

Evidence based nurse staffing in Danish acute hospitals

Final Project Report

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Content

Content.....	3
1 Introduction.....	4
2 Timeline and Involvement of Stakeholders	5
3 Results of the Analysis of the Current Situation at Regionshospitalet Gødstrup	7
4 Good Practice Cases	11
5 Planning model and framework	14
6 Systems and Solution Design.....	21
7 Implementation and Planning	22
8 Conclusion, Perspective, and Next Steps.....	25

1 Introduction

As the aging population expands and the proportion of patients with multiple diseases increases, necessitating both specialized treatments and highly skilled nursing staff, Regionshospitalet Gødstrup (formerly known as Hospitalsenheden Vest) is facing the challenge of developing and implementing a model that ensures appropriate care for hospitalized patients without compromising quality or employee well-being. The global shortage of nurses and healthcare professionals has been acknowledged for several years, leading to a need for the adoption of new innovative working methods to ensure safe nursing staffing and flexibility. The COVID-19 pandemic further highlighted the need for innovative approaches to care, flexibility, and adaptability. In recent years, Regionshospitalet Gødstrup has undergone significant changes, including a prolonged nurses' strike following the COVID-19 pandemic, and most recently, the relocation of hospitals within Hospitalsenheden Vest to the new Regionshospitalet Gødstrup. These changes have had a significant impact on working environment and well-being of the hospital staff.

The recent reforms in the Danish hospital sector and the growing shortage of healthcare workers have highlighted the importance of exploring alternative methods for work planning. These methods should prioritize patient safety and aim to enhance or maintain the working environment and job satisfaction.

Currently, there are no established national or regional guidelines for determining staffing levels in Denmark. Therefore, it is up to individual hospitals to set their own standards for nurses. The traditional method of determining staffing levels is based on economic factors, the number of available beds, the expected occupancy rate, and subjective assessments of patient complexity by senior nurses. This overall estimation method does not necessarily ensure an optimal balance between the supply and demand of nurses, as it does not consider patient characteristics and acute needs. This can result in a mismatch between the availability of nurses and the actual needs of patients at any given time.

During the management of the COVID-19 pandemic, the most common approach for planning used in Denmark revealed further limitations. Nurses were allocated based solely on the number of COVID-19 beds and were assigned to different departments across the hospital, regardless of their specialties and usual work areas. This approach ignored the needs of both patients and nurses, leading to a decline in nurses' well-being due to excessive workload and overtime. The situation was further exacerbated by the nationwide nursing strike in 2021, leading to a further decline in well-being and increased pressure on staff. The nationwide nursing strike in 2021 further compounded the issue, causing further deterioration in well-being and increasing pressure on staff.

Inadequate planning and management of resources can result in improper allocation of nursing resources, thereby hindering the ability to meet patients' care needs. Therefore, it is crucial for Regionshospitalet Gødstrup to develop tools and methods that can optimize their staff attendance and mix of skills(skill-mix), thereby ensuring efficient and appropriate care for their patients.

Therefore, it is crucial to adopt alternative methods for estimating the need for nursing resources based on patients' care needs, in order to improve the distribution of care hours and skills on a more evidence-based basis. In 2021, Regionshospitalet Gødstrup in the Central Denmark Region, in collaboration with PwC Denmark, initiated a project aimed at developing methods for evidence-based safe nurse staffing in the departments of Regionshospitalet Gødstrup. The project is funded by the European Commission (DG REFORM) and has involved stakeholders such as the hospital's management, selected specialists, researchers, and the Danish Nurses Organization (DNO).

The goal of the project is to develop an organizational model supported by data and IT that can aid managers and senior nurses in improving attendance and worktime planning in each department. Regionshospitalet Gødstrup aims to achieve high professional quality and standards and enhance the working environment, thereby preserving and ensuring the well-being of its employees.

The model is presented through an organizational framework based on an objective assessment of patient intensity, utilizing evidence and data on patients and their care needs. The objective is to estimate the necessary number of nurses and the mix and combination of their skills required to provide safe patient care, high-quality patient care, and achieve a healthy work environment in each department.

The project is focused on identifying or developing a system that can assist in estimating optimal nurse staffing levels. The system should take into account factors such as patient characteristics (care needs or indicators), patient flow, and nurses' competencies and specialization. The model should support an balanced allocation of resources to departments with high patient care needs and highlight areas where staffing is low relative to care needs.

2 Timeline and Involvement of Stakeholders

The project was initiated in October 2021 and has involved several sessions with multiple employees from Regionshospitalet Gødstrup. The project is structured with a steering group, an advisory board, and a project group, and project meetings and steering group meetings have been held at an agreed frequency. Meetings with the advisory board were conducted, but with low participation, leading to several cancellations.

Figure 2.1 provides an overview of the overall timeline for the project, including the main activities conducted at Regionshospitalet Gødstrup during the project. The project has planned two international study trips, but due to COVID-19 and national lockdowns, these were conducted in Denmark with online participation from several countries and the involvement of various specialists.

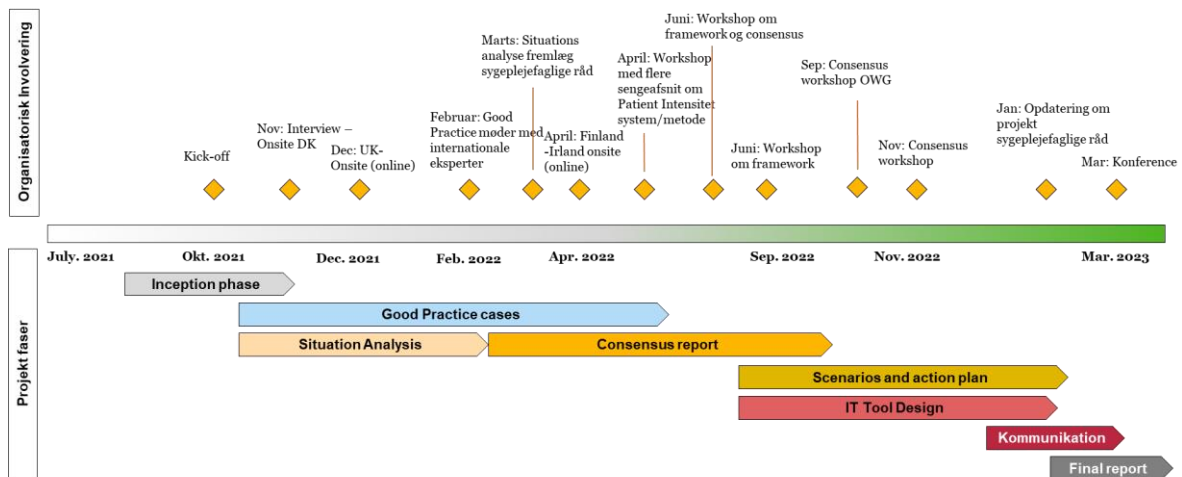


Figure 2-1 Overall implementation and involvement of stakeholders from the hospital and stakeholders for the project

An analysis of the current setup and similar good-practice cases from other countries has identified several areas for improvement, based on an adapted organizational framework that can ensure organizational transformation. This framework is designed to support the adaptation of various organizational elements and while implementing of methods and systems for assessing safe patient intensity and the derived care level. Furthermore, the framework is adapted to account for the prevailing conditions and identified barriers that has been investigated during the project at Regionshospitalet Gødstrup.

The framework is described with various scenarios defined in the project, and consensus has been reached around these scenarios, with a primary scenario chosen as the basis for continued implementation. Although some form of consensus has been achieved, the chosen scenario does not satisfy all stakeholders, and solutions to several challenges in the central elements of the framework must be found when implementing it.

