Next Generation Network (NGN): New Strategy in the Context of Continuity of Care

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ABSTRACT

The level of computerization of healthcare facilities and the quality of the IT tools available influence the organization of nursing work and, therefore, the quality of care. In fact, the quality of communication in the healthcare environment is also influenced by the technological resources available to healthcare personnel and constitutes an important, often underestimated, element of the nursing profession that is able to influence the relational skills of the nurse, the level of communication within the nursing team and the timeliness of nursing interventions. The "Next Generation Network" (NGN) represents a technological resource that is able to improve communication in any nursing work context, resulting in a general improvement in the quality of care, a reduction in expenses related to disorganization (inefficiency) and bureaucratizationallowing to better manage the clinical risk.

Keywords: Next Generation Network (NGN), continuity of care, PDA, telemedicine, nursing work.

1 – INTRODUCTION

The quality level of communication in the healthcare environment and the assessment of the organizational context are an important element of the nursing profession as they are able to influence the quality of care. The same Code of Ethics of the Nurse, approved by the Central Committee of the Federation and by the National Council of the Orders of Nursing Professions meeting in Rome in the session of 12 and 13 April 2019, states that:

- (Art. 9): "The Nurse recognizes the value of scientific research and experimentation. Elaborates, carries out and participates in research paths in the clinical assistance, organizational and training fields, making the results available";

- (Art. 10): "The Nurse bases his work on knowledge validated by the scientific community and updates his skills through study and research, critical thinking, reflection based on experience and good practices, in order to guarantee the quality

and safety of the activities. It plans, carries out and participates in training activities and fulfills the obligations deriving from the Continuing Medical Education program";

• (Art. 19): "The Nurse guarantees and protects the confidentiality of the relationship with the assisted person and the confidentiality of the data relating to it during the entire course of care. Collects, analyzes and uses data appropriately, limiting itself to what is necessary for nursing care, in compliance with the rights of the person and the legislation in force";

• (Art. 21): "The Nurse supports the relationship with the assisted person who is in conditions that limit their expression, through effective communication strategies and methods";

• (Art. 28): "In communication, including through IT and social media, the Nurse behaves with decorum, fairness, respect, transparency and truthfulness; protects the privacy of individuals and clients, paying particular attention to publishing data and images that may harm individuals, institutions, the dignity and image of the profession";

• (Art. 29): "The Nurse, also through the use of computer and social media, communicates in a scientific and ethical way, seeking dialogue and confrontation in order to contribute to a constructive debate";

• (Art. 30): "The Nurse at the various levels of care, management and training responsibility, participates and contributes to the choices of the organization, to the definition of the assistance, training and organizational models, to the fair allocation of resources and to the enhancement of the function nursing and the professional role";

• (Art. 31): "The Nurse contributes to the assessment of the organizational, managerial and logistical context in which the assisted person is located in order to protect them. It formalizes and communicates the result of its evaluations in order to improve the context itself".

• (Art. 32): "The Nurse participates in the clinical governance, promotes the best safety conditions of the assisted person, adopts the risk prevention and management paths, including infectious ones, and actively adheres to the operating procedures, to the methods of analysis of the events that have occurred and to the methods of informing the people involved";

• (Art. 33): "The Nurse is responsible for the accurate preparation of the clinical documentation of competence, highlighting the importance of its completeness and truthfulness also for the purpose of consent or denial, knowingly expressed by the person assisted in the nursing treatment".

Having said this, it is evident that the organization of assistance and the assessment of the organizational context are two essential elements of the nursing profession: currently, the assessment of the organizational, managerial and logistical context of the service or department in which the Nurse works. (Art. 31 of the Code of Ethics for Nurses) still finds many obstacles due to a health system centered more on the medical profession rather than on the nursing profession, as if the value of "nursing assistance" had less importance than work done by other professionals working in the health sector.

In reality, nursing work is no less important than that carried out by other professionals, on the contrary: nursing is the most important substrate on which it is possible to build public and/or private health services. In other words: it is not possible to create a health system that does without the skills of the nursing figure.

One of the main characteristics of the nursing profession is the continuous "evaluation" of the healthcare organization in relation to the resources available: a dynamic process without which it would not be possible to achieve any serious efficiency of the services offered to the citizen.The Nurse is therefore a professional, who for the work he is called to carry out is used to frequently assessing the characteristics of his own work environment: this allows him to identify the priorities and objectives to be achieved considering the resources (structural, temporal , economic, technological, human, etc.) that it has available; and it is evident that in a context like this the quality of the communication that is established between nurse and patient, between the members of the nursing team and between this and other professionals, is fundamental to obtain a high level of quality of the assistance and adequate management of clinical risk, also with a view to continuously improving quality [1] [3-6].It has been scientifically proven that quality improvement plans are direct indicators of the organization's effectiveness as they are de-

veloped starting from scientific evidence and the so-called "best practices".

