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Measuring healthcare performance in digitalization era: the Pharmacy Unit of Academic Hospital

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Abstract

The field of performance has grown so much over the years that in the various organizational contexts the awareness and use of Performance Measurement (PM) systems has increased. This change occurs also in healthcare. Performance measurement emerged in healthcare organizations to better quantify the achievement of objectives, to evaluate overall performance and promote excellence. Meanwhile organizations have increasingly refined ICT technologies and data collection and flows, in order to better configure performance measurement systems for the organizational units and processes. The focus of this research is to understand how technology can facilitate the monitoring of the indicators used in the measurement of health services, through an exploratory study on one specific hospital ward. In this case, the focus was on Academic Hospital of Catanzaro, where the performance measurement system was implemented in order to improve the quality of the offered service

Key words: Health Digitalization, Performance Measurement, Hospital Pharmacy.

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1. Purpose of the research

In recent decades, Italy as well as other European countries have been fertile ground for numerous New Public Management (NPM) initiatives, with the aim to improve performance in various areas of Public Administration. NPM tools based on management's principles and techniques are related to the reorganization of processes and objectives of public administrations, performance measurement and control (Di Paolo, 2007). The field of performance has grown so much over the years that in various organizational contexts the awareness and use of performance measurement systems has increased (Anjomshoae et al., 2019). This change occurs also in healthcare (Pollitt, et al. 2007) by introducing at the legislative level principles and criteria of effectiveness and efficiency typical of the business context (Borgonovi, 2005). Performance measurement emerged in healthcare organizations to better quantify the achievement of objectives, to evaluate overall performance and promote excellence (Gu & Itoh, 2016). Systems able to measure performance in complex organizations have been exposed to unprecedented interest with the management of information flows also in healthcare system. So, such levers have supported coherent healthcare management processes through the design of new application and technology platforms.

The evolution of the applications of Information & Communication Technology (ICT) in healthcare organizations significantly improved both the quality and quantity of services provided to citizens / patients and led to a change in structures and in the management and implementation of internal processes (Santarelli & Di Carlo, 2013). The application areas of ICT technologies in health organizations are manifold and include:

- Electronic Clinical Record - Electronic Health Record : Electronic Clinical Record refers to that system that provides support for management of patient's personal, clinical and health data throughout the entire health care cycle, inside Hospitals or IRCCSs. Electronic Health Record represents the dossier formed with reference to health data originating from different data controllers operating in the same territorial area;
- Departmental systems: all the technologies that allow widespread IT support (from management of diagnostic imaging in laboratory, from the management of operating room activities to radiology);
- Computerized management of drugs: these are ICT solutions to support the automation of the drug cycle;
- Business Intelligence systems: applications that support organizations in the detection, analysis and evaluation of the activities and results pursued;
- ICT systems to support care continuity: they are ICT applications that create an integration between hospital, district services, family doctors (telemedicine, digital therapies, etc.);
- ICT systems to support the process of providing services in healthcare facility or digital services to the citizen: these are applications that support the process of providing services in the various stages of the process (from booking to post-service management), of monitoring service levels and interactive

informative digital communication with users (integrated CUPs, automatic payment machines, totems for reservations, applications for the electronic management of queues and priorities, web portals aimed at citizens ...);

ICT applied to the health field are better known as e-health. The European Commission defined e-Health such as "*the use of ICT in products, services and healthcare processes, accompanied by organizational changes and new skills developments, all aimed at improving health, efficiency and productivity in the health sector, as well as greater economic and social value of health*". Over the years, organizations have increasingly refined the ICT technologies in order to configure performance measurement systems for the various organizational units and organizational processes. (Vagnoni et al, 2013). In healthcare organizations, the measurement of performance can identify sub optimized treatments and improve the quality of services (Pasqualine et al, 2012). Due to major reforms put in place in the area, performance measurement in healthcare has received growing attention from practitioners and academics recently. However, not many studies focus on IT support in measuring performance.

From these reflections, the goal of this research is to understand how technology can facilitate the monitoring of the indicators used in the measurement of health services. The purpose, specifically, consists in verifying, through an empirical investigation, if the digitalization can support the implementation of the performance measurement. This work concerned the study of te case related to the Academic Hospital of Catanzaro, where an implementation process of the performance measurement system is underway in order to improve the quality of the services offered.

