achieve substantial and rapid improvements or produce sustained quality gains. In 2007, the average baseline HAPU incidence at 21 hospitals was higher than the state average reported by CALNOC (California Collaborative Alliance for Nursing Outcomes).¹⁵

Specific aim

KPNC aimed to achieve breakthrough performance in the incidence of HAPUs in all 21 hospitals. The initial target was an 18% reduction in the incidence of stage III, IV, and unstageable HAPUs per 1000 patient-days in 2009.

METHODS

Setting

Kaiser Permanente is among the nation's leading health care delivery systems and not-for-profit health plans, with 9.1 million members in 7 regions nationwide. KPNC provides the entire spectrum of health care for 3.4 million members in settings that include 21 hospitals, with a total average daily census exceeding 2200. The Permanente Medical Group, which contracts with the Kaiser Foundation Health Plan to provide comprehensive care to members, includes more than 7000 physicians representing all specialties. An integrated electronic health record (EHR), KP HealthConnect,TM is used in all settings; inpatient nursing documentation was incorporated into it during this project.

Interventions

HEROES

The QI effort was a collaborative initiative between regional risk management and patient care services. Called Hospital and Emergency Department Reliability and Operational Excellence for Safety (HEROES), it

used the Institute for Healthcare Improvement breakthrough collaborative model and performance improvement methods that included the rapid improvement methodology developed by the Institute for Healthcare Improvement and the Associates in Process Improvement.^{16,17} The HEROES infrastructure included a regional steering committee that assessed strategy, infrastructure, and processes and addressed barriers; the steering committee also maintained regional pressure ulcer prevention and treatment policy and procedure documents. Other infrastructure elements included a partnership with regional risk management and patient care services staff for project management and data analysis and action teams at each of the hospitals. Regional and hospital leaders provided robust and visible sponsorship.

Evidence-based processes

A regional group of multidisciplinary experts identified evidence-based content to assist front-line teams to reduce HAPUs. Multidisciplinary involvement both garnered valuable expertise from other professional disciplines and clearly communicated the importance of performance improvement to the organization as a whole. The group, which included physicians, clinical services managers, quality and wound care nurses, respiratory therapists, nutritionists, and health information managers, conducted an evidence review to refine and enhance the SKIN bundle first described by Ascension Health.¹⁸ The resulting KPNC SKIN bundle consisted of 4 elements: (1) Skin assessment and correct surface, (2) **Keep turning**, (3) Incontinence management, and (4) Nutrition. Bundle performance targets are as follows.

Skin assessments using the Braden score were performed within 8 hours of admission and once per shift thereafter.¹⁹ Patients who scored low on the mobility and/or sensory perception scale of the assessment tool were placed on correct weight redistribution surfaces, as determined by a surface selection guide. *Keep turning* applied to patients who scored low on the mobility, sensory

perception, or friction and shear portions of the Braden tool; they were turned at least every 2 hours. *Incontinence management* required establishing an expectation with physicians and nursing staff alike that appropriate skin care management would obviate the need for Foley catheter insertion. This included eliminating diapers for incontinent patients; instead, staff used a selection guide to choose products, such as wicking pads and barrier lotions, to protect skin from moisture that could lead to skin breakdown. *Nutrition* consultations by a dietician took place within 8 hours of patients being identified as at risk by a low score on the nutrition portion of the Braden skin assessment tool.

Measurement

The primary outcome measures were (1) the rate of all-stage HAPUs (stages I-IV and unstageable ulcers) per 1000 patient-days and (2) the rate of stage III, IV, and unstageable HAPUs per 1000 patient-days. HAPUs were defined as pressure ulcers that were not present during the first 24 hours after admission. Unstageable ulcers were defined as full-thickness skin or tissue loss ulcers in which the depth was obscured by slough and/or eschar in the wound bed. Until enough slough and/or eschar were removed to expose the base of the wound, the true depth could not be determined; however, the ulcer would be either stage III or stage IV. Stable eschar on the heels serves as “the body’s natural (biological) cover” and should not be removed.²⁰

Deep tissue injury was defined as a purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear. The area may be preceded by tissue that is painful, firm, mushy, boggy, and warmer or cooler than the adjacent tissue. Evolution may include a thin blister over a dark wound bed. The wound may further evolve and become covered by thin eschar.²⁰ Because of the often rapid evolution of deep tissue injury that exposes additional layers of tissue, hospital-acquired deep tissue injuries were noted as

pressure ulcers but staged after evolution into a stage III, IV, or unstageable HAPU.