It is known that at a European level there is a problem relating to the digitization of the Italian health system [19];a problem that also affects the nursing work context. Having said this, it is evident that in the Italian nursing context there is a large margin for improvement in the organization of healthcare facilities, especially if we think of the level of computerization of nursing work: only in some hospitals is the computerized nursing record available, while only in very few hospitals is it available the "integrated" computerized medical record is available (ie composed of both the component drawn up by the doctor and the component drawn up by the nurse). To this we must add the scarce development and use of IT tools (software) designed to support nursing work: most of the software in use in healthcare facilities has been created to innovate the methods of supplying drugs and aids, and to request/view diagnostic tests of various types. Furthermore, very often there is no IT integration between the software, each of which requires access data for use.Unfortunately, in most cases, the technological innovation introduced in healthcare facilities has led to a slowdown (and not a speeding up) of nursing work; this happened be-

cause in the design phase of computerized systems, nursing advice is rarely required: a serious mistake which, as mentioned, often has negative consequences on the care process.

To improve the nursing working environment and obtain an improvement in nursing care, it is not necessary to overturn the organizational system of a health facility: it is sufficient to put the nursing staff in the conditions of being able to work well [22].Japanese studies on Total Quality Management (TQM), which began in the 1990s, have shown that to improve quality, it is simply necessary to ensure that operators work better, that is, in the best possible conditions.

Through this study, the authors want to propose a new methodology for improving nursing work based on the Next Generation Network (NGN), i.e. through a computer network integrated into the services that allows to improve the organization of nursing work by acting on a greater availability of IT resources intended for the nursing profession and the consequent improvement of communication within the nursing team and between this and other health professions/services: an approach that allows you to manage clinical risk more effectively and improve the quality of care.

2 – NEXT GENERATION NETWORK (NGN) AT THE SERVICE OF NURSING WORK

IT systems are distinguished by their multi-processuality (multitasking), i.e. for the characteristic of being able to perform multiple processes at the same time. This property makes it possible to create digital information management systems that can adapt to different contexts and to various needs, and it is not by chance that information technologies are also used in the health sector (health information technology) to interconnect clinical practice (information and communication technologies - ICT) and management practice.

Due to these characteristics, in the nursing field, IT resources are widely used [2] above all because they allow to obtain a more rapid circulation of information of various types (and in real time) within the team, they improve its organization and efficiency, reduce waiting times and related work-stress [20] [21].

The authors' idea is to equip every healthcare facility, in which the nursing staff works, with a Next Generation Network (NGN), i.e. a high-speed and low-time latency in a wireless network (mesh type) integrated in hospital services and in all available technological resources.A computerized network of this type would allow nursing staff to access a wide range of data through Personal Digital Assistants (PDAs) and video terminals located within the work environment.

The type of data made accessible through the NGN are:

- patientpersonal data;

- data relating to the patient's state of health: diagnostic reports, consultations, etc.;

- data compiled/updated daily by healthcare personnel: daily allowances, pharmacological prescriptions, etc.;

- data relating to the safety of the patient and healthcare personnel: audio/video data of the unit of the patient admitted to the critical area, video data of the access/exit points of the ward/health service, emergency exits, video data dedicated to monitoring the areas where narcotic drugs are stored, etc.;

- organizational support data: notes in real time, organizational plans drawn up by the nursing team, communications from the Nursing Coordinator, access to data on diets, access to the diagnostic imaging service plan, etc.;

- support data for nursing staff: pharmaceutical handbooks, technical data sheets, guidelines, protocols, procedures (available via intranet and/or internet), data flow derived from digital audio/video communication systems (simple audio, video communication), etc.;

- administrative data: institutional e-mail service, personal communications between healthcare personnel and the Healthcare/Administrative Management, notices, confidential communications with the Nursing Coordinator, etc.

The NGN dedicated to nursing work must be able to support a broadband data transfer not inferior to 100Mbit/s for each single access point (even within premises): this is a fundamental requisite for the creation of a computerized communication system equipped, among other things, with a high level of integration with various types of digital devices that is able to allow the sharing of high-resolution and high-quality multimedia elements (for example: telecommunication services, sharing of reports in PDF format, images, e-mails, attachments of various types, etc.).

