

General care

White paper

Enhancing workflow in **low-acuity areas of your hospital**

The problem

Among the nursing and midwifery workforce, job dissatisfaction, burnout and intention to leave are relatively common. Reasons for job dissatisfaction and burnout are multifaceted: They range from low wages and lack of educational opportunities¹ to work-related stress factors² such as:

- Work process inefficiencies (e.g., computerized order entry and documentation).
- Excessive workloads (e.g., work hours, overnight call frequency, nurse-patient ratios).
- Work-home conflicts.
- Organizational climate factors (e.g., management culture; lack of physician-nurse collaboration, value congruence, opportunities for advancement, and social support).
- Deterioration in control, autonomy, and meaning at work.

High workload, job dissatisfaction and health issues resulting from work-related stress are associated with a high intention to leave the current job or the nursing field altogether¹⁻⁴ that often translates into action. An Australian study ⁵ found an annual turnover rate per ward of 15.1% on average, a recent U.S. review reported a nursing turnover rate as high as 27%.⁶

This staff turnover is costly for health care organizations. An Australian study⁵ calculated an average total cost of turnover of 49,255 AUD (17,728 AUD to 104,686 AUD) per full-time employee. For the U.S., the cost of turnover among registered nurses (RNs) is estimated at 1.2 to 1.3 times their salary (estimated total costs of \$82,000–\$88,000 per RN in 2007²), in total estimated to cost hospitals an average of \$5.13M-\$7.86M per year.⁶ Burnout may also increase health care expenditures indirectly via higher rates of medical errors and malpractice claims, absenteeism, and lower job productivity.

When high demands in care coincide with a shortage in staff, the resulting environment could compromise patient care. Nurses report that important tasks are left undone because of lack of time, and indicated that adverse events were not uncommon. Nurses in hospitals across Europe are rationing care because of high workloads, and have concerns about eroding quality of care and insufficient priority by management on patient safety.⁷ Patient safety and timeliness of care are two of the six domains to describe and measure quality of care in health as proposed by the Institute of Medicine (since 2015: National Academy of Medicine⁸):

- **Safe:** Avoiding harm to patients from the care intended to help them.
- **Effective:** Providing services based on scientific knowledge to all who could benefit and refraining from providing services to those not likely to benefit (avoiding underuse and misuse, respectively).
- **Patient-centered:** Providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions.
- **Timely:** Reducing waits and potentially harmful delays for both those who receive and give care.
- **Efficient:** Avoiding waste, including waste of equipment, supplies, ideas, and energy.
- **Equitable:** Providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location, and socioeconomic status.

In this paper, we will look into several low-acuity areas: Emergency department waiting areas, general ward, and maternal ward. An Australian study⁵ found an annual turnover rate per ward of **15.1%** on average

> a recent U.S. review reported a nursing turnover rate as high as **27%**⁶

Emergency department

During times of emergency department (ED) crowding, the demand for emergency services outweighs accessible resources. Studies show that ED crowding is a global problem associated with increased patient mortality and poor guality of care.⁹ ED crowding is common and is becoming more acute. In the United States, millions of individuals access healthcare in the ED each year, and the demand for ED services has significantly increased over the past decades. From 1999 to 2009, the number of visits to the ED increased by 32% nationwide, from 102.8 to 136.1 million. During the same time period, the number of ED visits that resulted in hospital and intensive care unit admission increased from 13.2 to 17.1 million and from 1.4 to 2.2 million, respectively. This suggests that more critically ill patients seek care in the ED. Further, insufficient inpatient hospital capacity has resulted in patients boarding in the ED for extended periods of time.¹⁰