Patient-days indicate how many days all patients occupied hospital beds during the measurement period; for example, a nursing unit with a census of 30 patients for 30 days reflects 900 patient-days. If a single HAPU occurred on the unit during the 30-day measurement period, the rate would be $1/900 \times 1000 = 1.11$.

All identified HAPUs at any stage were included in the numerator. To assess incidence, wound, ostomy, and continence (WOC) nurses or assistant nurse managers maintained a daily log of HAPUs on individual nursing units, which enabled staff, managers, and leadership to access real-time HAPU data for all units in their hospital. HAPU logs were manually maintained in a parallel electronic format outside the EHR because of the required level of detail the EHR could not provide. For instance, sorting patients with HAPUs by respiratory devices used in their care led to early awareness of the role that such devices played in causing HAPUs and the use of appropriate “skin-friendly” alternatives.

On a monthly basis, hospitals submitted these data to regional risk management and patient care services leaders, who collated and distributed them. All 21 hospitals were able to view their performance relative to other sites. After the initiative began, each nursing unit also conducted process-of-care audits on 5 charts each week to ensure that the components of the SKIN bundle were being consistently implemented (see Supplemental Digital Content, Figure, available at <http://links.lww.com/JNCQ/A79>). Process-of-care audits were conducted until early 2010 when reliability was sustained at 95% for all 4 components of the SKIN bundle.

Analysis

A segmented linear regression model with a seasonality effect separately analyzed rates for all-stage HAPUs and stages III, IV, and unstageable HAPUs for 2 time periods: the first 2 years of the program (2008 and 2009) and subsequent years (2010-2012).

The regression modeled 2 lines, each with a separate intercept and a slope reflecting change in rates over time; the first line started in January 2008 and ended in December 2009, and the second started in January 2010 and ended in December 2012. The slope of the regression equation reflected the degree of change within each time period, and the intercept reflected the average of the rate across the time period. This project was carried out as a QI initiative and did not meet KPNC institutional review board criteria for oversight.

Implementation

Before implementation, all medical centers sent a multidisciplinary team to the first collaborative learning summit, at which performance improvement methods and the SKIN bundle were introduced. Afterward, action teams at medical centers implemented the SKIN bundle. Team members at each hospital included hospitalist physician and patient care services manager coleads; managers for perioperative, emergency department, and inpatient units; WOC nurses; respiratory therapists; nutritionists; health information management coders; and front-line staff from all hospital units (staff nurses, nursing assistants, and support staff). Multidisciplinary collaboration emphasized shared responsibility for HAPU prevention by the entire health care team; respiratory therapy rounding to ensure that the use of skin-friendly devices was an early intervention. Unit-specific implementation occurred through PDSA (plan-do-study-act) cycles; for example, nursing units tested various ways of using clocks and chimes to remind staff to turn patients every 2 hours.

After implementation, all hospitals participated in monthly collaborative calls that provided opportunities to share performance data, clinical decisions and interventions, and best practices. For example, one hospital was having difficulty with HAPUs in patients undergoing long neurosurgical operative procedures. Another hospital with a similar surgical caseload but no HAPUs was able to share its best practices.

RESULTS

All-stage HAPUs

During the first 2 years of the program, a significant decrease of 1.37 (95% confidence interval [CI], 1.2-1.54) occurred in the all-stage HAPU rate per 1000 patient-days. The average rate declined from 2.03 (95% CI, 1.88-2.17) to 0.66 (95% CI, 0.54-0.78), a statistically significant slope of -0.05 (95% CI, -0.06 to -0.04). By 2012, it decreased further to 0.59 (Figure 1). Although it was not included in the regression analysis, the 2013 annual rate of all-stage HAPUs per 1000 patient-days was 0.47.