2. Theoretical framework and applied theories

2.1 Digitalization in Healthcare

Digitalization represents a technical process capable of encoding different types of information, transforming them from analog to digital (Yoo, et al. 2010). According to McLoughlin et al (2017), digitalization in healthcare is normally used to refer to a cluster of information technologies that can be used for monitoring the individual, telemedicine deployed for diagnosis and therapeutic purposes and information system used to manage clinical data about patients. The healthcare sector is undergoing major digital transformation, as an innovation engine of the 21st century, which affects every organizations. One core area where this is taking place is the use of digital technologies able to increase patient experiences and access to medical care (Fiore-Gartland & Neff, 2015; Mentis et al., 2017; Gottlieb & Utesch 2019; Hess & Ribeiro 2016). Digitalization aims to improve the overall performance and quality of healthcare around the world (Preko, et al., 2019).

In order to obtain the maximum benefits that technology can bring in healthcare sector, it is essential to have a digital strategy that is clear and integrated in all areas of innovation. In healthcare sector, solutions related to the digitalization of clinical-healthcare processes are included and includes electronic medical record, systems for the computerized management of drugs, departmental systems, mobile hospital solutions and systems supporting Clinical Governance, systems for local medicine and home care, telemedicine solutions, electronical health record, pathology networks, electronic social record and support systems for patient services provided through pharmacie (Leoni et al, 2019). The importance of digitalization in healthcare is included among the priority actions in the 2014-2020 Digital Growth Strategy. It represents a "*fundamental step to improve the cost-quality ratio of health services, limiting waste and inefficiencies, reducing differences between territories, as well as innovating front-end relationships to improve the perceived quality of the citizen*".

The motivations behind the priority assigned to the digitalization process in health care are to make citizens able to play a more active role in managing their health. Therefore, the increasing use of a digitalized healthcare system involves the adoption of a new and modern information and communication technology (ICT) that opens new possibilities to improve the different aspects of healthcare such as: the ability to provide better access to patient information, greater transparency, ability to support and reconstruct business systems and processes (Cucciniello et al, 2014; Hunting et al, 2011). ICT in health care plays a central and pivotal role in influencing infrastructures, organizational models, work processes and professionalism (Cicchetti, 2003); so, their dissemination in clinical practice generally occurs in an unorganized and unpublished way, avoiding in most cases pathways that allow timely empirical assessment of their effectiveness and their clinical and organizational impact (Grilli, 2004). In order to find the right balance among technology pushes - which inevitably increase healthcare costs - and new health policies that focus on the patient's centrality, it is necessary to have an interpretative framework that supports the strategic use of ICT, like in external relationships such as business relationships with patients, suppliers, other companies, and finally in the overall information flows of the healthcare system. The benefits include not only cost reduction through dematerialization procedures but also fair access to the population at essential levels of health information and personal data. All of this allows to influence and expand the horizon to measure quality and performance (Joint Commission, 2008; Nuti, 2008).

2.2 Measuring Performance in healthcare

The concept of PM is often considered in managerial literature as a process (Armstrong, & Taylor, 2014) that allows to direct people's behavior towards objectives and results expected by the organization (D'Egidio, et al., 2004). In healthcare system, PM refers to tools and processes that can improve healthcare performance (Veillard et al., 2010) in line with political objectives (Smith, 2002) or

as a technological system able to manage behavior and results (Daniels & Daniels, 2004). Bergeron (2006), in this regard, states that PM is a continuous process in which health performance indicators must be acquired, designed or otherwise introduced to improve the process until it reaches the desired (or convenient) level of performance. In this sense, the PM in health sector aims not only at the systematic generation and control of the economic value of an organization, but also to optimize efficiency and effectiveness of the provision of the service (Mettler & Rohner, 2009). According to Mesabbah and Arisha, (2016) PM processes become a useful tool to improve the quality of service decisions in healthcare organizations.
In order to better understand this issue, it is necessary to explain some aspects. First of all, PM is a type of management that incorporates and uses information on services provided in in healthcare organizations, to carry out the decision-making process (Van Dooren et al., 2015) through three specific moments: measurement, evaluation and reporting (D'Amore, 2020). PM uses the information deriving from the measurement process, transforms it into knowledge through the evaluation processes and improves performance (Hinna, 2010). All this implies an activity aimed at shedding light the factors that explain the level of performance achieved, by drawing lessons for improvement with the identification of problems and actions able to overcome them (Maccari & Romigi, 2008). Secondly, from the analysis of the aforementioned definition of PM, the concept of performance measurement represents the processes and tools by which performance information is collected and made available, to measure the organizational effort (Liguori et al., 2012). This acquisition of information combines both quantitative and qualitative aspects (Alach, 2017). Performance measurement is a tool used to verify how the health system is able to achieve set objectives (Lega, 2013), identify strengths and weaknesses and be able to decide on future initiatives (Purbey et al., 2007). The same authors also say that a good health performance measurement system should have the following characteristics:

- measure performance from a multiple and related perspective; be valid, reliable and easy to use;
- be connected to the value and strategy of the organization;
- be sensitive to changes in the external and internal environment of the organization;
- allow comparison and monitoring of progress;
- rely on critical success factors or performance drivers.

