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## Use of Medical Protocols to Improve the Hospital Length of Stay and Quality of Care

### Αξιοποίηση Ιατρικών Πρωτοκόλλων για τη Βελτίωση του Χρόνου Παραμονής και της Ποιότητας στη Νοσηλεία Ασθενών

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#### ABSTRACT

Improving the quality of patient care includes measures to reduce hospitalisation time and improve recovery conditions and consequently patient safety during their stay in the hospital. The most common complications that arise during the nursing of patients in hospitals, which lead to extended length of stay, are hospital-acquired infections and thrombotic events. In our efforts, as the Naousa General Hospital, to reduce the incidence of these complications, we proceeded to the creation of specialized medical protocols for their prevention, early diagnosis, and treatment. We recorded measurements and results of improvements in various cases and different implementation times of medical protocols and processed the collected data with specific statistical indicators. Through the statistical analysis of the data recorded, we found significant benefits and a noticeable improvement in key performance and quality indicators in the overall conditions of hospitalisation of patients. We conclude that by applying and utilizing specific medical protocols and monitoring their results, we can reduce the incidence of hospital-acquired infections and thrombosis, thus we achieve to reduce the average length of stay in our hospital and increase the overall quality and safety of care. Our findings clearly indicate that investment of human and financial resources in the development, evolution, and proper application of protocols can have multiple benefits, both to patients and hospital organisations.

**Keywords:** *hospitalisation, Hospital Length of Stay, guidelines, quality, hospital-acquired infections, thrombosis*

#### ΠΕΡΙΛΗΨΗ

Η βελτίωση της ποιότητας στη νοσηλεία των ασθενών περιλαμβάνει μέτρα για τη μείωση του χρόνου και για τη βελτίωση των συνθηκών νοσηλείας και, κατ' επέκταση, την ασφάλεια κατά την παραμονή στο νοσοκομείο. Οι συχνότερες επιπλοκές που προκύπτουν κατά τη διάρκεια νοσηλείας ασθενών σε νοσηλευτικά ιδρύματα και οδηγούν στην παράταση του ελάχιστου χρόνου παραμονής τους σε αυτά, είναι οι ενδονοσοκομειακές λοιμώξεις και τα θρομβωτικά επεισόδια. Στην προσπάθεια μας να περιορίσουμε τη συχνότητα εμφάνισης των επιπλοκών αυτών στο Γενικό Νοσοκομείο Νάουσας, προχωρήσαμε στη δημιουργία εξειδικευμένων ιατρικών πρωτοκόλλων για την πρόληψη, την έγκαιρη διάγνωση και την αντιμετώπισή τους. Καταγράψαμε μετρήσεις και αποτελέσματα βελτιώσεων σε ποικίλα περιστατικά και διαφορετικούς χρόνους εφαρμογής των ιατρικών πρωτοκόλλων και επεξεργαστήκαμε τα συγκεντρωμένα στοιχεία που προέκυψαν, με συγκεκριμένους στατιστικούς δείκτες. Μέσα από τη στατιστική ανάλυση των δεδομένων που καταγράφηκαν διαπιστώσαμε σημαντικά οφέλη και αισθητή βελτίωση των ποιοτικών δεικτών στις συνολικές συνθήκες νοσηλείας ασθενών. Συμπεραίνουμε πως, με την εφαρμογή και αξιοποίηση συγκεκριμένων ιατρικών πρωτοκόλλων και την παρακολούθηση των αποτελεσμάτων τους, μπορούμε να μειώσουμε τη συχνότητα ενδονοσοκομειακών λοιμώξεων και θρομβώσεων, μειώνοντας έτσι σημαντικά τους μέσους όρους χρόνων νοσηλείας των ασθενών, ενώ ταυτόχρονα αυξάνουμε συνολικά την ποιότητα και ασφάλεια στην παρεχόμενη φροντίδα υγείας. Η επένδυση ανθρώπινων και οικονομικών πόρων στη θέσπιση, επικαιροποίηση και άρτια εφαρμογή πρωτοκόλλων μπορεί να έχει πολλαπλά οφέλη, τόσο στους ασθενείς όσο και στη συνολική λειτουργία του νοσοκομείου.