Stage III, IV, and unstageable HAPUs

During the first 2 years of the program, a significant decrease of 0.13 (95% CI, 0.09-0.18) also occurred in the rate of stages III, IV, and unstageable HAPUs per 1000 patient-days. The average rate declined from 0.18 (95% CI, 0.14-0.22) to 0.04 (95% CI, 0.01-0.08), a statistically significant slope of -0.001 (95% CI, -0.001 to -0.002). By 2012, it increased slightly to 0.09 (Figure 2). Although it was not included in the regression analysis, the 2013 annual rate of all-stage HAPUs per 1000 patient-days was 0.05.

All medical centers reduced the incidence of HAPUs, with the majority of medical centers performing better than the regional targets from December 2008 onward. At the time of submission, 9 medical centers have gone at least 1 year without a reported HAPU.

DISCUSSION

A KPNC QI initiative reduced the incidence of all-stage and stage III, IV, and unstageable HAPUs to a statistically significant degree across 21 hospitals. Strengths of this work include improvements occurring throughout a multihospital system and sustained over time. An additional strength is the use of surveillance data, which identify a higher proportion of HAPUs than do administrative data.²¹ Limitations include the fact that the generalizability of this experience is unknown.

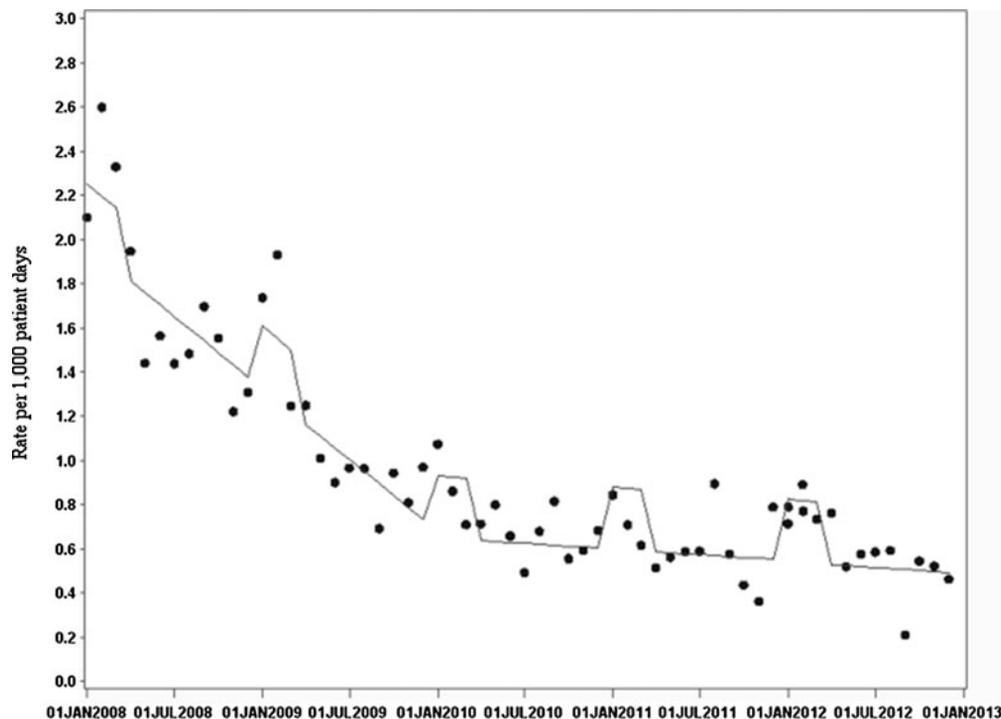


Figure 1. Change over time in rates of all-stage hospital-acquired pressure ulcers in 21 Kaiser Permanente Northern California hospitals.