Therefore, in order to measure performance, it is necessary to set objectives, establish quantities (i.e. indicators that are a faithful mirror of objectives), systematically detect (at defined time intervals) the value of the indicators based on objective criteria (Urbani, 2010). The measurement of public performance therefore requires the selection of performance indicators (Rota et al., 2012). According to Anselmi (2009), from the semantic point of view, an indicator represents a synthetic measure, generally expressed in quantitative form, coinciding with a variable or composed of several variables, capable of summarizing the trend of a particular phenomenon. From this it follows that the indicator may not identify with the phenomenon, but represents and summarizes, through behavior, one of the aspects

in which it finds expression. According to Apicella et al. (2013) the indicators express a qualitative (comparable) or quantitative (measurable) characteristic of an object or phenomenon that allows them to infer (build hypotheses, make judgments). While according to Maccari, & Romigi, (2008) the indicators are exclusively measurable variables that serve to synthetically describe a phenomenon. (usually represented by a proportion, a rate or an average). The indicators are grouped by size explored (accessibility, effectiveness, continuity, adequacy, etc.) (Apicella et al., 2013). The calculation and comparison of the indicators is possible only if you have a complex of procedures and tools that allow you to collect, classify, archive, process and use the different types of information deriving from the health system (Messina, 2014). Performance indicators should represent an integrated information network which constitutes a source of comparative analysis and strategic planning (Feng & Joung, 2011). Specific characteristics of the indicators are necessary in order to evaluate performance efficiently: measurability, relevance, clarity, reliability, data accessibility, opportunity and long-term vision.

Freeman (2002) and Marsden et al (2006) state that any measure selected to monitor a goal is never exhaustive in the representation of the phenomenon. It is therefore necessary to implement a selection of the indicators on the basis of a series of requirements, based on a) the relative meaning of the objective to be monitored, b) easy of measurement with simple and understandable algorithms and data availability.

In order to measure these results, the MES - Management and Health Laboratory of the Sant'Anna School of Pisa - proposed the adoption of a series of indicators that should meet the following requirements (Nuti, 2008):

- Validity: the indicator must be able to measure what it wants to measure and be consistent with other related indicators;
- Sensitivity: the indicator must be able to correctly record changes in time and space;
- Comparability: the indicator must maintain the same meaning over time and in different local realities;
- Consistency: the change in the indicator value must not be due to random errors.

From the analysis carried out on performance measurement it is possible to deduce peculiarities, purposes of measurement and PM cycle.

Regarding peculiarities, public performance measurement has some characteristics, such as (Rota et al, 2012): a) multidimensionality: observations and performance measurements under different dimensions (input, output, outcome, efficiency and effectiveness); b) difficulty of measuring outcome: it can be very complex to measure impacts outside of public action; c) subjectivity of the evaluation: the measures and indicators can lend to different interpretations, according to the subject who evaluates them and the moment and purpose in which they are used.

Regarding purposes, measuring performance in public sector and in healthcare, depends on (according to the economic-corporate doctrine, Osborne & Gaebler, 1995): a) organizational learning, in order to support the decisions of political