**Λέξεις κλειδιά:** *νοσηλεία, διάρκεια νοσηλείας, πρωτόκολλα, ποιότητα, ενδονοσοκομειακές λοιμώξεις, θρομβώσεις*





## INTRODUCTION

The quality of patient care clearly depends on the conditions of care, such as the cleanliness of hospital rooms, the courtesy of the staff, and the speed and frequency of services provided, it is however always inextricably linked to the time required for the patient to stay hospitalised until his condition is fully processed, i.e., the time of care. Important studies have been carried out worldwide, in search of the "golden ratio", the ideal hospitalization time, i.e., during which the diagnostic and therapeutic process can be completed, but without the patient's stay increasing the risk of complications and excessively burdening him and the Health System itself. This is because even when a patient receives care in ideal hotel infrastructures and with the most excellent staff in a hospital, the extension of the hospitalisation time is a source of stress and discomfort and a frequent source of complaints. Mainly, however, the extension of hospitalisation time leads to an increased possibility of further complications, which can sometimes lead to a bad outcome. Multi-day hospitalisations, however, also have consequences for the health system, as they cause fatigue to the staff, the possibility of human errors increases, beds are deprived, and the ever-increasing resource allocation for patients, results often in further degradation of health services.<sup>1</sup>

Hospital-acquired infections are responsible for approximately 1000 patient deaths per year.<sup>2</sup> On average, they occur with a frequency of 9% in Greece, and 6% in Europe, while in Intensive Care Units (ICUs) it reaches 55%.<sup>3,4</sup> In older patients, infections are the main cause of their deterioration and death during their hospitalisation, as their already burdened health condition makes them particularly vulnerable to adverse drug reactions.<sup>5</sup> It has been observed that especially in post-surgery hospital-acquired infections, the length of stay can be extended up to 32 days while the mortality rates increase significantly.<sup>6</sup> In addition, there is a need to administer more powerful antibiotics, increasing the chances of complications and prolonging patients' hospital stays even longer.<sup>7</sup> The extended stay becomes associated with an extended feeling of pain, reduced mobility, patient uncertainty about their outcome, and chances of returning to the housing environment familiar to them, and ultimately brings doubt to the patients regarding the health institution that hospitalizes them and its ability to provide quality services.

The prolonged bed rest and reduced mobility that the stay in the hospital entails, the incidents of fever and dehydration, the repeated catheterisations and venipunctures alongside the disease itself for which the patient is being hospitalised often lead to an emergent cause of prolonged stay and deterioration of hospitalisation, which is none other than thrombosis. The risk of thrombosis in hospitalised patients is 100 times higher compared to the general population. In Europe, it is estimated at 3.65%-14.9% of hospitalised patients.<sup>8</sup> It affects up to 60% of hospitalised patients in surgical clinics and 40% in pathological ones and is a significant cause of increased mortality and

patient suffering. One in ten deaths during hospitalisation is due to thrombosis.<sup>2</sup> However, up to 70% of those can be prevented. The fact that the impact of thrombosis varies significantly from country to country, reflects exactly the effect that specific measures such as medical protocols and improved workflows can have in reducing their frequency. This is a complication that has been particularly studied during the pandemic, as CoViD-19 infection has been linked to an increased incidence of thrombosis. Comparative studies with other respiratory infections showed that similar risk is found in those as well, although in a smaller proportion, but not negligible, and in particular calculated at 2.8% for arterial thrombosis (heart attack or stroke) and 5% for venous thrombosis.<sup>9</sup> We understand now that thrombosis is almost impossible to eliminate, as many diseases have an inherent thrombogenic effect, such as sepsis, surgical diseases, or cancer, where the risk of thrombosis increases by 4.5-6 times.<sup>10</sup> However, there are ways to significantly reduce the danger. Extensive studies at John Hopkins Hospital showed that thrombosis was the 3rd leading cause of patient deterioration and length of stay. This led health staff towards the improvement of medical protocols which involved up to an 85% increase in thromboprophylaxis administered measures, resulting in a significant reduction (67%) of emergent thrombosis incidents.<sup>11, 12</sup>