The organization of nursing work based on the use of NGN determines an improvement in the quality of nursing care only if it allows:

- reduce waitingtimes;

- reduce errors and manage clinical risk more effectively (Ministerial Decree of 5 March 2003);

- reduce nursing walking time;

- reduce the removal of nursing staff from the department/service in which they work;

- lighten the bureaucratization level of the nursing work, and in general, of the ward/health service;

- interact faster and constantly with all members of the nursing team;

- give immediate responses to the organization;

- increase the efficiency of the nursing team;

- keep a time track of the work done by the nursing team;

- interact with the diagnostic systems and make the data available in real time;

- increase the level of awareness of the entire nursing team (everyone knows what a particular nurse is doing at all times);

- interconnect other health professionals with the nursing team;

- introduce the computerized nursing record;

- break down languagebarriers;

- use "Artificial Intelligence" in a healthcare context that can provide important support to the work of the nursing team or to the individual nurse;

- use virtual simulations in virtual reality (VR) for the training of nursing students or as part of the continuous updating program in medicine;

- access the internet to ensure access to: literary works, technical data of medical and surgical aids, data on drugs, regulations, etc..

The reduction of waiting times for assistance (i.e. the reduction of the time necessary for the nursing

staff to give a correct response to the patient's needs) occurs only if all those actions that are not part of the nurse's competence are removed from the organization of the nursing work: the removal of the nursing staff by the department or by the health service in which works due to logistical needs (transportation of biological material, transportation of paper documents, withdrawal of patients that need to be hospitalized, etc.) is usually a condition that determines the consequences negative on nursing work and, therefore, also on the quality of care, and is caused by the general disorganization of work present in a health facility: these (non-nursing) activities subtract time from nursing work by reducing the average time that nursing staff dedicated to assistance.This disorganization generally depends on the total or partial absence of walking staff, on the total or partial absence of auxiliary personnel (generally during the night), on the total or partial absence of nursing support staff (OSS) or due to the absence of a general organization of the health facility that takes into account the characteristics of nursing work. Other causes that determine an extension of waiting times are represented by:

- the high level of bureaucratization of health facilities (compilation of many paper requests and forms of various types to record the work of nursing work);
- byredundant communication systems (the nursing staff must make a multitude of phone calls to trace the doctor, the radiology technician, the microbiology laboratory, etc.);
- from booking procedures of diagnostic tests in which the digitized requests must always be followed by telephone calls useful to confirm the reservation;
- by cumbersome procedures dedicated to the procurement of drugs and/or medical-surgical aids;
- an insufficient number of nurses with respect to care needs (care complexity);
- total or partial lack of communication between members of the nursing team and/or between the nursing and medical team;
- total or partial lack of shared awareness of the nursing team;
- impossibility of quickly assessing the results obtained through a specific organization of the work of the nursing team;

- inability to quickly change the nursing organization as needed;
- any other obstacle that, in practice, negatively affects the nursing work and does not allow the nursing team to work independently and in accordance with the provisions of the Nurse's Code of Ethics.

Another important element that influences the general quality of nursing care, waiting times, the level of awareness of the nursing team and, therefore, the management of clinical risk is represented by the characteristics of communication within the nursing team and between this and the outside. If all members of the nursing team know what is happening at all times in their work context, it would be possible to give faster care responses and manage clinical risk more effectively. Improving communication within the nursing team does not only mean expecting each individual nurse to communicate with their own team but, in the vast majority of cases, means enabling the nursing staff to be able to communicate more effectively easy with his team considering the structural and technological obstacles of the work environment. Here, then, the need to introduce in the nursing work environment the Next Generation Network (NGN).

La NGN velocizza i flussi informativi; semplifica l'accesso alle informazioni e il loro inserimento; moltiplica le potenzialità degli strumenti tecnologici di ausilio alla professione infermieristica; migliora la comprensibilità dei dati registrati e ne riduce l'errore interpretativo durante la lettura; consente di tenere traccia temporale delle registrazioni e dell'identità del professionista che ha inserito un dato; permette di velocizzare enormemente il processo di ricerca di un dato; consente di condividere velocemente i dati; consente di integrare strumenti dedicati alla terapia farmacologica che permettono di accedere alle guide sui farmaci; etc. Tutto ciò incide positivamente sull'efficienza dell'equipe infermieristica e sulla gestione del rischio clinico.

To create a NGN that allows to obtain these results, it is necessary:

- have a Personal Digital Assistant (PDA) equipped with a 5 GHz wi-fi network card, powered by batteries that can be recharged quickly;

- have a high-speed broadband network connection (throughput no less than 100Mbit/s for each access point) and low latency time;

- allow PDAs to automatically connect to wi-fi hotspots that offer better radio signal quality;

- have access points to the network (hotspots) capable of making data transmission efficient even within the premises with a transfer rate of no less than 100Mbit/s for each access point;

- have a team of specialized technicians able to quickly resolve any anomalies or malfunctions of the network (even at night and during holidays);

- have one (or more) connection to the internet with a speed of not less than 1Gbit/s;

- have efficient uninterruptible power supplies capable of keeping the network operational for a few hours in the event of malfunctions of the main electricity network;

- upgrade the intranet already present in the hospital if it has an effective transmission speed <100Mbit/s for each access point;