A recent systematic review by Carter et al.¹⁰ that included studies from the U.S., Canada, Australia and Korea aimed at assessing the relationship between ED crowding and patient outcomes. Studies found that ED crowding is associated with higher rates of in-patient mortality among those admitted to the hospital from the ED and discharged from the ED to home. Studies also consistently found that ED crowding is associated with higher rates of individuals leaving the ED without being seen. One retrospective study included in this review¹¹ found a positive relationship between adverse cardiovascular outcomes (e.g., dysrhythmias, heart failure, cardiac arrest, etc.) and several ED crowding measures outcomes in patients with both acute coronary syndrome (ACS)-related and non-ACS-related chest pain syndrome. Among 4,574 patients, 251 (4%) patients developed adverse outcomes after ED arrival; 803 (18%) had documented acute coronary syndrome (ACS), and of those, 273 (34%) had Acute Myocardial Infarction (AMI). Compared to less crowded times, ACS patients experienced more adverse outcomes at the highest waiting room census (odds ratio [OR] = 3.7, 95% confidence interval [CI] = 1.3 to 11.0) and patient-hours (OR = 5.2, 95% CI = 2.0 to 13.6) and trended toward more adverse outcomes during time of high ED occupancy (OR = 3.1, 95% CI = 1.0 to 9.3). Patients with non-ACS chest pain experienced more adverse outcomes during the highest waiting room census (OR = 3.5, 95% CI = 1.4to 8.4) and patient-hours (OR = 4.3, 95% CI = 2.6 to 7.3). Overall, Carter et al. concluded that ED crowding is a major patient safety concern associated with poor patient outcomes.

A recent Canadian study¹² found that during overcrowded conditions, high acuity patients presenting with chest pain or shortness of breath had a higher rate of triage to the non-monitored area of the ED, which could be considered as under-classification of severity. Under-classification of severity may lead to potentially dangerous situations.

General ward

Hospitals treat older and sicker patients who often present with significant co-morbidities requiring more and more difficult decisions as to health care priorities. Increasing economic pressure on health systems often leads to overloaded health care environments, potentially compromising patient safety.

There is a large body of research available on nurse workload and patient outcomes.

In a recent systematic review,¹³ Erikson et al. investigated the association between hospital capacity strain and inpatient outcomes in highly developed countries, namely the U.S., Europe, Canada, and Australia. Capacity strain is a subset of resource strain originally described in the intensive care unit (ICU). There is no universally accepted definition of capacity strain, but it has been defined as increased patient census, acuity, and/or turnover affecting an ICU's ability to provide high-quality care. This concept can also be applied to non-ICU settings.

The authors found that in highly developed countries, hospital capacity strain is associated with increased mortality and worsened health outcomes, indicating that care quality may degrade during times of strain. Specifically, they found the following outcome results:

• There was a statistically significant increase in mortality during times of capacity strain in 18 of 30 studies and in 9 of 12 studies in ICU settings. While two studies reported over five-fold mortality associated with capacity strain, several studies found more modest 50–150% increases in mortality.

- Eight studies examined the association between capacity strain and nonlethal adverse events, with five of eight identifying a statistically significant association between strain and aspiration pneumonia, methicillinresistant Staphylococcus aureus infection, Clostridium difficile infection, or adverse events in general.
- Of 15 studies examining the relationship between capacity strain and hospital, ICU, or postoperative length of stay (LOS), 10 reported a significant association between strain and increased LOS.
- Seventeen studies examined the relationship between capacity strain and additional outcomes, such as ICU or hospital readmission, representation to the ED, ICU admission, delayed testing or treatment, low Apgar scores, and composite measures including morbidity and mortality. All but six of these studies reported significant associations between capacity strain and outcomes.

Adequate staffing may be the single most critical resource to maintaining care quality, and shortfalls in nurse [or physician] staffing have been linked to increased patient mortality and decreased care efficiency. Two studies that are more recent confirm the findings of Erikson et al.

A Norwegian study¹⁴ aimed at examining the associations between nurse-reported characteristics of the work environment and incidence of surgical site infections after total hip arthroplasty. The incidence of surgical site infection among 2,885 patients undergoing total hip arthroplasty in 16 Norwegian hospitals was 2.6%. Overall, the risk of surgical site infections after elective total hip arthroplasty was lower in hospitals where nurses assessed staffing as adequate.