## AIM

Our purpose was to investigate whether the patient's length of stay in the hospital affects the quality of her/his hospitalisation, the ways through which the duration of hospitalisation could be reduced and, in particular, what effect the implementation of medical protocols would have in this direction, in order to immediately achieve the improvement of the quality of care.

## METHODS

By leveraging the literature information on the causes of prolonged hospitalisation and patient readmissions, but also by extending and optimizing - in many cases - the guidelines and protocols established during the CoViD-19 pandemic, we introduced improvements in a systematic way.

An important catalyst came from the policies of digital transformation and the digital patient file that are implemented and used in our hospital. The easy and quick access to the patient's history, the global picture of coexisting conditions or additional risk factors such as thrombophilia or immunosuppression, history of previous hospitalisations, and antibiotic use, enabled us to start antibiotic and antithrombotic treatment in a timely and appropriate manner, thus reducing the required days of hospitalisation.<sup>1,13</sup> In addition, it contributed to the more synchronized collaboration of physicians of various specialties, for the appropriate handling of complex cases, it facilitated medical staff collaboration and reduced the necessity for inpatient transfers, leading to less disruption of patients and a





reduction in hospitalisation time.

Above all, however, it contributed to the continuous evaluation of key performance indicators and identification of the necessary improvement actions, leading to a revision of clinical habits, workflows, and protocols. It was this very creation and implementation of modern protocols for dealing with infections, and protocols for administration of anticoagulation and transfusions that significantly increased the efficiency of clinical staff decisions and reduced human errors in medical and nursing operations, further improving the quality of the care provided. These protocols include detailed instructions for each case, as briefly stated below.

A. The hospital-acquired infection protocol is based on the current legislation (Ministerial Decisions, Health Provisions, Circulars) and International-National guidelines (Hellenic National Public Health Organization/EODY, World Health Organisation/WHO, Centers for Disease Control and Prevention/CDC). However, emphasis is placed on 4 main pillars:

#### A.1 HISTORY :

- History of previous hospitalisation, antibiotics administered (in the last 3 months), visit or stay in a tertiary hospital in the previous period.
- History of administration of corticoids - immunosuppressive treatment
- History of recent surgery
- History of diabetes, heart disease, congenital diseases, etc.

#### A.2 OBSERVATION :

- Cultures (blood, urine, pharyngeal smear, etc.) upon admission of a patient with fever and during hospitalisation until a sterile culture result. Particular emphasis is placed on the correct way of obtaining cultures of biological materials and handling samples, to avoid false negative cultures or contamination.
- Surveillance for surgical wound infections - overview - blind incision cultures
- Resistant microbes (immediate isolation of the patient) surveillance for the possible presence of the resistant strain in other patients - cultures of materials from patients and surfaces (knobs, bedside tables, etc.)
- Monitoring the consumption of antibiotics (especially sensitive ones such as carbapenems, colimycin), frequency of alternate administration in the same patient, rates of their combined administration
- In the event of personnel injury with a used sharp object or exposure to biological material, immediate incident reporting, laboratory testing and application of the relevant protocol.

#### A.3 DISINFECTION-CLEANNESS:

- Control for careful cleaning, and disinfection of hospital wards and operating rooms. Limiting infections is mainly achieved by the reverent application of measures to control their spread, as was seen during the pandemic. The correct application of antiseptics rules, the careful washing and disinfection of hands, the correct placement and use of uniforms and masks, and the regular

disinfection of surfaces lead to shorter hospitalisations, savings from the consumption of strong antibiotics, and, ultimately, better overall application of resources (material and human). Special emphasis was therefore placed on personal hygiene and on facilitating patients' hygiene.