A crucial prerequisite in the project has been to examine methods and potential IT solutions that can be used at Regionshospitalet Gødstrup to assess patient intensity and the derived care needs. This has been done through an analysis of good-practice cases, dialogue with potential suppliers, IT architects in the Central Denmark Region, and finally, an evaluation of whether the hospital should purchase or develop its own system.

The project has been concluded by outlining a possible implementation solution that describes both the approach to implementation, a potential project plan, and the projects that should be initiated to form the foundation for future implementation. Finally, the project hosted a large conference with broad participation from the Danish healthcare sector, and some key points from this event are included in this report.

3 Results of the Analysis of the Current Situation at Regionshospitalet Gødstrup

In Denmark, each individual hospital is responsible for determining its own nurse staffing levels, as there are currently no national or regional guidelines for safe nurse staffing. The necessary number of nurses in each department is typically based on financial considerations, the number of beds, expected bed occupancy, and the subjective assessments of workload by chief nurses. This rudimentary estimation method does not guarantee an appropriate match between the supply and demand for nurses, as it does not take into account patient characteristics and care needs (i.e., intensity). This can result in a misalignment between the availability of present nurses and the care needs of patients any given time.

The analysis of the current situation at Regionshospitalet Gødstrup has identified a number of limitations in the existing framework that need to be addressed through the implementation of a new framework that incorporates methods and IT systems for assessing patient intensity and determining care needs. The main challenges identified include:

The analysis of the current situation at Regionshospitalet Gødstrup has identified a number of challenges with the existing setup that should be improved through the implementation of the developed framework supported by methods and IT systems for assessing patient intensity and derived care needs, which is described in detail in the project's analysis report. The main challenges identified include:

- **Well-being and motivation:** The analysis has shown an organization under pressure. Despite the organization having a dedicated and committed group of employees, the overall well-being has been declining in recent years. The hospital's staff, including nurses, have faced numerous challenges such as the COVID-19 pandemic, strikes, relocations, and an increase in the complexity of patient care, which has led to an increase in workload and a decline in nurses' well-being. According to the nurses, the workload has increased due to more complex patients requiring more care, increased documentation requirements and administrative tasks, and increased demands from relatives seeking more information about diagnosis, care activities, and other information. In 2021 and 2022, there have been disheartening stories in the media about crying nurses, calls for immediate action, and difficulties in recruiting nurses have contributed to a negative impact on the healthcare sector and its employees. Although these stories are subjective and may be sensationalized, they still impact the healthcare sector and thus the employees in a more negative direction. Similarly, a well-being survey showed a decline in well-being and motivation caused by the direct influences on the employees, however, it also revealed pride in the work as a nurse and personal effort. The survey highlights the continued commitment to Regionshospitalet Gødstrup and the profession in general, while also highlighting the need for changes in management principles. Although Regionshospitalet Gødstrup previously had a principle of using nurses exclusively for patient treatment, they are now considering the involvement of other professional groups in patient care to relieve nurses of simpler tasks and allow them to focus on the most complex and intense patients.

- **Competencies and general overview:** A consistent approach to incorporating competencies into shift planning and assigning patients to a nurse at each shift change is currently lacking at Regionshospitalet Gødstrup. The utilization of competencies in planning varies among departments, with some lacking documented competence groupings and relying on tacit knowledge among planners. In other departments, color coding is used in the shift plan to show nurses' competencies, which simplifies planning and makes it easier to see if nurses want to swap shifts with colleagues at the same competence level. However, color coding is not systematically implemented across departments, and although it is visually presented in the shift plan, it cannot be visualized with data and therefore cannot be quantified and monitored. Moreover, there is a lack of clear descriptions of the nursing staff's general competencies, the necessary mix of skills and competencies, as well as competency mapping, which is essential. To support the possibility of flexible staffing and capacity leveling going forward, it is important that the employees possess the necessary competencies, and therefore, they are offered education and competency development to enable them to deliver high-quality care across specialties.
- **Economic barriers, including capacity:** The hospital currently operates within an economic framework that allocates 5.3 care hours per hospitalized patient per 24 hours for a given bed section. These hours are planned based on static attendance profiles, leading to significant variations in the ratio of hospitalized patients to present nurses without considering patient care complexity.
 - The analysis reveals notable fluctuations in the patient-to-nurse ratio over time, with day shifts ranging from approximately 1.2 to 5.4 patients per nurse. While no fixed pattern is discernible, a correlation between weekend and weekday shifts is evident, during which patient flow, patient activity level, and shift coverage decrease, resulting in a higher nurse-to-patient ratio. The figure below highlights the variations in the observed nurse-to-patient ratio in the cardiac department for selected months in 2021. In comparison to the economic framework that allocates hours per patient, the average ratio can be estimated at approximately 3.3 patients per nurse for day shifts.



Figure 3-1 Heatmaps illustrating the ratio of hospitalized patients to the attendance of nursing staff for a bed section in February and April 2021, respectively.

- The ratio of patients to nurses, based solely on numbers and working hours, indicates an imbalance between patient flow and staff attendance. The analysis has also revealed imbalances in the attendance of nurses for comparable shifts, such as comparable weekdays. By considering patient intensity, the imbalances may appear even more significant. The current method by which bed sections can resolve inappropriate imbalances is by managing a varying number of patients per nurse, hiring substitutes, or moving patients to open beds in other bed sections.
- **Organization and planning:** The hospital's planning structure is characterized by immaturity¹ and decentralization. Resource planning occurs at individual bed sections without coordinated and cohesive capacity management across sections. This decentralized planning model results in underutilized data, such as dynamic adjustment of attendance profiles. Central functions focusing on planning, budgeting, and data utilization at bed sections are not established, which would ensure the implementation of data analytics and business intelligence for optimal planning, evaluation of attendance, and continuous improvement of shift schedules, attendance profiles, and substitute utilization. Regionshospitalet Gødstrup conducts daily capacity conferences to ensure necessary capacity and optimal patient flow. However, these conferences lack system and data support concerning patients and attendance, which would facilitate better decisions regarding the optimal allocation of resources in daily understaffing/overstaffing situations. The conference is established and forms part of the daily management task. Although employees and the Danish Nurses Organization express concerns about the consequences of implementing increased flexibility across bed sections, it should be possible to develop agreeable structures and solutions to

¹ Immaturity is seen in relation to hospitals and other similar sectors that have professionalized the task. For example, in the English and Irish good-practice cases, there has been a professionalization of the planning function and a centralization and streamlining

address the problem of fluctuating ratios, which could satisfy all three stakeholders – nurses, patients, and the hospital. Other Danish hospitals have already implemented simple solutions that can be replicated or further developed. The project has described models from the Emergency Department in Horsens, Odense University Hospital, and Aalborg University Hospital. Ultimately, the well-being of nurses and patients is the primary goal and maintaining the status quo does not appear to be a viable long-term solution.