However, compared with the larger US inpatient population, the KPNC inpatient population includes a similar mix of individuals at risk for HAPUs by virtue of Braden score on admission, body mass index, number of surgical procedures, total operative time, and mortality risk.⁴ The role of the EHR in the results reported here is also unknown. When nurses document scores on the Braden assessment tool in the EHR, point-of-care best practice alerts are triggered for SKIN elements. In a separate study, implementation of EHR nursing documentation was associated with increased nursing process-of-care documentation and decreased HAPU incidence. However, HAPU rates also changed irrespective of implementation, suggesting that EHR nursing documentation alone cannot account for the observed results.²² In fact, all-stage HAPU incidence decreased by 25% before EHR implementation during the initiative reported here. The QI project likely benefitted from its availability, but an EHR is not required to

achieve substantial reductions in HAPU incidence.

Another limitation relates to our primary outcome measure: HAPUs per 1000 patient-days. The absolute number of HAPUs decreased year over year, with one exception: stage III, IV, and unstageable HAPUs between 2010 and 2011 (Table). However, the number

Table 1. Absolute number of hospital-acquired pressure ulcers over time, Kaiser Permanente Northern California hospitals

Year	All-stage	Stage III, IV, and unstageable
2008	1733	156
2009	1037	78
2010	660	57
2011	547	67
2012	432	66
2013	327	36

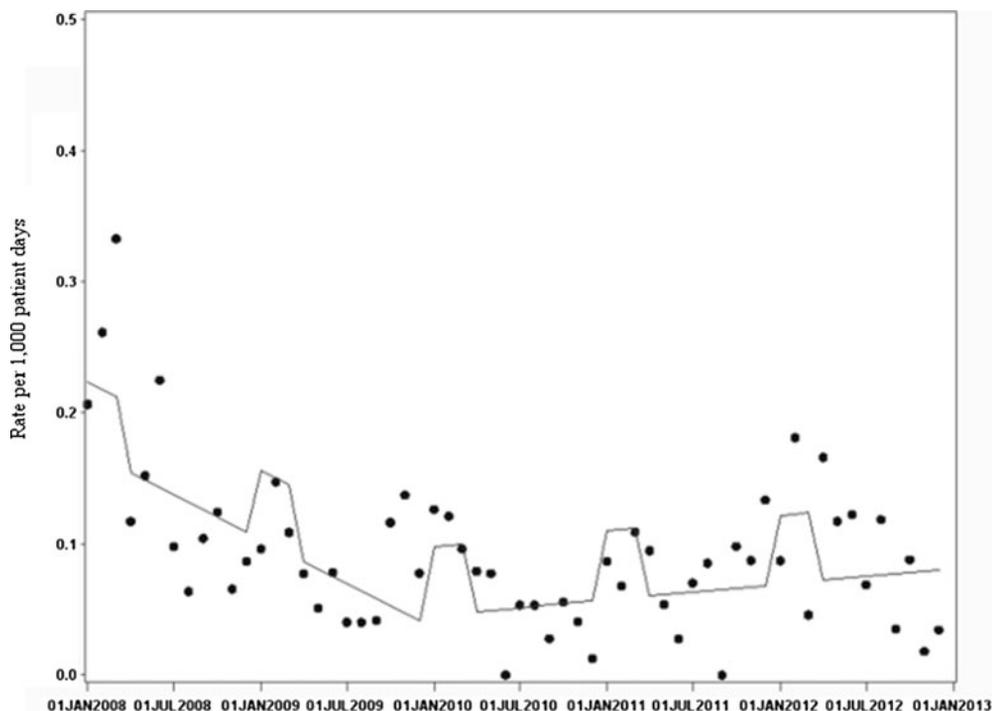


Figure 2. Change over time in rates of stages III, IV, and unstageable hospital-acquired pressure ulcers in 21 Kaiser Permanente Northern California hospitals.

of patient-days also decreased substantially year over year, consistent with a national trend that also reflects increasing acuity of all inpatient care and greater use of intensive care, where HAPU rates are highest.^{1,23} The rates reported here are not adjusted for these factors. We also note that risk-adjusted lengths of hospital stay are 6.4 days longer for inpatients who develop HAPUs than for those who do not.² Reduced incidence of HAPUs at KPNC likely also contributed to decreases in annual patient-days over time.