- create specific refresher courses for nursing staff, focused on information technology and the use of the video terminal/PDA;

- provide for the use of a computerized nursing record, or rather, "integrated";

- provide the use of software to support the nursing work (management of telemetry monitoring; dosage/dilution calculator; BMI calculator, etc.);

- provide for the use of semi-automatic robots for the preparation of drug therapy, able to dispose or report expired drugs;

- provide the use of computerized laser reading systems that allow nurses to identify drugs (and their dosage) during the preparation of the therapy;

- equip the Operating Unit with an adequate number of video terminals for access to integrated services;

- provide the use of electronic signature;

- provide a single authentication to access all integrated services;

- provide the access to integrated services also through PDAs;

- predict the input of personal data of a patient within the Operating Unit (if provided by the healthcare facility);

- prepare the NGN so that it can be easily updated (software) and extended (hardware);

- provide the use of on-screen signaling systems connected to telemetry alarms;

- provide the digital integration of systems reserved for reporting failures of electro-medical equipment and, in general, medical-surgical devices;

- integrate the e-mail service (personal and otherwise) to the NGN;

- provide a signaling service dedicated to emergency situations (fires, collapses, explosions, natural disasters, etc.) that generate acoustic and video signals on the PDAs and on the video terminals installed within the Operating Unit;

- provide a reporting service dedicated to emergency situations related to the clinical conditions of patients (the report must generate acoustic signals and videos on the PDAs in possession of the nursing staff and the medical staff);

- provide the presence of a service dedicated to simultaneous voice or text translation in various languages.

A very frequent problem that is observed in corporate networks is represented by the high latency time of the network, ie the response speed of the entire IT system represented by all the interconnected devices. On average, the latency time of a traditional xDSL network varies between 70 and 100 ms; while high-speed connections have a la-

tency time of about 15 ms. In a complex network such as that present in a hospital, this time expands enormously due to the presence of intermediate network devices placed between the computer through which the request is sent and the computer or device that must be reached by the request itself: Hub, Repeater, Switch or Bridge, Router, etc.It is therefore necessary that the network is created using the least number of intermediate network devices and those present must be equipped with ad-hoc electronics to speed up data transfer. (ASIC, CAM, etc.).

As already mentioned above, another feature of the NGN network designed to support nursing work is represented by the presence of transportable communication systems. Each nurse must in fact be equipped with a Personal Digital Assistant (PDA), that is a small laptop (also called palmtop) through which he will be able to communicate with the rest of the nursing team and interact with the various IT resources and with the main services present in the hospital (pharmacy, reception office, canteen service, concierge and order services, analysis laboratory, histology, radiology, nuclear medicine, cardiology, etc.), i.e. with integrated services. To avoid network connectivity problems or a degradation of the radio signal caused by interference from anthropic environmental electromagnetic sources, this network must operate at a frequency of 5GHz instead of 2.4 GHz. An integral part of the network are also:

- all computers present in the health facility;

- electromedical equipment that can be connected to the network;

- existingintranets.

PDAs must be equipped with dedicated software (applications) capable of interacting with the computer and electromedical equipment connected to the network, in such a way as to recall in graphics:

- data from the telemetry network (ECG, blood pressure, heart rate, pulse oximetry, body temperature, blood pressure, etc.), which can also be viewed in graphic format;

- data relating to vital signs entered manually by healthcare personnel;

- the reports compiled by the medical staff that have been drawn up in the diagnostic and outpatient services through computers connected to the network;

- data relating to the analytical activity carried out in the laboratories;

- the personal data of each individual patient;

- all data entered electronically in the computerized nursing record (or the "integrated" medical record), including information on drug allergies and food intolerances;

- data relating to drug therapy (name of the drug, active ingredient, pharmaceutical form, dosage, route of administration, warnings, time of administration, various notes);

- applications able to provide assistance to the operator (unit converter, digital pharmaceutical informer, calculator, countdown timer, various types of manuals, notepad, internet and intranet browser, QR code reader and bars, phonebook, etc.);

- audible and visual alarms that are activated when the electro-medical equipment connected to patients detects anomalies.

Considering the current technological twilight, communication within the nursing team and between it and the doctor or other health professionals can take place through:

- an audio call;

- a vide call;

- a simple text message.

The IP Audio Protocol (VoIP) offers several types of audio configurations:

- an audio channel that can be listened to by all team members ("open" channel) at the same time;
- reserved audio channels (each individual operator can be associated with a reserved audio channel): it is possible to create a

series of dedicated VoIP channels, designed to contact the anesthetist, the cardiologist, the doctor referring to the ward, the nursing coordinator, the radiology, the laboratory technician and, why not, the secretary in charge of the acceptance office, the technical office, etc..;

- customizable configurations also through dedicated software.

VoIP audio communication can also take place through the use of wireless headsets (BlueTooth).