- **Well-being, patient, and quality indicators:** Despite the Danish healthcare sector being highly specialized and providing efficient treatment to patients, quality indicators for hospitalized patients' and employees' well-being and motivation are not routinely incorporated into daily management and planning practices. Employee well-being assessments, as mandated by occupational health and safety legislation, occur infrequently, approximately every three years at a minimum, and the qualitative results of patient care are not part of an ongoing improvement process. The nationwide clinical quality program (RKKP) contains relevant information, but this is not utilized. Data on patient indicators are continuously entered into the electronic patient record; however, due to low registration rates for all patients, patient indicators cannot currently serve as a basis for calculating care needs without significant development efforts and additional data generation. Moreover, it has been suggested that registering patient indicators more frequently in the electronic patient record is not feasible due to the time involved. The project has identified selected and recommended the following well-being and patient quality indicators:

Patient quality indicators	Quality indicators for nursing staff
<ul style="list-style-type: none"> • Accidental incidents • National Patient Experience Survey • Length of stay • Patient case • Pressure ulcers (Decubitus) • Patient mobilization • Hospital-acquired infections • Discharges to home care • Mortality of hospitalised patients or patients admitted within 30 days 	<ul style="list-style-type: none"> • Employee turnover • Absence, typical illness • Motivation score • Leadership score

The situational analysis reveals that the organization is under considerable pressure, with declining well-being among nurses and employees who have faced increased stress due to COVID-19 and strikes. The increased workload can be attributed to more complex patients, greater documentation and administrative task requirements, and increased demands from relatives. As a solution, Regionshospitalet Gødstrup is considering involving other professional groups in patient treatment to relieve nurse workload and potentially reassign certain tasks to doctors. The data indicates a slight increase in hospitalizations and a consistently high occupancy rate, which impacts the organization's economy, which are based on occupancy rates and capacity. Additionally, the primary challenge lies in recruiting skilled and competent nurses and the ability to adjust staffing daily to meet the care needs of hospitalized patients.

4 Good Practice Cases

Many European countries experience similar challenges concerning nurse staffing as Denmark, in terms of nurse shortages, staff retention, and establishing evidence-based nurse staffing. No consensus exists on a valid and reliable tool for assessing nurse demand based on patient care needs, and any given nurse staffing tool should be viewed as a variable to support decision-making, as subjective clinical assessments remain necessary. Despite the abundance of evidence and research aimed at identifying optimal nurse staffing levels, no "gold standard" or one-size-fits-all solution has been established, and no single approach has been universally adopted. Defining exact figures for what constitutes safe nurse staffing levels is enormously complex, as it involves a range of elements that can be configured differently from country to country, region to region, and even between hospitals.

Globally, the definitions of "safe" nurse staffing levels vary widely, adding complexity and difficulty to the process and limiting the possibilities for comparing staffing across individual hospitals and departments, both nationally and internationally. Evidence regarding the impact of these tools on care quality and patient safety, as well as evidence of improvements in nurses' working conditions or environments in the selected good practice examples, has proven limited. The conclusions indicate that further research is needed to determine the tool-related or tool-specific effects on nurse and patient outcomes.

Another limitation of the analysis of nurse staffing tool was the inability to access the types of algorithms used in estimating nurse staffing due to commercial considerations. However, it is strongly recommended that Regionshospitalet Gødstrup and/or the Central Denmark Region explore the benefits of nurse staffing tools in creating transparency, overview, and alignment.

The analysis of good practice cases, derived from international experts and leaders of other countries' programs aimed at achieving safe nursing staffing, can be summarized in the following key points:

1. The overall recommendation is to concentrate on the work environment and management before considering changes (increases) in nurse staffing.
2. Create transparency in the hospital organization's decision-making process by involving department heads and nurses, fostering their engagement and involvement.
3. Consider three different aspects of workload, including task level, job level, and unit level, where emotional and physical workloads are taken into account to prevent burnout, reduce medication errors, and improve job satisfaction.
4. The optimal skill mix between nurses and healthcare assistants is recommended to be at least a ratio of 80% nurses to 20% healthcare assistants. Research indicates that above a certain threshold, increased levels of healthcare assistants have harmful effects on patient care (Griffiths, 2019).²
5. A nurse staffing tool should be regarded as a support instrument for appropriate distribution of health resources, along with the application of professional judgment. In other words, a nurse staffing tool should be used in conjunction with other methods. Triangulation (combining methods) is recommended, as no single tool (yet) can incorporate all factors and variables known to influence nursing work.
6. It is advised to implement an existing patient acuity tool available in the market, rather than developing one from scratch. The time required to develop and validate a newly developed tool is exhaustive, with limited evidence.
7. One of the main challenges in implementing a new tool or framework is the resistance encountered by nurses. Implementations are often perceived as an additional administrative burden; therefore, it is crucial to involve nurses early in the process of implementing a new tool or framework.

International specialists involved in the project and participants in the final conference have highlighted several evidence-based results derived from research, which are worth considering for future staffing and planning to ensure safe staffing at any given time:

International specialists involved in the project, who participated in the final conference³ have highlighted several evidence-based results derived from research, which are worth considering for future staffing and planning to ensure safe staffing at any given time:

- An increase in a nurse's workload by one patient increased the likelihood of a hospitalized patient dying within 30 days of admission by 7% (Aiken et al., 2014).
- For every 10% increase in educated nurses, the likelihood of mortality decreased by 7% (Aiken et al., 2014)⁴.
- There was a significant association between increased mortality and increased exposure to shifts in staffing when nurse staffing was 8 hours or more below the desired target (Needleman et al., 2011)⁵.

² Peter Griffiths, 2019: Nurse staffing, nursing assistants and hospital mortality: retrospective longitudinal cohort study

³ Jonathan Drennan, Conference Regionshospitalet Gødstrup, 22-March-2023.

⁴ Aiken et al, 2014: Nurse staffing and education and hospital mortality in nine European countries: a retrospective observational study, May 2014

⁵ Needleman et al, 2011: Nurse staffing and inpatient hospital mortality, March 2011

- The relationship between increased mortality and high patient turnover was also significant (Needleman et al., 2011).

The experiences from implementing a nationally politically decided program and framework for safe nurse staffing in Ireland demonstrated that numerous departments experienced a significant reduction in the utilization of temporary staff following the implementation of the recommendations in their framework. Across three research phases, the treatment points most frequently reported as "not completed" were comfort/conversation with patients and teaching patients and/or family. The tasks least frequently unachieved during a shift involved pain management and completion of treatments/procedures.

From the same case in Ireland, it was found that care quality improved markedly after implementing Safe Nurse Staffing, with a skill mix ratio set to 80-20%, and by maintaining the established ratio.

- The number of uncompleted care activities was more than halved (from 2.51 to 1.08)
- Shifts with at least one care activity not completed decreased from 75.6% to 39.3%
- Controlling for the mix between nurses and healthcare assistants, each additional nurse-sensitive adverse event experienced by a patient was associated with an increase in length of stay of 0.48 days.

Jack Needleman⁶, an international specialist from the USA, posed the question, "Does staff matter?" The answer can be summarized as follows: Hundreds of studies, utilizing a wide range of methods and outcomes, have found that the level of professional nurse staffing matters:

- Employing care staff without adequate education or time for care leads to increases in adverse events such as infections, falls, pressure ulcers, and deaths, as well as longer lengths of stay.

Martsof et al. (2004)⁷ concluded that increased staffing paid for itself.

- Increases in nurse staffing were associated with...
 - Reductions in hospitalization time and adverse events due to insufficient nursing care but did not simultaneously lead to increases in patient care costs.
 - Changing the skill mix by increasing the number of registered nurses as a proportion of care staff resulted in cost reductions.

It is also emphasized that an IT system itself is not important. The value and results are created through the collection and utilization of data to discover correlations between patient intensity, appropriate average staffing, flexible resources, and management and control at the hospital.

⁶ Jack Needleman, Konference Regionshospital Gødstrup, 22-March-2023.

⁷ Martsof et al., "Examining the value of inpatient nurse staffing: an assessment of quality and patient care costs," Medical Care, 2014-

5 Planning model and framework

The primary goal of implementing a framework is to enhance patient care quality and improve employee well-being and motivation. Patient care quality is anticipated to improve through evidence-based nurse staffing levels, based on the appropriate average staffing and the possibility for daily flexibility. Employee motivation and well-being are expected to increase through better staffing, increased leadership in the wards, uniform processes, and a variety of support processes that contribute to improved well-being at Regionshospitalet Gødstrup. A successful implementation of a framework could potentially position Regionshospitalet Gødstrup as a leading hospital in Denmark, known for creating coherence, employee involvement, and high motivation among employees. However, this cannot be further substantiated but is seen as causal relationships between transparency, good management, and motivated employees.