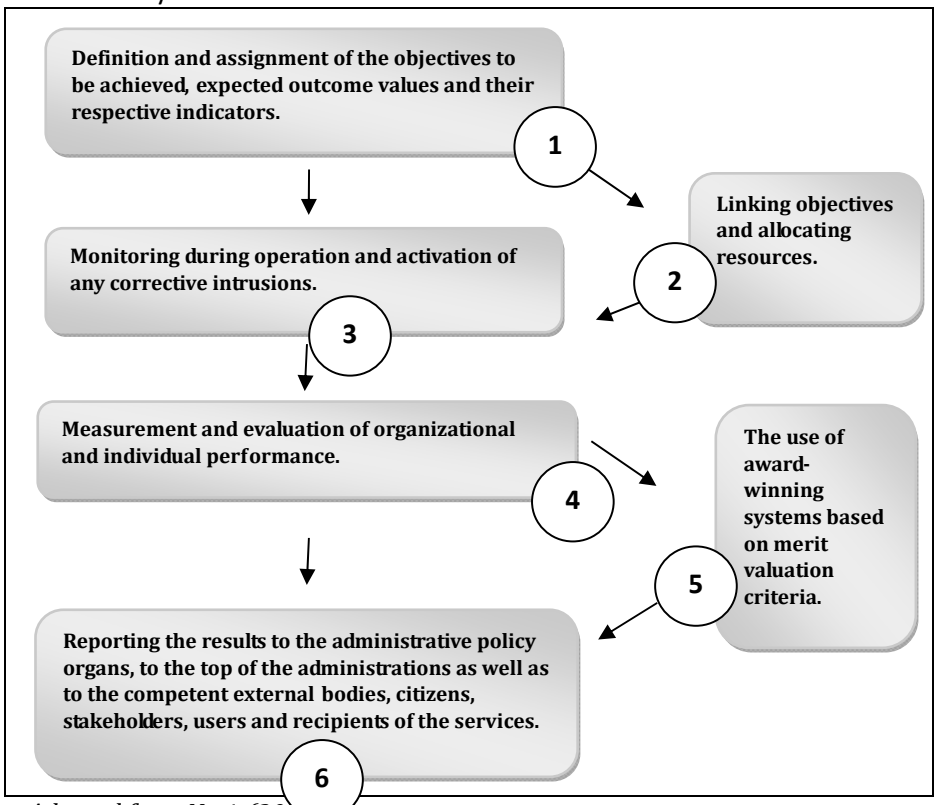
bodies and technical bodies. In this regard, there is talk of a circular mechanism in which the information to be collected is defined consistently with the objectives and, once collected, is used as feedback, for the next programming cycle; b) improvement of performance, in terms of services provided to the community. The calculation of the efficiency, cost-effectiveness indicators, as well as the quality, fairness and adequacy of the services rendered with respect to the needs expressed will allow to estimate the results achieved and the resources used; c) improvement of accountability. It refers to the information based on the external communication processes, which aim to consolidate and improve the process of democratic legitimacy of public action, better known with accountability.

Taking up the concept of PM and performance measurement, Urbani (2010) states that the PM cycle was established to allow the transition from performance measurement to PM. In fact, with the approval of Legislative Decree 27 October 2009, 150[1], better known as "Brunetta Reform", the Italian legislator introduces the term "Performance" in order to identify the results of the organizational structures of public administrations, including the health system, and the performance of the employees to whom the evaluation function is addressed (Giovanelli, 2013). Furthermore, in "Title II" of the aforementioned decree, the measurement and evaluation of performance are regulated, in order to guarantee high quality and economic standards of the service provided to users by improving the results and organizational and individual performance. The PM cycle (Brunetta reform) requires that the administrations develop in an integrated and coherent way some phases that make use of new tools (Urbani, 2010): 1) performance plan: identification of the performance objectives of the administration as a whole and the various organizational units that make it up and link between objectives and resource allocation; 2) Management control and evaluation: performance measurement, evaluation of achievement of objectives, performance reporting for internal control purposes; 3) Performance report: external reporting of performance to the competent external bodies and citizens. In light of the provisions of article 4 of legislative decree 150/2009, we can describe the management of cycle performance, which is divided into 6 phases (Figure 1).

In addition, the concept of performance evaluation, with which we intend to judge the conformity or adequacy of a behavior, an action or a result, falls within the field of PM studies in the public sector, as previously mentioned (Giovanelli, 2013). So, it is possible to argue how much, how and why these situations have affected the level of achievement of the organization's goals (Urbani, 2010). According to Preite (2011), the evaluation consists in analyzing the measured values to express a consequent judgment.

[1] Legislative Decree 27 October 2009, n. 150. *"Implementation of the law 4 March 2009, n. 15, regarding the optimization of the productivity of public work and the efficiency and transparency of public administrations"*. This decree proposes an organic reorganization of the disciplines of the employment relationship of employees of public administrations, in matters of collective bargaining and on the evaluation of personnel, also affecting the health system.

Figure n. 1 – PM Cycle.



Source: Adapted from Nuti (201

In literature there is a huge interest in the development of ICT applications for the domain of the management of healthcare facilities (Yu et al., 1997; Waring & Wainwright, 2002), on PM in healthcare (Mettler, & Rohner, 2009; McDermott, et al. 2019; Gerrish, 2016), on relationship between ICT and the improvement of health services (Buchana, et al., 2018); but in particular, research on how digitalization can facilitate the analysis of the indicators adopted in the measurement of health services is not numerous. Through an empirical investigation based on a case study, we will try to discover the existence of this relationship in support performance measure.

3. Research method

The paper uses a case study methodology in order to verify the measurable set of impact indicators of the Academic Hospital of Catanzaro. Specifically, the present work focused on Pharmaceutical Unit of AH of Catanzaro. The choice was made with respect to: a) the relative independence of organizational unit; b) the small dimension of observed ward; c) its similarity respect to other clinical wards regarding process management; d) the impact of pharmaceutical expenditure on

Hospital Balance. So that, it could be easier to understand the possibility – through small operational changes – to impact deeply on general performance of Academic Hospital.