The possibility of being able to access the internet by health professionals (nurses, doctors and technicians) is not a mere requirement of the computer networks used in the health sector but represents an indispensable resource in the context of continuous quality improvement, as it allows access information on:

- drugs;

- medical-surgical aids;

- guidelines, protocols, procedures and care plans.

Currently, technology allows us to create a wireless network with these characteristics at acceptable prices, also considering the improvements that this technology is able to bring to the nursing organization (to its efficiency) and to the entire problem solving process. Improving nursing work means improving the quality of the services provided to citizens.

3 – EXPECTED RESULTS

The results that this type of technology is able to provide in the nursing field are identifiable both in the organizational and assistance fields, touching all the phases of problem solving.

In the organizational/administrative field:

- drastic reduction of waiting times necessary to coordinate interventions (efficiency);

- better management of human resources;

- reduction of the bureaucratization level of the nursing work;

- traceability of activities: recording the date, time and identity of the operator when making an online request (drug supply, communication with the kitchen/canteen service, requests for blood chemistry tests, therapy administration, etc.);

- traceability of care activities (registration of the date, time and identity of the nurse who fills out the computerized or "integrated" nursing file);

- compilation of computerized requests: reduction of errors due to compilation, reduction of request processing times, reduction of paper volume, better clarity and accuracy in the collection and recording of data, better readability, greater clarity of compilation;

- reduction of expenses necessary for the purchase of stationery material;

- drastic reduction in the removal of nursing staff from the ward (for example to send health documentation to other services/departments in health facilities where walking staff are not available);

- greater confidentiality of data as it is necessary to authorize access to the network to view the sensitive data of a particular patient;

- no case of loss of paper documents;

- reduction of demotion/disqualification level of the nursing staff;

- drastic reduction in the walking time of the nursing staff;

- reduction of workloads related to administrative activity;

- reduction in the rate of absenteeism due to illness;

- better management of drug and medical-surgical aids expirations;

- the reduction of work-related stress leads to an improvement in concentration and a better physical response to work, with a consequent reduction of health costs caused by adverse events.

In the care sector:

- provides more appropriate responses to the patient's needs (effectiveness);

- traceability of care activities (registration of the date, time and identity of the nurse who compiles the computerized or "integrated" nursing record);

- access to scientific information;

- access to therapeutic plans at any time and in every room of the Operating Unit;

- better clinical risk management: reduction of errors during therapy preparation thanks to the use of laser readers and/or semi-automatic robots; more effective and efficient monitoring of patients thanks to computerized support; reduction of transcription errors or errors due to incorrect interpretation of handwritten prescriptions (calligraphy), etc.;

- continuous quality improvement: increase in the quality of nursing care thanks to easy access to technical-scientific information (integration of the internet);

- increase in the motivation of the nursing team: reduction in the level of demotion/disqualification of nursing staff and

consequent increase in personal motivation (increase in efficiency);

- reduction in the workload of nursing staff determined by the drastic reduction in walking time, with consequent efficiency of nursing care;

- reduction of work-related stress thanks to the reduction of walking time and consequent reduction in the rate of absenteeism due to illness;

- improvement of continuity of care thanks to increasing the awareness of the team that is constantly interconnected with the NGN;

- greater clarity of daily nursing records with a consequent reduction in error;

The extent of the improvements that can be achieved by creating an NGN network dedicated to nursing work essentially depend on:

- technologicaltwilight;

- economic availability of the company;

- characteristics of the network and integrated services;

- level of computerization of the structure;

- quality of hardware resources used;

- operating characteristics of the software;

- ergonomic level that reaches the entire computer system;

- ability to easily update the software and hardware used;

- adaptability of NGN to care needs (network design consistent with the needs required by nursing work).

In addition, it should also be carefully assessed the impact that new technologies have on:

- the quality perceived by patients [23] (not all citizens adequately understand the usefulness that new technologies introduce on the organization of work);

- the influences perceived by the nursing staff on the computerized organizational support [23] (not all professionals working in the health sector have a good relationship with new technologies, and in general with the computerization of work).

But that is not all. The quality of nursing care is not only linked to the efficiency of nursing work or the reorganization of the technological resources of the Operating Units or services; this depends on the characteristics of the resources available (or made available) and the general organizational substrate on which the Regional Health Service is based: characteristics that cannot be improved by the nursing team. So what is the task of the central institutions?