Variations in nurse staffing, the number of hospitalized patients, and the need for patient care throughout the day may necessitate flexibility in nurse staffing to maintain a consistent and uniform level concerning patient care. Implementing a tool to estimate patients' care needs promotes improved capacity management when it is based on patients' care needs instead of the traditional method based on bed occupancy in a department.

Resource planning at the hospital and in the wards should follow a cyclic Plan-Do-Control-Adjust process, which requires continuous use of data to adjust plans in both the short and long term. The project has designed the following cyclic process, see Figure 5-1:

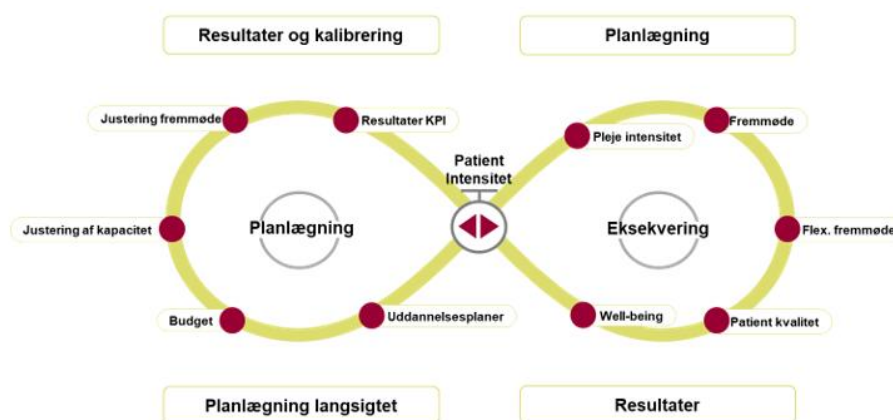


Figure 5-1 Planning model that cyclically ensures planning, control, and follow-up

The starting point is that patient intensity is assessed at least once daily, and preferably several times. The process has several phases that are implemented in different cycles. The right side of the model is focused on execution, while the left side focuses on planning. The starting point for the model is an approved budget, including approved attendance profiles, shift schedules, and available resources. With this as a starting point, the model runs through different cycles:

- **Patient intensity:** Daily assessment of patients' care needs through a system for measuring patient intensity and workload.

- **Cycle 1 - Daily staffing:** Evaluation of necessary staffing in wards and the hospital for the next 24-48 hours. Flexible resources are allocated as needed, based on the difference between patient intensity and nurses in attendance. It is also assessed whether additional resources should be called in for the coming days.
- **Cycle 2 - Weekly quality:** Evaluation of patient quality and employee engagement at weekly stand-up meetings to adjust processes and plans.
- **Cycles 3, 4, and 5 - Monthly, quarterly, and annual adjustments:** Accumulated results on patient quality, well-being, patient intensity, occupancy, and attendance are used for follow-up and adjustment of attendance profiles and capacity plans. This occurs monthly, quarterly, and annually. Annual budget allocations for wards and flexible resource pools are also adjusted.

The goal of implementing daily resource leveling on hospital wards is to ensure optimal alignment between available resources and hospitalized patients through a triangulation of patients' care needs, nurses' competencies, and a professional assessment from a leading nurse of admitted patients and nursing staff on duty. Plans and budgets should be continuously leveled to accommodate changes in patient flow and care intensity. It is essential to focus on cross-functional collaboration, motivation, and well-being to support flexibility, education, and skill development, which creates a work environment where employees can deliver quality care and expect well-being and engagement, contributing to efficient and sustainable resource allocation in the hospital.

The project, in collaboration with employees at Regionshospitalet Gødstrup and primary stakeholders, has developed a framework that, through implementation and transformation of a series of processes, creates increased coherence and transparency between management and the daily operation of patient care.

The framework is based on information about patient intensity and care needs and describes several interconnected organizational elements that should be adjusted and implemented in a transformation process.

The aim is to improve the use of knowledge and data as well as consideration of patients' conditions in daily practice. The elements in the framework are interconnected and necessary to achieve a transformation from the current situation to a situation where patients' care needs are matched by nursing staff. The framework consists of four overall governing elements: Governance, organization, KPI & reporting, and leadership. In addition, there are eight defined sub-elements: quality indicators, well-being and motivation, budget, capacity, daily adjustment of staffing, processes, education and training, and competencies. Based on patient intensity, the



goals for patient quality, well-being, and economy must be achieved. The table below summarizes the main recommendations, findings, and elements of the nurse staffing framework.

Elements	Description
Organization	Regionshospitalet Gødstrup should establish a central-decentralized planning structure. The central function should continuously analyze patient flow and intensity to improve daily staffing and capacity utilization, while the decentralized function will take care of shift plans and ensure a balance between work and personal life for employees.
Governance	Regionshospitalet Gødstrup should establish a governance structure around patient intensity, quality indicators, and well-being to ensure coherence across the elements in the framework.
KPI & Reporting	Reporting should be done both through the existing BI portal and by more visual methods, involving employees. KPI and reporting should be actively used in the individual wards in the future. Thus, it should be an essential part of the culture that wards continuously see results and initiate improvements in the wards together with the leader. This helps to increase involvement, motivation, and the importance of working together on common goals in the team.
Leadership	Leadership is the foundation for organizational change and requires leaders who will lead the transformation and provide the necessary resources. Leadership is a modern management approach that is dialogue-based and grounded in trust, dialogue, and belief in the employee's inner motivation to solve challenges. The relationship between leader and employee is essential, and leaders should stimulate employees' inner motivation by listening, inspiring, and convincing rather than dictating and forcing opinions on them. Leadership is about expanding the capacity to adapt to current and future changes in the organization. Control can be used to create an overview and ensure progress in projects, and the management approach can be justified in some cases. Leadership is supported by the MED-system and the involvement of employees, serving as a starting point for collaboration between managers and employees, particularly during changes.
Budget	The current budget model is based on the average occupancy rate within each department. In the future, patient intensity should also be included in budgeting to ensure that departments with increased patient demands (high-intensity patients) are allocated more resources. By including patient intensity, possibly adjusting norm periods, optimizing resource allocation based on workload, and evaluating resources in different cycles, hospitals can achieve a more nuanced and efficient budget model that meets both patients' and employees' needs and improves overall performance and quality of care.

Capacity	Capacity management ensures that all organizational activities are included in a department's overall calculation of available hours, assessing compliance with estimated attendance profiles and employee well-being. To ensure this, capacity management should include a capacity model that considers hires, retirements, vacation, illness, holidays, education, skills development, and meetings. The purpose is to assess whether activities can be carried out, plan holidays, absences, substitutes, and hires.
Daily Staffing Adjustment	With the implementation of a patient classification tool, the daily capacity conference should be based on a triangulation of the total patient intensity in the departments. Triangulation of patient intensity has three elements that need to be assessed daily: demand (patient intensity), capacity (beds, presence, competencies, etc.), and professional judgment (evaluation by head nurse). The process around the daily capacity conference should follow an outlined process with capacity assessment, overview of patient intensity, and professional assessment. The capacity conference should provide an overall overview and decisions on resource leveling, with hospital management responsible for the conclusions. Daily staffing adjustments should be made through the establishment of flexible resources, which can be established in various ways. This has been addressed with scenarios in the project.
Processes	It is recommended that processes related to patient treatment be standardized between departments. Processes that can be standardized include, among others, ward rounds, medication, documentation, use of Klinik Logistik board, recruitment, onboarding, development interviews and performance reviews, education and skills development, team meetings, distribution of daily tasks and patients, roles, and team structures. A standardization process should follow a best-practice approach with the most effective processes implemented in the hospital, while taking into consideration the differences that are justified by professional expertise and specialties.
Competencies	The overview and transparency of competencies are essential to ensure clear descriptions of staff competencies (basic, primary, and secondary patient care competencies) are documented in a way that provides a comprehensive view across departments.
Education & Training	Each ward should have education plans for both new employees and those who will ensure flexibility across wards. The education plans should document how new nursing staff are trained, educated, and prepared for the specialized level. Additionally, the education plans can describe how nursing staff from other wards can be educated and trained to a basic level, allowing them to safely perform tasks in the ward. Finally, a structured hiring process should be established where new employees are hired in fixed periods throughout the year, followed by structured continuing education in their respective specialties.