In this way, it is possible to front the topic easily, by verifyng if and how the PM take place and its measurement. In fact, for example, the relation between the pharmaceutical unit and the others clinical wards could permit to verify how cost reduction activities impact on general performance of AH. So, all this can contribute to understand the different possibilities to act regarding PM in health sector by stimulating new fields of research.

The research uses a combined approach developed in two phases: in the first phase - on the desk - the objective is to seek and focus on Health Digitalization and PM literature, referring to both national and international publications. Moreover the investigation was carried out through the use of documentary sources that were made available by the pharmaceutical unit and by others that it's possible to find on the website (Corbetta, 2014). In the second phase, on the work, a semi-structured interview was conducted (Qu, & Dumay, 2011) with the Director of the operating unit who, compared to other professional figures, has an overall knowledge of how different units operate. We privileged the use of a semi-structured interview in order to obtain more information. We analyzed the data emerging from documentary sources and from the interview, in order to verify the implication of the use of digitalization in performance measurement. Specifically, we have grouped the data collected, through a synoptic prospect, into three parts: the procedures, the ICT and the types of indicators used.

4. Case study

The organizational unit "Hospital Pharmacy" is part of the "Mater Domini" University Hospital[2] and operates on two structures located on the territory of the province of Catanzaro.

The main activities carry out can be summarized as follows:

- Information on drugs and medical devices and consultancy activities for other organizational units;
- Procurement and supply of medicines and medical devices to other organizational units and patients;
- Assistance: development, drafting, validation and disclosure of corporate and regional guidelines;

[2] The "Mater Domini" University Hospital, formerly known as the "Mater Domini" Hospital, was established with the Decree of Regional Government of February 8, 1995, n. 1708, and Regional Law of November 12, 1994, n. 26 (Establishment of Local Health Units and Hospital Companies). It is an institution with public legal personality, which operates through two hospital units. For further information see: http://www.materdominiaou.it (access on 07 April 2020).

- Pharmaceutical and regulatory consultancy: elaboration, drafting and diffusion of therapeutic handbooks, repertoire of medical devices, repertoire of disinfectants;
- Management of AIFA Monitoring Records - payback and refunds from negotiated procedures;
- Supervision: supervision, inspection and control within the company on the correct conservation of drugs, medical devices, drugs and control of the adequacy of the quantities of the pharmaceutical material required;
- Statistics: processing of drug and medical device consumption data by therapeutic group, by product class, by cost center, etc…;
- Monitoring of hospital pharmaceutical expenditure: analysis of expenditure by drug, by active ingredient, by therapeutic group, by cost center;
- Technical/pharmaceutical assistance for purchases: preparation and drafting of technical specifications for the purchase of the relevant materials; drugs and medical devices;
- Logistics: proposal to resolve problems relating to the supply of medicines and medical devices in pharmacies and departments;
- Tutor: Pharmacists perform tutor activities for students of the School of Specialization in the Hospital pharmacy of the University Magna Graecia of Catanzaro and students in the pharmacy who must carry out the pre-graduate internship;
- Study and research: scientific publications, active participation in scientific conferences and company training courses with original contributions.

These activities are carried out by 13 people, who cover different roles as can be seen in the following table 1 (Mater Domini Catanzaro University Hospital, 2019):

Table n. 1 – People and roles in Hospital Pharmacy

Role	Number of people
PHARMACY DIRECTOR	1
PHARMACIST MANAGER	3
ADMINISTRATIVE STAFF	5
TECHNICAL OPERATOR WAREHOUSEMAN	4

Source: Adapted from data of Mater Domini Catanzaro University Hospital (2019).

In order to guarantee carrying out of these activities, the continuity of care and avoid emergencies that can generate risk factors, it was necessary to prepare a regulation aimed at standardizing the pathways and procedures of drugs and medical devices operating within the organization and to comply with all the obligations due in an appropriate manner.