- Correct segregation of waste is checked and attention is paid to sharps and potentially infectious materials.

#### A.4 PRECAUTION

The physical separation of patients, the placement of many dividers within clinics, and the spatial isolation of patients according to disease severity protect not only the staff but also the other patients from healthcare-associated infections and prolonged hospitalisations.

B. Regarding transfusions, although reported human errors were rare in our hospital, the phenomenon of over transfusion had been observed in several patients. Specifically, those with chronic conditions and their prolonged hospitalisation for unnecessary transfusions and the management required often due to complications from those transfusions. Thus, we have created a Transfusion Protocol, based on the current and modern guidelines for the administration of blood to patients with chronic neoplastic diseases, hematological diseases, or post-surgery, as well as for the correct pre-transfusion control and the correct management of any adverse events.

C. To limit the incidence of thrombosis in hospitalised patients, the experience and knowledge gained from the CoViD-19 infection and the accompanying high rates of thrombosis were used in the creation of an analytical thrombosis protocol. This includes the indications for administration of anticoagulation as well as its type, duration, and dose. It contains instructions, both for the patients of the pathological and surgical fields, as well as for those cases that will need individualisation in the treatment with specialized instructions from the hospital hematologist, evaluating the bleeding and thrombotic risk of the patient. Especially for the calculation of the thrombotic risk and the proper thromboprophylaxis of the patients, the use of a questionnaire-checklist (Figure 1) was established, which directs the patient to declare in detail possible aggravating factors, individual and family, that may

#### EVALUATION OF THROMBOTIC RISK

- Reason of admission
- Medical history of thrombosis
- History of thrombophilia
- Acquired risk factors for thrombosis
- Family history of thrombosis
- Cancer
- Decreased mobility
- Use of anticoagulants
- Obstetric complications

Figure 1: Thrombotic Risk Assessment Questionnaire





have spread during the reception of the medical history.<sup>8,14</sup>

It was taken as granted that the regular re-evaluation and improvement (where necessary according to collected data and indicators) of the protocols, but also the training of all staff are of great importance so that each health professional from his position can not only implement but also control the correct sequence of actions before a medical practice.<sup>11</sup> All protocols must be taught, updated, supervised, and facilitated with advice. The continuous training and updating of the staff became possible with the modern electronic means that we have in place for daily use. Furthermore, training and information are also provided to patients and their companions with the implementation of a Patient Information Protocol in our hospital. The rules of hygiene, the avoidance of overcrowding in the hospital ward, as well as the prudent use of antibiotics by patients, are communicated to patients with information brochures and information from health professionals, with the aim of limiting the spread of infections, inside and outside the hospital and improving quality in the health services provided.

**RESULTS**

The results of the establishment and implementation of specific protocols are considered particularly encouraging. Following the examples of other hospitals, we also established additional internal regulations, in addition to traditional medical protocols, adapted to the experience and data from our hospital. A bright example to follow is the hematology clinic of the Laiko General Hospital of Athens, where the faithful application of additional measures led within 3 years, according to data from the CDC, to the elimination of the carriage of multi-resistant microbes, from the 12.3% observed occurrence it was previously, but also to a significant limitation of hospital-acquired infections.<sup>4</sup>

The results at the Naousa Hospital are derived from the calculation of indicators and their statistical analysis. In particular, the hospital-acquired infection rate, which hovered around 3% until 2020, showed a gradual decrease, in 2021 it was on average 1.4%, in 2022 1.3%, while in the first half of 2023, it now reached below 1% and specifically to 0.8%. Equally spectacular was the reduction in the antimicrobial resistance index, from 17.5% in 2020 to 5.5% in the first half of 2023. All this demonstrates the catalytic effect that the protocols established in order to deal with the pandemic had. The expansion of pre-existing ones and the evolution of a better mindset from staff regarding discipline in

instructions and self-assessment brought significant improvements (Table 1).