<p>Well-being & Motivation</p>	<p>To ensure well-being and motivation among employees, it is recommended to increase the frequency of measurements compared to the current process. Management should ensure daily recording of employees' workday evaluations and correlate these data with information about patient intensity, attendance, and occupancy rate. This will give management a better understanding of employee well-being and motivation and enable continuous improvement of the work environment. Moreover, in-depth assessments of employee engagement should be conducted monthly or quarterly to identify and focus on areas that ensure the fulfillment of employees' basic and growth needs in the workplace. Management should monitor well-being and motivation and work to ensure improvements, while hospital management ensures that individual ward managers follow up on results and continuously work to improve job satisfaction and well-being.</p>
<p>Quality Indicators</p>	<p>To monitor and improve the quality of patient care, it is crucial to have clear quality indicators. These indicators should be measured and reported to both management and ward managers so that the impact of staffing in relation to patient intensity can be closely monitored. Continuous improvement initiatives should be implemented to prevent low quality and adverse events. In case of repeated low-quality indicators, ward management should develop action plans. National clinical quality databases can also be incorporated into management's quality indicators.</p>

As described earlier, the variation between admitted patients and nursing staff present is crucial to assess daily, in order create a safe nursing staff level. The need for daily leveling and the desired flexibility remain important themes, particularly since care intensity cannot currently be measures. To assess the need for daily leveling, when implementing the developed framework, there is a need for continuous adjustment of the present capacity between wards, based on the number of admitted patients and the care needs of each individual patient. The starting point for adjusting between wards is that there are sufficient resources present in each ward. To evaluate the scope of a changed setup where resources need to be continuously leveled between wards, a simple analysis was conducted based on data from the second quarter of 2022. This analysis, founded on the number of admitted patients, calculates over- or understaffing expressed in care hours, assuming each ward is staffed based on the average attendance hour-by-hour throughout the quarter.

The analysis demonstrates variations in the number of admitted patients, resulting in periods with either more or fewer patients admitted. Using the allocation of 5.3 hours per patient per day, the total variance in hours and care hours can be calculated. For instance, if 19.5 patients are admitted for all hours of a day, and the average for the entire period is 18 patients, this would result in a deficit equivalent to 1.5 patients, which corresponds to a shortage of 7.95 care hours per day.

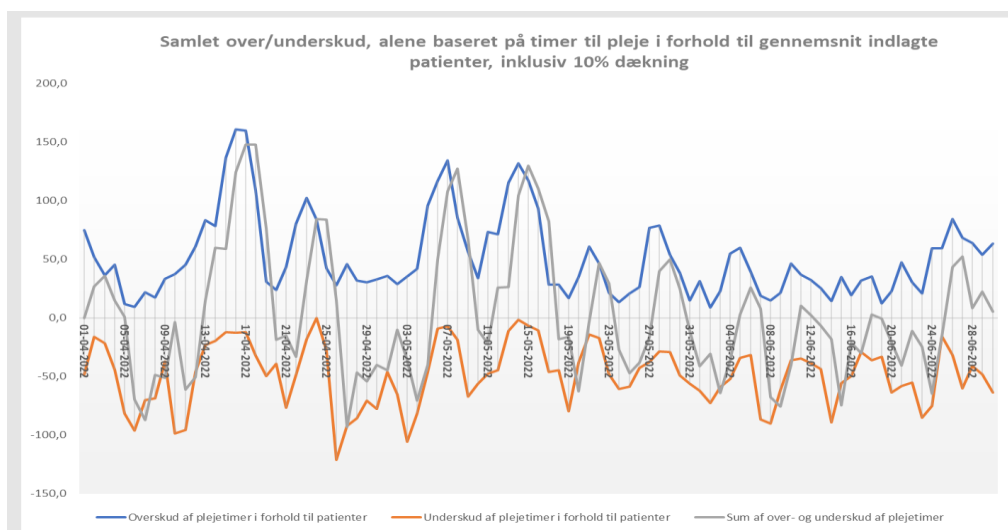


Figure 5.2: Continuous surplus and deficit of care hours in Q2 2022. Surplus and deficit are calculated solely based on the average number of admitted patients per hour during the quarter and do not take into account the actual attendance of nursing staff or patient intensity. In the figure above, deviations of less than 10% relative to the average are excluded. The gray graph in the chart represents the sum of the blue and orange graphs.

It is important to note that the graphs do not include information about the actual attendance of nursing staff, patient intensity, etc. Therefore, it cannot be concluded whether overstaffing or understaffing exists. The graphs solely show the need to move care hours, based on the variance in admitted patients, calculated from the average in Q2 2022.

Given that the graph above does not contain data on the actual attendance of nursing staff or patients' care needs, it cannot be determined whether there are too many or too few nursing staff presents. However, the figures highlight the need for flexibility in being able to relocate staff between wards to accommodate wards with more or fewer patients admitted. It is crucial to emphasize that experiences with measuring patient intensity and planning accordingly will likely contribute to better alignment between attendance and admitted patients. In Figure 5-2, the gray graph represents the sum of the blue and orange graphs.

Based on the graphs above, the need for flexible capacity can be assessed. The most significant negative deviation from the average (orange graph) is approximately 120 hours daily. Converted to employees on a day shift, this corresponds to about 60 hours or roughly 8-9 employees on a day shift, 5-6 employees on an evening shift, and about 2-3 employees on a night shift. The simple assessment, based solely on data for admitted patients in the second quarter of 2022, has indicated that in about 90% of the days in the quarter, it would have been necessary to move ten nurses between departments daily to accommodate the variance in the number of admitted patients, assuming the departments had been staffed correctly based on the accurate average.

The project outlined various scenarios, each describing different models for implementing the framework and the organizational elements affected by implementation. Scenarios serve as a learning process for participants and facilitate a shared understanding of potential future

development paths. They are used as an inspiration tool to uncover uncertainties and challenge conventional thinking within organizations, opening different future developments. By incorporating and applying scenarios into organizational development, decisions can avoid being based on oversimplified assessments that do not consider entire value chains.

The project evaluated a total of three different scenarios to achieve optimal distribution of patients, care needs, and the number of employees in attendance. Among these scenarios, the one featuring a flexible nursing team was identified as the most appropriate solution. This solution involves forming teams composed of nurses from existing departments, who are allocated daily to other departments to address any imbalances. This team can also serve as a specialized team for onboarding and training new nurses at the hospital before they choose their future specialization.

While there was general agreement on the chosen scenario, several factors must be considered for the final solution selection. The Danish Nurses Organization does not agree that the chosen scenario can be implemented as described, necessitating negotiations and a potential compromise between the Danish Nurses Organization and Regionshospitalet Gødstrup. As a result, the final solution may differ from the outlined scenarios.