In our case the procedures are extracted by the original documents; specifically, the following list – called "Pathways and Operational Procedures" – belong to the Operational Unit of HP in Academic Hospital. So, n°20 procedures and operating pathways were developed as listed below (Hospital Pharmacy, 2019):

1. Planning and Programming Process - Definition of Requirements;

2. Procedure for Supply and Storage of Medicines and Medical Devices;
3. Procedure for procurement and delivery of cancer drugs;
4. Procedure for Supply and Delivery of Off-Label Medicines;
5. Procedure for Supply and Delivery of Foreign Medicines;
6. Procedure for Supply and Delivery of Medicines and Medical Devices in transit;
7. Procedure for purchase of products not present in hospital pharmacy;
8. Procedure for procurement and delivery of drugs/medical devices not present in tender;
9. Storage, handling and transport of medicines procedure;
10. Procedure for Acceptance and Fulfillment of Supply Requests of the organizational units of Drugs and Devices;
11. Sending and Processing Requests for Drugs Under Monitoring;
12. Sending and processing requests for monitored drugs (regulatory requests) and emergencies;
13. Procedure for statistical evaluation of consumption, reports by cost center, sending information flows;
14. Pharmacovigilance activity;
15. Management of experimental drugs;
16. Expired Management product;
17. Process of purchasing exclusive products and fungible goods;
18. Deposit Purchase / Delivery Process;
19. Secretarial activities;
20. Medical Gas Management.

The procedures are necessary for carrying out the activity of the organizational unit. The activity of the HP is based in particular on established paths and on choices that imply checks, controls and responsibilities. The checks and controls are fundamental for monitoring the activity and pharmaceutical expenditure of the organizational units with subsequent economic impact also on the territory, while responsibility means the ability to respond appropriately to any event in order to guarantee the best assistance activity. After having identified all the necessary procedures for a correct and punctual carrying out of the activities, subsequently, n°15 indicators were identified, listed in the table 2. Indicators, in general, are "measures" that provide information on current and past trends and help managers to make decisions able to influence future results. They are tools capable of showing and measuring the progress of a phenomenon that is considered representative for the analysis and are used to monitor or evaluate the degree of success or the adequacy of the implemented activities. The indicators put in the following table are the results of the interview developed with Head of Operational Unit of HP.

Our focus have analyzed them on the basis of the external or internal impact that each indicators perform. The indicators were thus distinguished in terms of effectiveness and efficiency. Effectiveness is the ability to obtain the desired results; efficiency is the ability to obtain the desired output with the minimum use of resources. The efficacy indicators show if achieved results are consistent with the planned objectives, they are indicators obtained from the "activity objective/result achieved" ratio. The efficiency indicators, on the other hand, concern the relationship between output (i.e. performance produced or rendered) and input

(productive factors, or more generally resources used to produce them). It is a measure of the relationship between the results obtained and the resources committed. Specifically, the table n. 2 shows a taxonomy of the separate indicators based on the concept of effectiveness and efficiency, looking at their impact respectively inside and outside the organizational unit. The percentage of realization is calculated through an information system in which the data of the procedures linked to the indicator flow together. The hospital business unit started this project in 2016, and from a first analysis of the results obtained from 2016 to 2018 there is a positive increase of implementation of the indicators.

Table n. 2 – Internal and external impact of the indicators

No.	Name of Indicators	Efficiency	Efficacy
1	Number of needs forwarded to the Health Department of supervision / total needs (Nn/Tn)		X
2	Number of purchase requests sent to UABS / total of requests (Nr/Tr)		X
3	Number of reminders sent to the competent unit for non-receipt of direct management devices / drugs / total of requests sent (Nrq/Trq)		X
4	Percentage value of the number of bill orders without order references / total of the bill orders (Nbwo/Tb %)		X
5	Number of bill orders on which discrepancies were noted between ordered and received / total of the bills order (Nbi/Tb)		X
6	Number of operations performed on the computerized system per qualified operator (Nop x Op)	X	
7	Number of delivery notes delivered by the operating units relating to deliveries not made to the pharmacy / per operating unit (Ndnnp/ou)	X	
8	Number of drug / device return procedures initiated by the pharmacy / total deliveries (Ndr/Td)		X
9	Number of off-label and foreign drug requests forwarded to the health department (Nrol)		X
10	Number of record paths relating to the information flows sent to the competent company contacts (Nrif)		X
11	Number of requests assessed for purchase with financial funds (Nrff)	X	
12	Number of dispensations of drugs / devices carried out (Ndd)		X
13	Number of requests processed for monitored drugs (nominative requests) / total of requests (Nrmd/Tr)	X	
14	Number of shipments received relating to clinical trials / compassionate use (Nctcu)	X	
15	Number of inquiries drawn up by the pharmacy for exclusive products / non-fungible goods (Nip)	X	

Source: Own elaboration on ward's data.