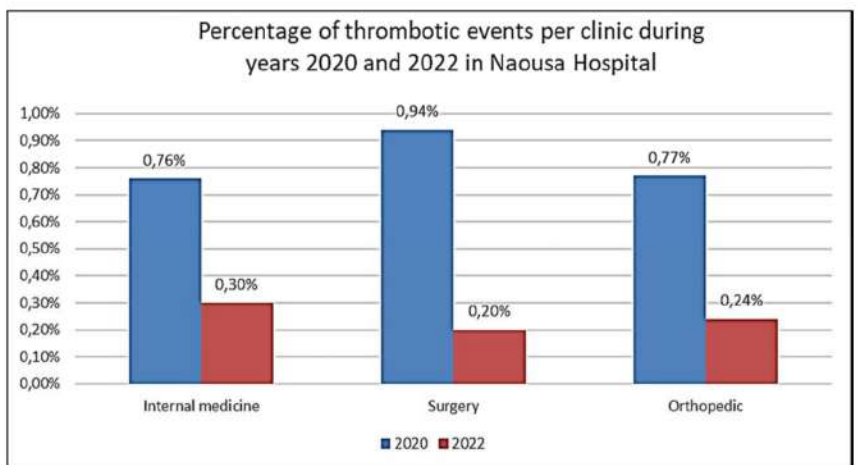
With regard to blood clots and the overall thrombosis occurrences, there has been a significant improvement here as well, thanks to the establishment of specific guidelines. Specifically, from the 0.65% that the indicator was in 2020 on average, it reached 0.19% in 2022. In fact, the highest rates of thrombosis during hospitalisation were observed in the surgical clinic (0.94% in 2020, while in orthopedics it was 0.77%, and in pathology 0.76%). These observations confirmed the underestimated thrombotic risks in those clinics which alongside the increased fear of possible bleeding on post-surgery patients treated with anti-coagulants, led to insufficient antithrombotic coverage of patients overall. Those were effectively the departments with the most important improvements, reaching the rate of thrombosis during hospitalisation to 0.2% in 2022 (in orthopedics it respectively decreased to 0.24% and in the pathology clinic to 0.3%), demonstrating the positive contribution of knowledge and security provided by the protocols (Table 2 & Chart 1).

**Table 1: Percentage of Hospital-acquired infections in Naousa Hospital from 2020 until the first semester of 2023**

YEAR	Number of patients	Hospital-acquired infections	Percentage of hospital-acquired infections
2020	5397	146	2,7%
2021	6459	99	1,39%
2022	7289	98	1,34%
2023 (first half)	2968	24	0,8%

**Table 2: Number of thrombotic events during hospitalisation and their percentage among all hospitalised patients at Naousa Hospital**

YEAR	Patients	Blood Clots	Thrombosis %
2020	5397	35	0,65%
2022	7289	14	0,19%



**CHART 1: Illustration of the reduction in the incidence of thrombosis in hospitalised patients by clinic. Specifically, in 2020 in the pathology clinic, 17 cases of thrombosis were recorded during hospitalization in a total of 2216 patients (0.76%), while in 2022, 7 cases in a total of 2278 patients of the clinic (0.3%). In the surgical clinic in 2020, 8 out of 843 patients (0.94%), and in 2022, 2 out of 863 patients (0.2%), while in the orthopedic clinic in 2020, only 7 cases in a total of 905 patients (0.77%) and 2022, 3 incidents in a total of 1240 clinic patients (0.24%).**





Concerning the institutions' transfusion policy, although human error had been almost eliminated in recent years, the implementation of this protocol helped to save precious blood, limiting transfusions by approximately 15%, despite the marked increase in hospitalised patients and performed surgeries in recent years. It also led to better management of adverse effects, avoidance of unnecessary suffering, and prolongation of patient hospitalisation, but also early diagnosis of cases of transfusion-induced immunomodulation in patients who were frequently transfused and the continuation of their transfusions with greater safety (Chart 2).