Professor Jack Needleman ⁸participated in the project's concluding conference, where he highlighted various internationally recognized methods for achieving flexibility among nursing staff:

- **Cross-trained nurses:** These nurses are trained to work in different units or departments and can move between them depending on demand. However, this requires that there is no simultaneous high patient intensity or occupancy rate across the bed sections, and that there are no periods of high utilization of, for example, operating sections, which in turn require higher presence in recovery sections, etc.
- **Internal pool of part-time employees or on-call nurses:** This involves creating an internal pool of nurses who work part-time or are available on-call.
- **External temporary staffing agencies:** The hospital can collaborate with external temporary staffing agencies that provide temporary staff as needed. This can give the hospital access to a larger pool of labor that can be drawn upon when there is a need for extra staffing.

Jack Needleman also emphasized the importance of identifying the appropriate staffing level and the ability to be flexible around this level to accommodate varying patient intensity, patient flow, and occupancy rate. He identified two primary challenges in prioritized order:

- Determining the correct average level for optimal and safe staffing
- The ability to flex around the right average level, which involves:
 - Being able to increase staffing when patient intensity, patient flow, or occupancy rate is high

⁸ **Jack Needleman** Professor and Chair, Department of Health Policy and Management, UCLA Fielding School of Public Health. Conference Regionshospitalet Gødstrup 22. March 2023.

- Being able to lower staffing when patient intensity, patient flow, or occupancy rate is low

6 Systems and Solution Design

Through the assessment of good practice cases, it has been evaluated how other countries and hospitals have used systems to assess patients' care needs. From good practice cases, three primary systems have been identified: RAFAELA, SNCT (Safer Nursing Care Tool), and Trendcare.

Owing to companies' commercial rights, further investigation into the factors, calculation methods, and algorithms was not conducted. However, a fundamental similarity between the three systems was observed, as none rely on patient indicators but instead focus on methods that evaluate patients' needs through the assessment of care tasks. The systems also differ in their structure, affecting their usage for both prospective and retrospective assessment of care needs.

Through analyses and dialogues with system suppliers, examination of data in the electronic patient record, and workshops with leading nurses across several wards at Regionshospitalet Gødstrup, two foundational methods with the potential to create a data basis for calculating patients' care needs were identified. Initially, two basic methods were proposed:

1. **Patient Care Needs Assessment (PCNA):** Continuous assessment and registration of patients' care needs. With this method, nursing staff, based on work with the patient and the assessment of the upcoming day, indicate the expected care tasks as well as the scope and complexity of the tasks.
2. **Patient Indicator Assessment (PIA):** Continuous registration of patient indicators that provide the foundation for establishing mathematical relationships between patient indicators and care needs.

Based on several discussions with data experts at PwC and Central Region Denmark, as well as dialogue with Regionshospitalet Gødstrup, it was determined that there is no data basis of sufficient quality or volume to implement PIA as a method. Similarly, the electronic patient record is unsuitable for registering the required patient indicators multiple times a day due to the time-consuming and complex nature of registering these indicators. As a result, the preliminary recommendation is to select PCNA as the approach and foundational method for evaluating potential system solutions.

Patient intensity systems determine the necessary nursing care for each patient based on the individual patient's intensity level, nursing, and required tasks. These systems allocate resources according to patients' needs, rather than solely the number of patients or occupancy rate. This approach ensures that resources are allocated efficiently and tailored to the actual care needed by each individual patient. These systems can be generally categorized into three main groups:

- **Informal assessment of patient intensity:** This involves a subjective assessment of patient intensity, often conducted by department managers, coordinators, or similar

staff members. These assessments are based on their own experience and discretion rather than quantitative measurements.

- **Overall assessment – less refined evaluation:** These tools provide an overall assessment of patient intensity and care needs but are less detailed and sophisticated. These systems use patient intensity systems, such as Safer Nursing Care Tool (UK) and RAFAELA (FIN).
- **Systems for actual measurement of patient intensity and care needs:** These systems employ detailed clinical data for each patient during each shift and utilize algorithms adjusted for patient types and care models. This allows calculating the need for care in hours or minutes for each shift. The systems include Acuity Plus, Cerner Clairvia, TrendCare.

To achieve more efficient planning and resource allocation within individual departments and across departments, it is recommended to acquire a system for measuring patient intensity. A make/buy analysis has evaluated factors such as integration with the existing electronic patient record system, necessary data flow adjustments, implementation strategies that consider both internal and external variations, compliance with GDPR and Danish data protection regulations, and required investment costs. The evaluation also encompasses functionality, economy, strategy, and risk. Based on this analysis, it is recommended to acquire a system containing information about patient pathways and recommended care time, rather than undertaking extensive IT development.

Moreover, it is essential to determine whether Regionshospitalet Gødstrup can implement both the patient intensity system and the framework at a local level or if anchoring the project in Central Region Denmark and possibly involving other hospitals in the region is necessary. The initial recommendation is for the implementation of the patient intensity system to be carried out at the regional level, as it requires larger investments, IT integrations, and the utilization of data across data sources. Consequently, the region's IT architects, and IT organization should spearhead the implementation. The project has submitted a recommendation and application to the region's IT prioritization council (DIDA), and the final prioritization decision will be made in the upcoming months.

7 Implementation and Planning

To achieve the identified goals, it is essential to establish an organization and a governance plan that outlines which project activities are carried out, by whom, and when. Implementing the framework requires a particular emphasis on change management, as the changes impact a wide range of the organization. This includes implementing new processes and standardizing existing ones, introducing new tools, and altering work methods. Change management must support the organizational transformation and address technology, processes, and most importantly, assist and support the involved parties. Change management spans the entire implementation process, with the involvement of the MED committee as a critical prerequisite for a successful transformation. Process change not only concerns the process itself but also involves people. Ensuring the successful implementation of a new or revised process requires

understanding how people work and what it takes to change that, which is particularly challenging in a complex environment like the healthcare sector.

The framework's outer structure encompasses governance, organization, KPIs and reporting, and leadership, which shape the other framework elements. Establishing these governing elements ensures that all decisions are made contextually, and results are assessed, and initiatives launched, anchored with management. Introducing a tool for measuring patient intensity and creating structures around it aims to ensure coherence between all activities described in the framework and action plan. The governing elements should not be perceived as a bureaucratic process slowing down task resolution; rather, they should be viewed as a leadership and information structure that ensures cohesive management at all levels.

The framework's core comprises eight elements that directly impact nurse staffing assessment and resource allocation; thus, they must be systematically assessed and monitored at the department and organization levels. These elements consider the effects of nurse staffing and resource allocation on patient care to ensure proper and timely escalation, as well as efforts to safeguard patients and staff. While there is potential to include numerous factors, only the organizational elements that have the most significant impact on patient outcomes have been incorporated.

The project has developed a recommended three-year implementation plan for both the framework and the patient intensity tool. This plan follows a layer-by-layer approach, containing sub-projects such as pilot-and-roll-out, which allows for testing, evaluation, and adjustment of solutions before wider deployment, as well as ensuring that implementation occurs at a pace manageable for both the organization and the implementation program.

The implementation should proceed through synchronized project waves consisting of multiple prioritized projects and continuous planning between the waves to strengthen project execution maturity and resource prioritization. The projects should be executed using a PADIS approach⁹ or similar, where projects are planned and executed in waves with a duration of 12-14 weeks.

In the recommendations, it is noted that dialogue and negotiation should be conducted with the Danish Nurses Organization, Regionshospitalet Gødstrup, and possibly Danish Regions to determine a potential solution for the desired flexible nursing resources. The solution agreed upon by the parties will form the basis for launching pilot projects focusing on the new organization of flexible resources, supported by the patient intensity tool and the evidence-based data generated by the tool. While the dialogue is ongoing, no definitive solution has been established by the end of this project. However, a trial action has been initiated, testing a setup with flexible nurses.