Two barriers initially interfered with fully implementing the SKIN bundle. The first was a lack of appropriate surfaces. Before launching the QI initiative, the HEROES steering committee created a business case for purchasing the correct surfaces. KPNC subsequently invested more than \$2 million in pressure redistribution mattresses and surfaces for all medical/surgical and operating room tables and beds, as well as emergency department,

postanesthesia care unit, and transport gurneys. Although the effect of any single element of the initiative cannot be determined, the reduction in HAPU incidence and published evidence suggest that this investment was money well spent.²⁴

A second barrier was the limited availability of nurses with expertise on skin assessment, because an accurate Braden score is required to trigger the SKIN bundle appropriately for at-risk patients. WOC nurses have this expertise, but not all KPNC hospitals had one on staff. In 2009, KPNC trained 200 assistant nurse managers as skin champions. A daylong educational opportunity for both assistant nurse managers and clinical educators provided content on pressure ulcer prevention, pressure ulcer staging, and wound management. The goal was to increase their knowledge base related to pressure ulcer prevention, identification, and management. WOC nurses at hospitals provided ongoing oversight, competency development, and

assessment validation for these members of the nursing staff, who were then available as resources on each unit 24/7. This additional support for front-line nursing staff improved admission assessments and ongoing skin assessments.

An early challenge was that original HAPU incidence logs were not standardized across hospitals before regional reporting. The overall reporting burden increased significantly with the implementation of regional reporting, eliciting negative reactions from regional and local hospital leaders. Regional risk management and patient care services leaders engaged chief nursing officers at each medical center and modified the logging and reporting tools on the basis of their recommendations. Reporting compliance subsequently improved.

Sustainability is supported by daily HAPU reports to unit managers and assistant managers. Unit managers are accountable to departmental leaders, who also review performance frequently and identify any concerns. Hospital, health plan, and medical group executives and regional quality staff review performance monthly.

Between 2010 and 2011, an increase in the number of stage III, IV, and unstageable HAPUs across the region was driven by 6 hospitals that were having difficulty sustaining consistent implementation of the SKIN bundle. Regional HEROES staff members conducted focused diagnostics and interventions with these hospitals in 2011-2012. Diagnostics focused on identifying unit-level factors that prevented nursing units from achieving the same HAPU rates as elsewhere, for example, competing priorities or management transitions. Senior leaders at both the regional and facility levels engaged with unit leadership to address these factors with additional resources, if needed, and clear messaging about the high priority of reducing HAPUs in all settings; leaders also continued to follow HAPU rates.

Regional quality staff conducted focused interventions with nursing units that included sharing successful practices from other sites,

encouraging site visits to hospitals with low HAPU rates, and reviewing cases to differentiate pressure ulcers from other skin injuries. Hospital nursing leaders provided programs to enhance direct patient care and nursing management knowledge and skills regarding HAPU prevention and staging, and 2 of the 6 also developed skin champion roles. These interventions were effective: the 2013 rate of stage III, IV, and unstageable HAPUs per 1000 patient-days was 44% lower than the rate in 2012. This experience highlights the importance of continuing monitoring of HAPU rates, and although process auditing was discontinued at the regional level, hospitals are encouraged to conduct spot audits of nursing care. The culture of nursing care changed from one in which HAPUs were viewed as regrettable but inevitable occurrences to one in which they are perceived as predominantly avoidable events on the medical/surgical units from which they have been virtually eliminated.

The data document a seasonal variation in the incidence of HAPUs. This may be related to increased hospitalization among the population at risk for HAPUs and use of respiratory devices during seasonal influenza. Next steps include verifying this hypothesis and adjusting tactics as needed. In addition, most remaining HAPUs occur in intensive care units and maintaining skin health is an increasing focus of care in that setting. Some emerging evidence suggests that not all HAPUs near the end of life are avoidable.²⁵

CONCLUSION

A multifaceted, multidisciplinary, collaborative approach to reducing HAPU rates was effective across 21 hospitals, and gains have been sustained. The entire approach, from HEROES partnership between risk management and patient care services to the use of front-line PDSA improvement cycles, subsequently became an integral part of the safety and quality culture at KPNC, also leading to improvements in other preventable inpatient conditions, such as falls and *Clostridium difficile* colitis.

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