5. First considerations

From the analysis of the case study, resulting from the summary of the main documentary sources and the interview carried out, within the pharmacy unit of the Academic Hospital "Mater Domini" of Catanzaro, at this stage some considerations are possible. First of all, in order to better understand the relationship between the

procedures used, the ICT systems adopted and the indicators identified, within the performance cycle, we have prepared one special table (Table 3). Based on what literature stated (Santarelli & Di Carlo, 2013; Cicchetti, 2003) about the supporting role played by ICT systems in the healthcare system, the empirical evidences show that most of the procedures used are implemented and supported with ICT systems. The only processes of the pharmacy unit that are not digitalized are (see table 3): *1. Planning and programming / definition of needs. 14. Pharmacovigilance activities. 15. Experimental drug management. 20. Medical gases.*

Table n. 3 Procedures, ICT & indicators at Hospital Pharmacy Unit of AH of Catanzaro

No.	Process / Procedure Hospital Pharmacy Unit	Digitalization (ICT systems)		Type of ICT used	Indicator Name	Indicator type		Impact Indicator	
		Y	No			%	No.	Efficiency	Efficacy
1.	Planning and programming / definition of needs.		X		Number of needs forwarded to the Health Department of supervision / total needs.		X		X
2.	Procedure for procurement (tender products) and storage of medicines and medical devices (direct management).	X		IT management system to highlight reordered drugs / devices.	Number of reminders sent to UABS for non-receipt of direct / total management devices / drugs of the RDA transmitted.		X		X
					(**) Number of bill orders on which discrepancies were noted between ordered and received / total of the bill orders.		X	X	
					(***) Percentage value of the number of bill orders without order references / total of the bill orders.	X		X	
3.	Procedure for the procurement and delivery of cancer drugs.	X		Insertion of patient's therapeutic plans on information support.					
4.	Procedure for the procurement and delivery of off-label drugs.	X		IT load in the warehouse of the relevant health products.	(*) Number of off-label and foreign drug requests forwarded to the health management.		X		X
					(***) Percentage value of the number of bill orders without order references / total of the bill orders.	X		X	
5.	Procedure for the procurement and delivery of foreign medicines.	X		IT load in the warehouse of the relevant health products.	(*) Number of off-label and foreign drug requests forwarded to the health management.		X		X
					(***) Percentage value of the number of bill orders without order references / total of the bill orders.	X		X	
6.	Procedure for procurement and storage of products in transit.	X		Forwarding, through an IT system, of proposals to purchase products.	(**) Number of bill orders on which discrepancies were noted between ordered and received / total of the bill orders.		X	X	
					(***) Percentage value of the number of bill orders without order references / total of the bill orders.	X		X	
					Number of bill orders delivered by the operating units related to deliveries not effected in pharmacy / for operational units		X	X	
7.	Purchase products not present in the	X		Computerized loading and	Number of requests evaluated for purchase with financial funds.		X	X	
					(***) Percentage value of the number of bill	X		X	

	hospital pharmacy purchased with financial funds.			unloading of bill orders.	orders without order references / total of the bill orders.				
8.	Procedure for the procurement and delivery of drugs / medical devices not present in the tender / pta / ptr.	X		IT load in the warehouse of the relevant health products.					
9.	Storage procedure for drugs and DM managed in the warehouse.	X		Use of the computerized inventory.					
10.	Procedure for the acceptance and fulfillment of requests for procurement of operating units of drugs and direct management devices.	X		Transmission of requests through the IT system.					
11.	Sending and processing requests for monitored drugs (AIFA registers).	X		Request of drugs on University Hospital computer system.	Number of drug / device dispensations made.		X		X
12.	Sending and processing requests for monitored drugs (name requests) and emergencies.	X		Request of drugs on computer system (name requests).	Number of requests processed for monitored drugs (nominative requests) / total of requests.		X	X	
13.	Procedure for the statistical evaluation of consumption, reports by cost center, sending information flows.	X		Extraction, verification, validation and sending of information flows on drugs through the computerized system.	Number of record tracks relating to the information flows sent to the competent company contacts.		X		X
14.	Pharmacovigilance activities.		X						
15.	Experimental drug management.		X		Number of shipments received relating to clinical trials / compassionate use		X	X	
16.	Expired management of products managed in warehouse / returns.	X		Management of computerized discharge of expired drugs.	Number of drug / device return procedures initiated by the pharmacy / total deliveries.		X	X	
17.	Purchase process of exclusive products and	X		Acquisition of new requests to purchase	Number of inquiries drawn up by the pharmacy for exclusive products / non-fungible goods.		X	X	

	non-fungible goods.			products on the IT platform.					
18.	Purchase / delivery consignment process.	X		Loading operation on the IT system and the procurement of prosthetic materials.	Number of operations performed on the computerized system per qualified operator.		X	X	
19.	Secretarial activities.	X		Creation of a computerized folder on all files of forwarded communications.					
20.	Medical gases.		X		Number of purchase requests sent to UABS / total of requests		X		X

Source: Adapted from data Mater Domini Academic Hospital of Catanzaro – Italy (2019).