Another trial action has been launched, testing methodology and simple patient classification in specific sections. This trial action aims to uncover the potential of patient classification and its utilization for distributing patients among attending staff, ensuring a balanced and uniform daily care workload among all nurses. Alongside this trial action, the possibility of data collection via Klinisk Logistik, Regionshospitalet Gødstrup's system for logistical patient

⁹ PADIS – Plan, Analyze, Design, Implement, Sustain

management that ensures transparency, collaboration, and an overview within and between inpatient wards, is being explored.

The trial actions are considered potential solutions and thus serve as the foundation for future implementation of the full framework at the hospital. As they can set a precedent for implementing the framework and patient intensity tool in Danish hospitals, it is crucial that management explores how elements of the framework and patient intensity tool can be anchored at Central Region Denmark to ensure prioritization, resources, and successful implementation of a patient intensity tool.

To initiate the implementation of the framework, several activities should be launched, providing the foundation for further work with implementation. The following projects should be started immediately, as they partially define the final solution and consequently the implementation of the framework:

- **Establishment of PMO organization** – A project organization should be established to ensure transformation and implementation at Regionshospitalet Gødstrup.
- **Trial action of tool to assessing patient intensity**, which is already initiated in the surgical ward and is expected to be expanded to 1-2 medical wards. The trial action should uncover the usability and value of the PI method with a simpler setup than, for example, Trendcare, including expanding Klinisk Logistik to contain and collect data. The trial action is seen as an informal assessment of patient intensity.
- **Selection and sourcing of IT system** as a patient intensity tool at the hospital. The patient intensity tool should be selected and purchased in collaboration with the region's IT. Therefore, submission and prioritization with DIDA are necessary so that the hospital alone does not define and possibly purchase and implement an IT system.
- **Negotiation between the Danish Nurses Organization and Regionshospitalet Gødstrup** on the framework and content for solutions on flexible nurses and the local agreement that should apply to the affected employees.
- **Trial action on flexible nurses, such as a flexible midwife**, where it is assessed whether the solution being tested in the midwifery area is also suitable for inpatient wards.
- **Education and training** - trial action on structured/systematized employment processes, which has already been initiated successfully, with 22 new nurses employed with simultaneous start-up in the medical area.

After the completion of wave 1, projects for the next project wave should be prioritized immediately. The content in the next wave is clearly related to the first wave and the results created here. Projects in wave 2 are assessed to possibly include:

- **Trial action of tool to assess patient intensity:** Continuation of the trial action and expansion to more inpatient wards.

- **Selection and sourcing of PI-Tool:** Submission to DIDA, including the final choice of whether to develop or purchase a system, as well as negotiation and purchase of the IT system.
- **Budget adjustment:** Through assessment and calculation of any seasonal variations, possible adjustments of the norm periods, and better, more flexible, and specific adjustment of the attendance profile.
- **Trial action on flexible nurses, such as a flexible midwife (continuation from wave 1):** Assessment of whether the solution being tested in the midwifery area is also suitable for inpatient wards.
- **Capacity:** Establishment of a coherent capacity plan - activities, vacation, training... Monthly calculation of the capacity plan (Norm time surplus/deficit).
- **Quality indicators (pilot):** Development of a dashboard and reporting with the selected quality indicators.
- **Well-being and motivation (trial action):** Testing and assessment of the suitability of the platform, selected questions, and validation of the effect of other initiated trial actions and pilot projects.

The project has thus defined a project plan with a series of projects expected to run in the next 2-3 years before all elements of the framework are implemented, and the organization and all inpatient wards are transformed.

8 Conclusion, Perspective, and Next Steps

The project concluded with a conference where invited specialists contributed their knowledge and experience in the field, presenting research findings that supported the project's objectives and results.

Needleman et al. (2011)¹⁰ demonstrated that the level of professional nurse staffing matters. Utilizing care personnel without adequate education or time for care leads to increased unwanted events such as infections, falls, pressure ulcers, and deaths, as well as longer hospital stays.

Martsof et al. (2014) concluded that increased staffing paid for itself¹¹, as increases in nurse staffing were associated with reductions in nursing-sensitive adverse events and length of stay but did not lead to increases in patient care costs.

Needleman et al. (2011) thus concluded the following about costs and cost offsets with adequate staffing:

- There are strong arguments for nursing as the core delivery of care in hospitals, with appropriate levels of care and skill mix, which are associated with shorter hospital stays, fewer hospital-acquired complications, fewer readmissions, and fewer deaths among

¹⁰ Needleman et al., 2011: Nurse staffing and inpatient hospital mortality, March 2011

¹¹ Martsof et al., "Examining the value of inpatient nurse staffing: an assessment of quality and patient care costs," Medical Care, 2014

inpatients. However, this is not valued, as the full extent of nurses' work is not understood.

- The economic costs of adequate staffing are modest, approaching zero when cost offsets are considered.
 - Attempts to "de-skill" nursing by replacing registered nurses with less-educated care personnel will increase costs rather than save costs, due to longer stays, unwanted events, and readmissions.
 - Net costs per death avoided are within the range of acceptable cost-effectiveness levels.

Furthermore, Jack Needleman emphasized the importance and need to measure patient intensity and overall care needs, particularly when flexibility is required. Patient intensity systems determine the necessary nursing care for each patient based on the level of intensity, nursing, and tasks required for each patient. These systems allocate resources based on patients' needs rather than the number of patients or occupancy rate. In this way, resources are allocated efficiently and tailored to the actual care required for each individual patient. However, it is highlighted that the system itself is not the most critical element, but rather the value and results generated through the effective use of data to find correlations between patient intensity, appropriate average staffing, flexible resources, and management and control in the hospital.

From the concluding conference and the contributions of the international experts who participated in the conference¹², the following can be summarized:

- Research shows clear evidence that the correct mix between professional groups affects the quality of care. A mix with a minimum of 80% nurses is recommended, and the number of nurses has an significant impact on care outcomes.
- A national standard for minimum staffing in relation to patients and their care needs should be established, as well as the development of methods for assessing patient intensity and, consequently, the need for care resources.
- Safe Nurse Staffing should be implemented at a national level, as the overall necessary transformation cannot be achieved locally. However, the Regionshospitalet Gødstrup should continue its implementation and thus serve as a pilot project for the establishment of a regional and national standard.
- Ensuring safe care should be achieved through the establishment of the correct average staffing level, based on data and evidence, followed by methods for flexible adjustment according to variance.
- The economic costs of adequate average staffing are modest, approaching zero when cost offsets are taken into account. There are strong arguments for nursing as a core delivery of care in hospitals, with appropriate levels of care and skill mix, being associated with shorter hospital stays, fewer hospital-acquired complications, fewer readmissions, and fewer deaths among inpatients.

¹² **Sinead Lardner** National Lead for Safe Nurse Staffing and Skill Mix, Ireland. **Koen van den Heede** Expert Health Services Research, KCE Belgium. **Jonathan Daniel Drennan** Professor of Nursing and Health Services Research at University College Cork. **Jack Needleman** Professor and chairman, Department of Health Policy and Management, UCLA Fielding School of Public Health.

The overall recommendation from the project is divided into two primary recommendations. It is assessed that there should be continued work on a local implementation of the framework and patient intensity tool, while nationally there should be an effort to establish levels for safe care staffing.