A large Korean study¹⁵ examined the relationship between nurse staffing level and nursing-sensitive adverse outcomes in adult patients in tertiary hospitals (46 hospitals, 3,665,307 patients over two years). Among the patients included, 9.23% had at least one nursing-sensitive adverse outcome. The following nursing-sensitive adverse outcomes were included in the analysis (those with statistically significant relationships highlighted in bold):

- Urinary tract infection
- Upper gastrointestinal tract bleeding
- Deep vein thrombosis
- Hospital-acquired pneumonia
- Pressure ulcer
- Sepsis
- Shock/cardiac arrest
- CNS complication
- In-hospital death
- Wound infection
- Physiologic/metabolic derangement and pulmonary failure

ED visits



From 1999 to 2009, the number of visits to the ED increased by 32% nationwide, from **102.8 to 136.1 million**.¹⁰

Resulting in hospital and ICU admissions



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Maternal ward

Acuity in maternity care is increasing with women trending toward being older, having preexisting medical conditions, as well as being obese.^{16,17} The increase in acuity, combined with increased screening and treatment for conditions, such as gestational diabetes and infection, are creating additional workloads in the care of both woman and baby.

Overall, the evidence on the relationship between high workloads and outcomes is not as conclusive for maternity care as it is for general care, but the general trend is the same.

A prospective workload study in 23 consultant-led labour wards in Scotland addressed the question whether midwife workload was associated with quality of process of care and neonatal outcome indicators.¹⁸ The study found wards to be understaffed by 15% or even 35% of the time (depending on criterion used). Moreover, there was an association between increasing staffing ratios and lower odds of adjusted neonatal resuscitation (excluding bag and mask only) that could indicate detrimental direction of effect of midwife workload.

A study conducted by researchers at King's College London investigated the association between midwifery staffing and birth outcomes – specifically, the maternal readmissions rate to any hospital within 28 days of the birth.¹⁹ It was concluded as plausible that better outcomes were consistently associated with higher levels of more experienced and more highly qualified clinical staff. Freeman et al.²⁰ used a detailed dataset from the delivery unit of a major U.K. teaching hospital to better understand how workload impacts quality. First, they demonstrated that workload has an effect on the care pathway – discretionary but resource-intensive interventions, such as pain relief via epidural anesthesia, are less likely to be administered at high workloads. Second, they showed that workload increases the propensity of some adverse outcomes, such as perineal tears: They observed a 20.1% increase in the incidence of tears at the 90th percentile of workload as compared to the 10th percentile. They also examined postbirth length of stay, and found that women who do not receive an epidural, and delivering at the 90th percentile of workload, stay 4.4% longer than those at the 10th percentile.

Bailey et al.²¹ investigated the association between midwife workload and documentation process compliance, specifically quality of basic note keeping and partogram documentation, in a prospective observational study. The quality of partogram completion varied inversely with the ratio of women to midwives (i.e., decreased as the workload increased). If documentation is an accurate surrogate marker for quality of care, then this may suggest that as workload volume increases, the quality of care is compromised. The current guideline of the National Institute for Health and Care Excellence in the U.K. on safe midwifery staffing ²² also confirms that there is a relationship between midwifery staffing and maternal or neonatal safety outcomes. Nonetheless, confirmative evidence is still lacking, and there is a need for more research on this topic.



Effects of high workload/strain on the nursing/ midwifery work force

In 2009-2010, in a large population of fully qualified professional nurses from medical-surgical units (33,659 in about 500 general acute care hospitals in 12 European countries, 27,509 in about 600 general acute care hospitals in U.S.,¹), researchers from the RN4CAST program found high rates of:

- Nurse burnout (EU: 10% (Netherlands) to 78% (Greece),
 U.S.: 34%)
- Job dissatisfaction (EU: 11% (Netherlands) to 56% (Greece), U.S.: 25%)
- Intention to leave (EU: 19% (Netherlands) to 49% (Finland, Greece), U.S.: 14%)