Taking as reference the distinction made in literature between indicators in percentage terms and in numerical terms (Apicella et al., 2013; Maccari, & Romigi, 2008) it is assumed that a single indicator out of the remaining 14 considers one percentage. This is the indicator: *"Percentage value of the number of bill orders without order references / total of the bill orders".* Specifically, table 3 shows that there are procedures where ICT systems are used, but no indicators have been identified. The reference is to procedures n°8, 9, 10, 19. On the contrary, there are procedures in which digitalized systems are not adopted and indicators have been identified, like procedures n°1, 15, 20. In one procedure (n°14) no computerized systems are adopted and there are no indicators. In another procedure (n°3) there is the use of technologies, but no indicators have been outlined. Within the procedures n°2, 4, 5, 6, 7, in which ICTs are applied, several indicators have been grouped. Some of these indicators have been detected not only in a single procedure, but in various procedures, since they are attributable to similar activities carried out within each of them. So, we can recall as highlighted in table 3, the relative indicator (*) *Number of off-label and foreign drug requests forwarded to the health management,* existing in procedure n°4 and n°5; or (**) *Number of bill orders on which discrepancies were noted between ordered and received / total of the bill orders,* repeated both in procedure n°2 and n°6. Finally, the indicator (***) *Percentage value of the number of bill orders without order references / total of the bill orders*, is present in procedures n°2, 4, 5, 6 and n°7. In the same table 3, regarding the presence of efficiency and efficacy indicators in health organizations, Apicella et al. (2013); Feng & Joung, (2011), it's possible to deduce, in the pharmacy unit of the AH of Catanzaro, similarly in table 2, the type of internal and external incidence of the indicators. In particular, we could see that in the procedures where there is no application of technologies, the related indicators are: based on effectiveness, in the procedures n°1 and n°20; while there is a focus on efficiency in procedure n°15. In other procedures where there is the adoption of digital systems, the existence of efficiency indicators in the procedures n°12, 16, 17 and n°18; while in procedures n°11 and

n°13 we have found some efficacy indicators. In addition, we have noticed several indicators in the procedures that adopt technologies, but include the following elements within them. In the procedures n°6 (in which there are three indicators) and n°7 (two indicators) the priority contained is attributable only to the efficiency criterion. On the contrary, in procedures n°2 (three indicators), n°4 (two indicators) and n°5 (two indicators) there is a mixed composition of indicators that focus on efficiency but also on effectiveness. Based on Purbey, et al. (2007), as regard to a good system for measuring health services, it would seem to emerge, from the documentary analysis and the related interview, that the system adopted in the pharmacy unit of the "Mater Domini" hospital in Catanzaro is carrying out a measurement performance from a multiple and related perspective and it is easy to use. But, currently, we do not have the data, since it is too early to understand the type of support provided by technology to measuring performance.

At this step of research, our focus was on possibility to measure the performance through some specific clinical indicators. The pharmaceutical case study provides in-depth analysis of some indicators, highlighting how these tend to detect the ability to implement policies to curb pharmaceutical spending. The indicators considered were: - the most reliable in both data and calculation criteria; - the most representative of the performance of pharmaceuticals; - those normally used at national level for the evaluation of comparative health systems. The chosen indicators are the ability to explain specific aspects related to performance measurement in health context.

6. Conclusion

The article examined, through an empirical investigation, the type of support offered by digitalization in performance measurement. The paper focused specifically on the analysis of the case study relating to the pharmaceutical unit of the "Mater Domini" Academic Hospital of Catanzaro. The research was carried out through the study of the main managerial literature on ICT and digitalization in healthcare, to focus on PM which includes, according to Van Dooren et al., (2015), also the concept of measuring performance by studying the related indicators. The main results deriving from the analysis of the Hospital Pharmacy unit permit to emerge the following informations. First, IT systems support most of the procedures examined in the case study. Second, performance measurement would be implemented from an easy to use multiple perspective, as Purbey, et al. (2007). Third, we have noticed how several indicators in the procedures adopt technologies, but there is not informations that allows us to understand, currently, the type of implications and above all the support deriving from technology on performance measurement.

The application of this research could allow in practical terms healthcare organizations to carry out a specific verification on the usefulness of technology in measuring performance throught indicators. With this study it will be possible to suggest and test other empirical practices that can be used in the future for health

organizations. In fact, once the knowledge becomes more specific and wider than before, in the future research could focus on specific aspects and the next step could introduce new indicators of the adequacy of the pharmaceutical product delivered. The results of this research can be used for further research which can subsequently translate into a refined theoretical framework with high practical relevance.

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