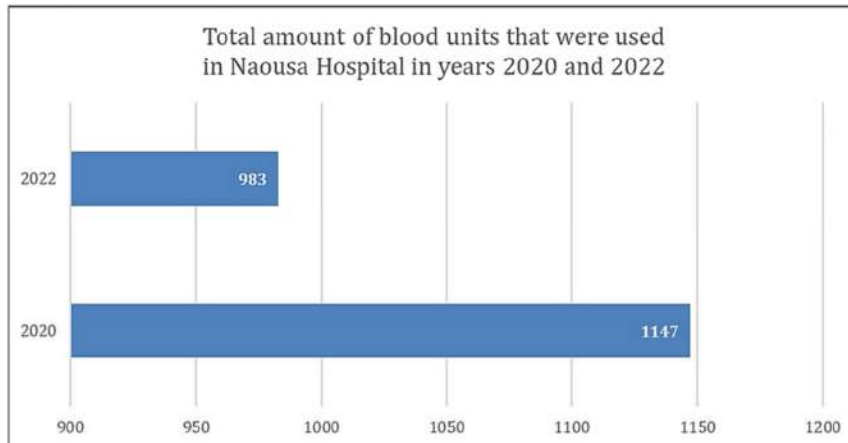


Chart 2: Reduction of donated blood units at the Naoussa Hospital in the last 3 years, which in percentage terms corresponds to a saving of approximately 15% of total collected blood units (From 1147 they decreased to 983 donated per year, a difference equal to 164 blood units=14.3 %).

The result of all the above was the overall reduction in the hospitalisation time of patients, from approximately 4 days in 2020 to an average of less than 3 (2.69), which is considered ideal hospitalization time in several clinics.

## DISCUSSION

We easily find that the factors that lead to an extension of the patient's hospitalisation time largely coincide with the same ones that lead to an increase in morbidity and mortality during the stay in the nursing structure. A rate of 10.8% of hospitalised patients will develop a complication during hospitalization, which in turn will lead to a longer hospital stay, while in at least half of these cases, the complications could have been prevented. The resulting costs are prohibitive for national health systems, as they lead to a reduction in available health credits (in Australia the cost is estimated at 4.7 billion, and in the UK at 1 billion per year).<sup>11</sup> This cost is multiplied when we take into account the increasing fatigue of the staff and what has been observed in recent years as an increased tendency of hospital staff to resign from the public health sector.

The literature study showed that the main causes of prolonged hospitalisation time include hospital-acquired infections, social reasons, and thrombotic events.<sup>1</sup> Although most of the time social problems, such as the lack of a family environment for home care, are insurmountable or at least cannot be solved by the healthcare provider, other factors can be prevented and are indeed prevented

by >50%,<sup>11</sup> leading to significant restriction of patient readmissions.<sup>15</sup>

The unprecedented difficulties faced by the health system during the CoViD-19 pandemic have been a springboard for significant changes and improvements on many levels. The establishment of protocols for the treatment of infections and the control of their in-hospital spread, the more accurate assessment of thrombotic risk, and the need for anticoagulants during hospitalisation, are only some of the positive steps taken. The fact that many of the complications during hospitalisation can be prevented, demonstrates the value of establishing and monitoring indicators, as well as the need for implementation and timely modification of protocols. The ultimate goal of these is to improve the quality of hospitalisation and reduce unnecessary costs.

## CONCLUSION

A hospital's investment in the creation, implementation, and observation of the results of medical protocol application is proving highly rewarding, as it can lead to a significant reduction in complications during patient hospitalization, a reduction in hospital length of stay, and an improvement in the health services provided. The safety of the

patient, the avoidance of iatrogenic complications, and the reduction of their discomfort and suffering must be the main concern of nursing structures since they constitute basic conditions for improving the quality of health care provision which must thrive to be patient-centric.

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