The authors are convinced that to determine an increase in the quality of health services and a consequent improvement in the management of clinical risk, it is necessary to implement regional and national policies that:

- considerably reduce the misalignment of values between public and private providers, favoring the values of public providers;

- reduce conflicts of interest between suppliers and providers (cost reduction);

- improve the working conditions of the nursing staff (360-degree nursing consultancy is essential to identify all the organizational and managerial anomalies that determine and/or support nursing demotion);

- increase the number of nurses within the Operating Units and health services: this number must be calculated considering:

  o the level of objective care complexity of the Operating Unit or the health service;

  o the percentage of absence of nursing staff (sickness, 104, 1204, parental leave, holidays, etc.;

- reduce the privatization of health services;

- reduce the fragmentation of care pathways between public and private providers;

- ensure that the State-Regions Agreement of 22 February 2001 becomes operational, through which the support figure for the nursing staff (Social Health Operator - OSS) was created, a figure that still today (over 20 years of distance from its creation) is not always present in all Operating Units and in all health services where it is necessary to carry out domestic-hotel activities, personal hygiene and completion of the physiological functions of the patient, environmental hygiene, change of linen, cleaning and maintenance of furniture and equipment, waste collection and storage, etc.. [31];

- increase the salary of nursing staff which, to date, is among the lowest in Europe.

These actions have the potential to bring about profound improvements in the quality of health services, as:

- they redistribute economic value by facilitating public health facilities;

- reassign ethical and professional value to nursing work (increases the motivation of the nursing staff);

- the prestige of the nursing profession is safeguarded (the motivation of the nursing staff increases);

- work-related stress of the nursing staff is reduced (thanks to the increase in motivation) with a consequent reduction in the percentage of absence of nurses;

- by reducing demotion, an important part of the time that nursing staff used to per-

form non-nursing functions or tasks is reallocated to care;

- an improvement in clinical risk management is determined on the basis of improvements introduced in the nursing pro-

fession (salary increase, increase in personal motivation, reduction of work-related stress, reduction of demotion).

The expected results, therefore, only partially depend on the introduction of an NGN and a reorganization of nursing work.

4 – DISCUSSION

In Italy, after the chronic shortage of nursing staff (and support staff) that is found at any level and in every healthcare facility, the first evident problem in the nursing work is represented by the high level of bureaucratization with which it is necessary continually confronting each day and the lack of an integrated computer system capable of giving quick responses to care needs.

Yet, the efficiency of information systems and, in general, of information communication systems within an organization was analyzed by the Technical Commission on Clinical Risk of the Ministry of Health. The results, published in the Ministerial Decree of 5 March 2003, establish that the characteristics and quality of information within the care teams, and in the context of administrative services, heavily influence the management of clinical risk: the decree provides precise indications on health care areas in which action must be taken to reduce clinical risk, and makes clear references to "information management"; the "promotion of communication", "factors related to instrumentation", "controllable environmental factors", and "clear communication of priorities" within organizations.

For this reason, in the Italian healthcare reality, especially with a view to continuously improving the quality of healthcare services, it is necessary to propose an innovative strategy that allows to improve communication within the nursing team that touches all the care and organizational aspects in a way to improve the quality of care and reduce the likelihood of making a serious mistake; and this is possible through information technologies.

For many years there has been talk of "computerized nursing records" and "integrated" but in Italian hospitals, apart from some exceptions or some cases of experimentation that lasted a few months, this type of technology is not present or is insufficiently or partially integrated with the real resources available. The result is that in many cases

computerization does not bring any added value to the nursing work, indeed in some cases it makes it worse. This happens when the software and technologies adopted to achieve this type of service integration have not been designed to facilitate nursing work, improve clinical risk management and improve the quality of care, but have the sole purpose of making more efficient data transmission from departments to offices. This happens because when a health facility decides to create a computerized platform able to connect the wards, services and offices, its main objective is the efficiency of the purely administrative aspects without dealing with the healthcare aspects, as if the speeding up of the processes alone administrative aspects are sufficient to improve the quality of the services provided. It is because of this erroneous conception of computerization and the efficiency of healthcare facilities that nursing advice is never necessary in cases where an upgrade of the computer systems or, in general, of the digital technologies in use is expected. The authors are convinced, however, that information technologies, the integration of services and telemedicine in general are valuable if:

- allow to facilitate/simplify the work of the nursing team;

- allow to improve the perceived quality of nursing care;

- allow a better management of clinical risk [1].

The use of the Personal Digital Assistant (PDA) represents a nursing resource with enormous organizational, administrative and managerial potential [3] [5] [7-9]: it allows to drastically reduce the access time to data, allows to share them, speeds up interventions, reduces errors.It represents a flexible communication resource capable of adapting to all

needs and all healthcare scenarios. In a 2007 study (Sue Greenfield, 2008) it was shown that the use of the PDA in the nursing field allows to reduce errors in the event that decisions have to be made quickly.

This device, if equipped with dedicated software, allows the reading of barcodes and/or QR-Code (Quick Response Code) printed on identification bracelets worn by patients: each code can be associated with a series of useful information for the nursing staff (and not only):

- personaldata;

- current state of health;

- upcomingpathology;

- historical data on the surgical interventions to which the patient has undergone;

- details on the drug therapy in progress;

- type of allergies/intolerances;

- name and surname, telephone number of a family member/tutor;

- ward of belonging, nosological number and date of admission;

- bloodgroup.