Similar findings have been reported for the midwifery field:

- Lack of job satisfaction has been identified as the number one cause of midwifery workforce attrition²³
- Intention to leave: Australia (2012) 33.6%³, The Netherlands (2010) 32.7%⁴

In a recent systematic review, Wei et al.⁶ examined the nurse work environment in the U.S.. Findings of the review indicate that nurses' stress levels were directly associated with their workload, the number of patients assigned. The quality of nurse work environments and nurse staffing had a negative relationship with nurse burnout. A recent discussion paper on the website of the National Academy of Medicine by Dyrbye et al.², specifically looks into the burnout rates among health care professionals (HCPs). As to the extent of burnout among nurses, they found the following reports:

- In a 1999 study of more than 10,000 registered inpatient nurses, 43% had high degree of emotional exhaustion.
- A subsequent study of approximately 68,000 registered nurses in 2007 reported that 35%, 37%, and 22% of hospital nurses, nursing home nurses, and nurses working in other settings had high degree of emotional exhaustion.
- The prevalence of depression may also be higher among nurses than in other U.S. workers: In a study of 1,171 registered in-patient nurses, 18% had depression versus a national prevalence of approximately 9%.
- In a study of in-patient nurses, each increase of one patient per nursing staff ratio (self-reported staffing levels) increased odds of high degree of emotional exhaustion by 23% and job dissatisfaction by 15%.

Prevalence of depression among U.S. workers





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Strategies to improve patient and nurse outcomes

Conceptual frameworks

Several research groups have proposed conceptual frameworks to explain why more effective nursing care may reduce inpatient adverse events and mortality. Underlying all of these conceptual frameworks is the belief that surveillance is a critical factor that can be improved with more staff, better-educated staff, or a better working environment.²⁴

According to Spetz et al.,²⁵ one key component of patient care provided by nurses is surveillance, which involves identifying emergent complications and intervening to prevent their progression or subsequent mortality or other adverse events. The surveillance process demands that nurses have sufficient time and opportunity to directly observe patients, as well as coordinate and deliver interventions. If nurse staffing is low, relative to patient needs, the process of surveillance may be compromised. Moreover, high nursing workloads could impinge on nurses' ability to provide all needed care, leading to deleterious effects on quality. Nurses who face a heavy patient burden might be more prone to errors. In addition, increased workload may inhibit a nurse's ability to engage in discharge planning, as well as patient and family teaching, which are important aspects of ensuring good outcomes.

Thus, Spetz et al. conclude that increasing nurse staffing might enhance nurse surveillance, reduce missed care and errors, and improve patient and family teaching, leading to improvements in quality of care. In addition, vigilant surveillance may lead to more timely intervention for patients who develop complications, and thus greater staffing should be linked to shorter hospital stays for patients experiencing adverse events.

As for better nursing education, the Institute of Medicine had asserted already in 2010 that care within hospital and community settings has become more complex which calls for a higher education level. Specifically, in hospitals, nurses must make critical decisions associated with care for sicker, frailer patients and work with sophisticated, life-saving technology. Nurses are being called upon to fill primary care roles and to help patients manage chronic illnesses, thereby preventing acute care episodes and disease progression. They are expected to use a variety of technological tools and complex information management systems that require skills in analysis and synthesis to improve the quality and effectiveness of care. Across settings, nurses are being called upon to coordinate care and collaborate with a variety of health professionals, including physicians, social workers, physical and occupational therapists, and pharmacists, most of whom hold master's or doctoral degrees. To respond to these demands of an evolving health care system and meet the changing needs of patients, nurses must achieve higher levels of education and training.