Local implementation: Regionshospitalet Gødstrup should initiate the implementation of the framework, which contains elements that can improve the hospital's working environment. However, one of the weaknesses of the framework is that implementation partially requires a patient intensity tool to provide an overview of individual patients and the overall care needs of all inpatients. Currently, Regionshospitalet Gødstrup cannot implement a patient intensity tool on its own, but should continue to expand the use of existing simple methods to more departments, as they can provide transparency and thus assist management in the decision-making process regarding staffing, scheduling, etc. The analysis has identified several weaknesses in the current setup that can be improved through a program-driven transformation, where management, professional organizations, and employees collaborate to enhance the situation at Regionshospitalet Gødstrup.

Throughout the project, it has been consistently noted that overall staffing at the hospital is insufficient, that there are challenges in recruiting new employees, and that the working environment suffers due to a lack of staff. By implementing the framework with simple patient intensity systems, increased transparency can be achieved in relation to inpatients, their care needs, and staff attendance.

In parallel with the implementation of the framework at Regionshospitalet Gødstrup, it should be prioritized at the regional level to acquire an actual patient intensity tool. The project, through dialogue with the Irish program on "Safe Nursing Staffing," has become acquainted with Trendcare, a system for measuring patient intensity and care needs. This system uses detailed clinical data for each patient on each shift and employs algorithms adjusted for patient types and care models. This allows the calculation of care needs in hours or minutes for each individual shift and patient. The project has recommended initially purchasing a patient classification system rather than developing one. Therefore, the choice, purchase, and implementation should take place at the regional level, ensuring better integration, scalability to other hospitals in the region, data security, and the use of data through the region's BI systems.

The local goal should be to establish evidence-based standards for the average number of care staff that should be present and to establish flexible agreements that ensure variances in inpatients and their care needs can be addressed. This should, in turn, ensure the establishment of safe staffing and a culture where the right staffing is in focus, creating a satisfactory working environment at the hospital. The hope is that Regionshospitalet Gødstrup, with an improved working environment, can hire the necessary number of care staff, which in turn positively affects the working environment. In this way, it is hoped that a positive cycle can be established around the hospital and the nursing profession, creating a safe environment for patients and staff.

National anchoring: Numerous studies using a wide range of methods and outcomes have demonstrated that the level of professional nurse staffing matters¹³. Utilizing care staff without adequate education or time for care leads to increases in adverse events such as infections, falls, pressure sores, and deaths, as well as longer hospital stays.

Furthermore, it has been shown that increased staffing pays for itself¹⁴. Increases in nurse staffing were associated with reductions in nursing-sensitive adverse events and hospitalization time but did not lead to increases in patient care costs. Altering the skill mix by increasing the number of registered nurses as a proportion of care staff led to reductions in costs.

Experiences from a similar national program in Ireland included a significant reduction in the use of temporary staff as a result of implementing the recommendations in their framework. Across three research phases, the care points most frequently reported as "not implemented" were comfort/conversation with patients and teaching patients and/or family. The tasks least frequently accomplished during a shift were pain management and implementation of treatments/procedures.

Thus, there are compelling arguments for nationally establishing a minimum standard for the number of nurses present in relation to the number of patients and their care needs at all hospitals in Denmark. The project at Regionshospitalet Gødstrup has demonstrated a direction, including a framework based on a patient intensity tool that can be scaled and used nationally to establish a standard for minimum staffing, supported by evidence on care staffing, adverse events, hospitalization time, and deaths resulting from inappropriate staffing.

The goal of scaling the project to a national level should be to ensure that national standards and methods for ensuring quality and working environment are established at Danish hospitals. By guaranteeing minimum levels through an established national structure, it is also possible to continuously collect new innovative methods across hospitals.

9 Activities planned

The continued implementation of the framework at Regionshospital Gødstrup, as well as expansion to other hospitals in Central Region Denmark, has not been decided at the end of the project. The proposed activities in form of pilot projects, foundation activities and the establishment of a project organization, see section 7, lack an approval before the next activities can be planned.

¹³ Jack Needleman, Conference Regionshospital Gødstrup, 22-March-2023

¹⁴ Martsolf et al., "Examining the value of inpatient nurse staffing: an assessment of quality and patient care costs," *Medical Care*, 2014

The national decisions of the project, including the national establishment of safe nurse minimum standards, is not something the project is actively working on. In Denmark, with its current structure, with five regions, it is a very big and political task to influence the national political debate, with solutions like the one designed in this project. The influence of national political decisions can take many years, just as the influence of regions other than Central Region Denmark is also made difficult by the decentralized political structure.

Attempts are still being made to present the project and the results from the project to the Robustness Commission, to start an initial national dialogue about the need to establish Danish levels for safe nurse staffing.

Specifically, the following activities are planned at Regionshospital Gødstrup:

Activity	Description	Deadline
Management decision	Decision regarding continuation of implementation of the project in Regionshospital Gødstrup. The hospital management must decide the scope and timetable for continued implementation of the project, including IT implementation	May 2023
Next step - planning	Planning next step, including continued involvement of consultants or Regional central project organization, as well as structure of the PMO	May 2023
Continued trials	Continuation of trial action, evaluation of results on the Surgical and Medical Wards	June 2023
Expansion of patient intensity measurement in additional wards	Expansion to other wards, to use patient intensity measurement, on the basis of trial action in surgical and medical wards. Concretely, it is the Midwife section that is included in the trial process for testing the measurement of patient intensity	June 2023
IT support for trial actions	Enhancement (Development) of Clinical Logistics to collect data, as well as the possibility of reporting, so that Patient intensity measurement can be used for reporting, data analytics etc.	June 2023
Trendcare demonstration	Live demonstration of Trendcare at Regionshospital Gødstrup, with the participation of specialists from Trendcare, and selected managers and nurses from the hospital	July 2023
Continued well-being surveys	Establishment of a platform, questions, and initiation of continuous measurement of well-being and motivation	August 2023
Trial action flexible nurses	Decision on the establishment of a pre-pilot for flexible nurses, in collaboration with the Danish Nursing association, including a possible setup which can be used for the final solution	August 2023

Annex I – Delivery’s in the project

The following reports and documents are delivered throughout the project:

Delivery 1 - Inception	Deliverable1_Inception report_DK Deliverable1_Inception report_ENG Appendix I Evidence-based Nurse Staffing Presentation
Delivery 2 – Situation Analysis	Deliverable2_situation_analysis_DK Deliverable2_situation_analysis_ENG Interviewguide_CDR (Danish. Excel)
Delivery 3 – Good Practice Case	Deliverable3_good_practice_case_report_DK Deliverable3_good_practice_case_report_ENG
Delivery 4 - Consensus Report	Deliverable4_consensus_report_DK Deliverable4_consensus_report_ENG
Delivery 5 – Scenario Report	Deliverable5_scenario_report_DK Deliverable5_scenario_report_UK Appendix3_actionplan (Excel)
Delivery 6 – IT Solution	Delivery6_IT Løsningsdesign_DK Delivery6_IT_Solution_design_ENG Appendix 2.1 PwC EBNS - Make-Buy Assessment Appendix 2.2 PwC EBNS - Make Economic Assesment - V 2.0 Appendix 2.3 PwC EBNS - Buy Economic Assesment - V 2.0 EBNS - Make-Buy Economic Assessment (Power Point)
Delivery 7 – Communications and Information	Delivery7_Kommunikation og information DK Delivery7_Communication and Information ENG Appendix I Evidence-based Nurse Staffing Presentation FactSheet_v2.0_DK FactSheet_v2.0-ENG Kernefortælling_Flyer_V2_DK Kernefortælling_Flyer_V2_EN Public project brief final EBNS_project_summary_ENG (Power point) Translation_Nursestaffing_DGReform
Delivery 8 – Final Project Report	Delivery8_Final_Projekt_Report_DK Delivery8_Final_Project_Report_ENG



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