All these data could be entered without problems within a simple QR-Code as this type of two-dimensional matrix barcode can contain up to 4297 alphanumeric characters.

Data such as the presence of drug allergies could even be engraved on the arm in the form of color codes: all this would lead to better management of clinical risk.

Regarding the Artificial Intelligence (AI), this is a technology with which the man, via complex software algorithms, is able to transfer tasks on a machine that are normally destined to an exclusive resolution of the human mind, indeed very often even these are tasks that should be carried out by diverse working groups that bring together more skills and experiences. An estimate by Business Insider Intelligence reported that spending on AI in Healthcare should increase by about 50% every year, on the previous year, in the four-year period 2020-2023 [10] [11]. In the nursing profession, we cannot fail to consider the technological evolution that in recent years has been causing entire sectors of our society to evolve and change, starting with the corporate one. Even in the nursing field, Artificial Intelligence can be of help to nursing work. Obviously, this paradigm shift can only take place by revolutionizing the internet and the computer systems connected to it. In a 2019 study, researchers showed that artificial intelligence-based systems helped reduce notifications received from healthcare professionals by up to 99.3%. With such a computerized system, nurses can be informed about cases that need attention and focus on those [12].

Virtual simulations could support the nurses' training phase. A survey by Wolters Kluwer [13] even found that 65% of nursing education programs adopt virtual simulations, including VR (Virtual Reality, a way of simulating reality through the use of computers and the aid of special interfaces). Thisensures an improvement in the training process[14].

5 – CONCLUSIONS

The use of advanced information technologies in the hospital environment is a reality that must be given greater consideration since the improvements that this technology introduces in the nursing field are enormous. Better management of clinical risk and a consistent reduction in error are two fundamental aspects of nursing work (Ministerial Decree

of March 5, 2003) that cannot be dealt with effectively without the use of information technology. Next Generation Networks (NGNs) introduce new resources to manage continuity of care and today represent the best solution available that can be easily applied both in hospitals and on local services. In this context, the authors highlighted the im-

portance of telematic work and that linked to the elimination of paper documentation, which still represents, within certain realities, an obstacle to the development of work management processes for the next 15 years. It is clear that a great deal of upgrade work must be done in all those healthcare facilities where the quality and type of hardware/software systems used to introduce the computerization of services are old and obsolete compared to the resources that the industry today makes us available.On this perspective, work will have to be done in the near future to ensure that the computerization of the National Health System (SSN) and Regional Health System (SSR) can really help the nursing work and the quality of care.The first step would be to equip every healthcare facility with identical software and hardware resources, also considering the simplification of access procedures, often redundant, slow and numerically excessive in a context, instead, which must be able to rely on streamlined computerization, fast and flexible.

It is no longer conceivable (and temporally sustainable) to use ten different software to carry out one's work within a hospital ward/service: many software each of which has different access credentials (login) from the others. The introduction of an NGN conceived to support nursing work (and not only) would, on the other hand, allow access to all (integrated) services with a single login.

5.1 – EVALUATION OF THE COMPUTERIZATION PROCESS

In the development process of any system there is a need for a final evaluation process of the characteristics that this system possesses (with respect to the results achieved) and, therefore, also of the choices that have been made to create it. In this case, the flexibility of the computerized system (in terms of hardware and software upgrades) must be considered one of the main resources in the design phase.

In "Problem Solving", evaluation is the last of the processes to consider, but certainly not the least important. It allows to understand where any problems in the care process are located; it allows to understand if the choices made were able to produce the desired results.To obtain an efficient and

flexible computerized system with respect to care and organizational needs, a continuous evaluation of the NGN is needed: only in this way it is possible to identify bugs or inefficiencies in the system that can be solved or improved. The same needs may, over time, change or no longer be indispensable; therefore, the constant evaluation of the NGN will serve to update its characteristics according to the assistance and organizational needs.The flexibility of the system, as has already been stated, is one of the main characteristics to be taken into consideration when designing an integrated information network in services (NGN).

5.2 – EFFECTS IN THE SOCIAL AND ECONOMIC CONTEST

What are the effects that this will result in our socio-economic context?