The American Association of Nurses defines a healthy work environment as a workplace that is safe, empowering, and satisfying.²⁶ The American Association of Critical Care Nurses (AACN) published standards to establish and sustain healthy work environments.²⁷. These standards for establishing and sustaining healthy work environments are:

- **Skilled Communication** Nurses must be as proficient in communication skills as they are in clinical skills.
- **True Collaboration** Nurses must be relentless in pursuing and fostering true collaboration.
- Effective Decision Making Nurses must be valued and committed partners in making policy, directing and evaluating clinical care, and leading organizational operations.
- **Appropriate Staffing** Staffing must ensure the effective match between patient needs and nurse competencies.
- **Meaningful Recognition** Nurses must be recognized and must recognize others for the value each brings to the work of the organization.
- Authentic Leadership Nurse leaders must fully embrace the imperative of a healthy work environment, authentically live it and engage others in its achievement.

Staffing

In January 2004, California started to establish specific nurse-to-patient ratios for general acute care hospitals, acute psychiatric hospitals, and specialty hospitals. Several reviews are available in the meantime looking at the impact of these ratios on nursing workforce and the work environment of nurses.

Seratt found in her review²⁸ that nurse-to-patient ratios have decreased by almost 1 (-0.98) less patient per registered nurse (RN.) Nursing hours per patient day (HPPD) increased by a minimum of 30 minutes with some studies reporting as much as an additional hour. Percentage of increase in average RN HPPD ranged from 20.8% to 16.2%. As for the impact of ratios on work environment outcomes, she found that nurses working in California, during a time of mandated nurse-to-patient ratios, reported better workload perceptions than did nurses working in states without ratio regulations, job satisfaction improved after the ratios went into effect and neutral to positive effects on turnover, burnout and intent to stay.

Marks et al. found in their study on patient outcomes²⁹ that failure to rescue decreased significantly more in some California hospitals, and infections due to medical

care increased significantly more in some California hospitals than in comparison state hospitals. There were no statistically significant changes in either respiratory failure or postoperative sepsis. The finding that infections due to medical care increased may reflect increased detection of these events, rather than an actual increase in their numbers. If early detection improves and prompt treatment begins, then length of stay for patients with these complications should not increase which was supported by several studies.

Leigh et al.³⁰ sought to determine whether statemandated minimum nurse-to-patient staffing ratios in California hospitals had an effect on reported occupational injury and illness rates. The evidence suggests that the California law was associated with 55.57 fewer occupational injuries and illnesses per 10,000 RNs per year, a value 31.6 % lower than the expected rate without the law. The most probable reduction for licensed practical nurses (LPNs) was 33.6 %.

In the midwifery sector, the Queensland Nurses and Midwives Union (QNMU) has issued recommendations for minimum staffing levels.³²



Education

In a retrospective observational study in nine European countries, Aiken et al.³¹ were able to show that an increase in a nurses' workload by one patient increased the likelihood of an inpatient dying within 30 days of admission by 7% (odds ratio 1.068, 95% CI 1.031–1.106), and every 10% increase in bachelor's degree nurses was associated with a decrease in this likelihood by 7% (0.929, 0.886-0.973). These associations imply that patients in hospitals in which 60% of nurses had bachelor's degrees and nurses cared for an average of six patients would have almost 30% lower mortality than patients in hospitals in which only 30% of nurses had bachelor's degrees and nurses cared for an average of eight patients. Marks et al.²⁹ provide another rationale why a skill mix might help to improve patient outcomes: Staffing with more LPNs, even given their limited scope of practice, might allow RNs additional time to engage in enhanced surveillance – a critical clinical process in preventing patients' deteriorating conditions from worsening, reducing missed care and ultimately improving patient outcomes.



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Work environment

In a paper using RN4CAST data from Europe and the U.S., Aiken and co-workers¹ found that hospitals where work environments were good or excellent and where nurses cared for fewer patients each, nurse burnout, dissatisfaction, and intent to leave their jobs was lower, nurses' ratings of quality and safety of care were higher, and patients were more likely to be satisfied with their care.

Based on the studies included in their review of nurse work environments, Wei et al.⁶ found the following associations between healthy work environments and different types of outcomes:

Nurse outcomes:

- Positive association with nurses' psychological health and negative correlation with nurses' emotional strains.
- Significant positive correlation with job satisfaction and retention. Nurses' job satisfaction was a significant determining factor for nurse retention.

Patient care quality

• Was significantly associated with nursing work environments. Healthy work environments had for example a direct relationship with patients' cardiac arrest survival rate and were negatively associated with patients' 30-day inpatient mortality rate.

Hospital accidental safety

 Healthy work environments were significantly associated with hospital safety climate and culture.
 A poorer hospital safety climate and nurse work environments were significantly correlated with increased risk of patients' mortality rate.

Wei and co-workers conclude that healthier work environments lead to more satisfied nurses who will result in better job performance and higher quality of patient care, which will subsequently improve healthcare organizations' financial viability.



How can Philips support workflows in low-acuity areas of your hospital?

In addition to hiring more and better educated nurses and to establishing and sustaining healthy work environments such as defined by the AACN,²⁷ technology could be a means to improve workflows, and thereby create an improved work environment for nurses.

Philips Patient Deterioration Solution^{*} is a comprehensive solution that consists of an integrated suite of devices, wearable sensors, software, and professional services to help address clinical deterioration and patient care. It allows caregivers to automatically acquire vital signs, automate early warning scoring (EWS) calculations, aid in identifying early signs of deterioration, and can inform responsible clinicians for early, effective intervention. It is embedded in clinical workflows and automatically integrated in electronic health records.

In a prospective study³³ with more than 4,000 patients in two general wards of a hospital in the United Kingdom, Subbe et al. observed after the introduction of the Philips Patient Deterioration Solution a 22% increase of rapid response team notifications, a 20% decrease in mortality, an 86% decrease in cardiac arrests, a 24% reduction in ICU admission, and a 31% reduction in the severity of patients admitted to the ICU. Similar positive effects on patient outcome were found in a study on two surgical wards in Germany,³⁴ where critical notifications to the ward physician became six times more likely, in-hospital cardiac arrests decreased by 60%, and unplanned ICU admissions decreased by 17%. Hubner and co-workers have tested Philips Patient Deterioration Solution in a waiting area of an emergency department in patients with acute cardiac or pulmonary symptoms or in potentially life-threatening conditions.³⁵

The automatic acquisition of vital signs by wearable sensors, the automatic calculation of Early Warning Scores and their automatic transmission into the EMR system frees up nursing time that they can in turn invest in patient care. This automation also helps to have more complete records of vital signs and early warning scores and may also help to reduce manual entry and calculation errors.

IntelliVue GuardianSoftware, an integral part of the Philips Patient Deterioration Solution, is able to handle different Early Warning Scores, e.g. MEWS or NEWS for the general care areas, but also EWS specific for the maternal care area such as MEOWS or IMEWS.

Via large hallway screens with an overview of patient early warning scores, the IntelliVue GuardianSoftware system can support the communication among the nursing team (e.g. during shift handover) but also the communication between nurses and physicians. This enables a better collaboration among all clinicians involved in patient care and effective decision making.

Their observational cross-sectional study found the Philips Patient Deterioration Solution to be feasible and safe to assist medical staff rapidly respond to potentially life-threatening situations of patients. Feedback from patients and medical staff via questionnaires showed overall very good acceptance and patients felt that they were given better care. In a large multi-center study in the U.S., Europe and Australia, Bellomo at al. were able to show a significant reduction in the time required to complete and record a set of vital signs from 4.1 ± 1.3 mins to 2.5 ± 0.5 mins.³⁶

^{*} Philips Patient Deterioration Solution consists of IntelliVue GuardianSoftware and compatible devices.



Figure 1: Philips Patient Deterioration Solution – Components overview

The latter is also supported by the IntelliVue GuardianSoftware mobile application that automatically notifies nurses and / or physicians about patient deterioration so that they can react fast. Overall, the Philips Patient Deterioration Solution can help to streamline workflows in low-acuity areas of your hospital and thereby help to improve nurse productivity. As it reduces documentation workload and frees up time for patient contact and care it may also contribute to increased job satisfaction among the nursing staff.

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