In general, especially in the initial phase, the changes made in the context of public administration and in citizen-oriented services are not always well tolerated by the population. To obtain a good consensus of the changes introduced in services for citizens it is essential that the results obtained are an added value to the context. In the health sector, therefore, it is essential that the computerization of integrated services (NGN) produces tangible improvements in the area of assistance and services reserved for citizens. It is imperative that these improvements take place quickly. The previous chapters have already listed the improvements that NGN can bring within the general organization of nursing work and in terms of clinical risk management. The improvements obtained through the use of an NGN have a positive effect:

- on the quality perceived by patients/users;

- on the reduction of waiting times;

- on the general organization of the Health System;

- on the management of clinical risk and the economic impact associated with adverse events;

- sulla qualità della comunicazione in ambito sanitario;

- on the reduction of costs necessary for the efficiency of the system (after the initial economic investment necessary for the creation of the NGN);

Anything that affects the slenderness and elasticity of the health system also positively affects the socio-economic context. Speed, reduction of waiting times and efficient organization are also essential when citizens need to deal with health services.

From an economic point of view, public health services and those equivalent to the public (accredited and affiliated private health facilities) must not be companies for profit since their interest is not to obtain a mere economic gain but the production of health.For this reason, the privatistic drift of the National Health Service must be avoided both in terms of financing and in terms of providing services. In fact, it has now been proven that the quality of nursing care worsens in private for-profit hospitals due to the fragmentation of care pathways between public and private providers and due to a misalignment of values [24-30].From this it can be deduced that the quality of health services is closely linked to nursing work, continuity of care and values that are not merely economic.

5.3 – THE NATIONAL INTERNET NETWORK

We were among the first in the world. After the United States, Germany, Great Britain and Norway, there was us.

Italy entered the network earlier than almost all of its European neighbors. It was April 30, 1986 and the first connection between the CNR of Pisa and Pennsylvania, in the United States, transported us to that network which then, a few years later, allowed the birth and development of the Internet. The signal traveled through a SIP cable to Italcable in Frascati (RM), from which international calls departed, and then arrived in Fucino, in Abruzzo, from where it was sent into orbit towards the Intelsat IV satellite that sent it to the United States. A few seconds later, the answer came: we were connected to what would become, years later, the Internet. What happened to that Italian record? Of that important achievement [17] [18]?

The Plan for the digital future of Europe [15] approved in recent months (February 19, 2021)

should be articulated according to three main axes that seem to outline a very specific direction: technology at the service of people; a fair and competitive digital economy and an open and sustainable democratic society. In other words, the Commission led by Ursula Von Der Leyen aims to combine technology, environment and culture in a triad that should guide the development of the coming years throughout the Eurozone [16].

Digital broadband is still slow in our country, where there are still areas not covered by the internet. Between 2020 and 2021, the global pandemic crisis underlined the importance of the global Internet on which billions of people have turned to study or simply to communicate, in the face of the enormous importance that this technology has.

It is therefore inevitable that in the coming years also in Italy the high-speed internet network must be enhanced and made available to all citizens, even free of charge. This technology has enormous potential: it was, in fact, used as the main connection system during the SARS-CoV2 pandemic between 2020 and 2021, to:

- distanceeducation(FAD);

- distancelearning(DAD);

- private communications between Covid19 patients, family members and health services.

The European report "Shaping Europe's Digital Future" underlined how Internet technology and, in general, future investment in technology, will allow all citizens of the European Union to be able to work better [15]. The authors are of the same opinion as they believe, in the face of the examples cited, that technology, if used well, can be a sure source of improving work in the health sector.

Digital technologies are profoundly changing our daily life, the way we work and do business, and the way people travel, communicate and relate together. Digital communication, social media, interaction, e-commerce and digital businesses are constantly transforming our world, they are generating an ever-increasing amount of data which, if shared and used, can produce a completely new means of creating value. It is a transformation as fundamental as that brought about by the industrial revolu-

tion. In his political guidelines, the President of the European Commission (Von Der Leyen) stressed the need for Europe to lead the transition to a healthy planet and a new digital world. This double challenge with greener and a digital transformation must go hand in hand. It requires, as established in the European Green Deal, an immediate change of direction towards greater sustainability, efficient solutions from the point of view of circular resources and neutral from the climate point of view; every citizen, every employee, every businessman will have a good chance, wherever they live, to reap the benefits of our increasingly digitalized society [15].

Digital solutions such as communication systems, artificial intelligence or quantum technologies can enrich our lives in many ways, but the advantages deriving from digital technologies are not lacking in risks and costs. Some citizens feel that they no longer have control over their personal data and are increasingly overloaded with artificial inputs to evaluate. Malicious cyber activity could threaten our personal well-being or destroy our critical infrastructure and broader security interests. This substantial transformation of society requires a profound reflection at all levels of society on how Europe can better meet and continue to mitigate risks and challenges.

All of this will require an enormous effort, but Europe undoubtedly has the means to make this digital future better for all, by weighing the risks and the best in the lives of all of us. It is impossible to think that we can continue to work as we work today in 50 years; the world of work changes every day and with it the needs of people change, and they adapt to the new context of life. A new industrial revolution, that of the digital, awaits us and we must be able to grasp the importance of the role of technology that has helped us live better than in the 19th century.

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