

# PERFORMANCE MEASUREMENT AND OPERATING ROOM: EVIDENCE FROM AN ITALIAN SURVEY (ID: 62)

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**Abstract:** In the healthcare setting, surgery is considered one of the most complex activities, also from an organizational perspective. The optimisation of resources devoted to surgical pathways is mandatory, as demonstrated by an initiative of Italian Ministry of Health: in January 2018, a pilot study was developed aiming at the definition of a set of Key Performance Indicators (KPIs) useful to monitor the operating room activities and to be used by the hospitals at national level. A literature review was performed in order to investigate KPIs already used to monitor the performance of the surgical pathway. A dedicated team was also established to further explore specific KPIs for the surgical pathway. Between April and May 2021, an online survey was structured to investigate KPIs really monitored by Italian hospitals for the surgical pathway. The invitation to participate was sent to 398 Italian healthcare organizations. The results provided an overview of the Italian situation taking into consideration the monitoring of performance of surgical pathway. These monitoring activities are not yet conducted systemically but should be consolidated and standardised using also specific tool, as the dashboard proposed, by multidisciplinary teams in order to balance technical and clinical components.

**Keywords:** surgical pathway, operating room, KPI, performance measurement, healthcare organization.

## I. INTRODUCTION

In recent years, the term performance has been introduced into the health services industry, transforming process management into an important resource [1, 2].

The concept of performance in healthcare services represents a tool for combining quality, efficiency and effectiveness. The monitoring of performance, through key performance indicators (KPIs), is essential to understand the strengths and weaknesses of healthcare facilities, improve performance, and optimize internal performance and services [3, 4]. The monitoring and use of performance indicators is a necessary tool from which to start because only by measuring can we improve.

In the healthcare context, in particular in the hospital setting, surgery is considered one of the most important and complex activities.

In order to optimize the surgical process, a holistic approach is needed allowing the monitoring of health services by the management of policies that focus on the users' needs, guaranteeing quality and safety [5].

In January 2018 a project was launched by the Italian Ministry of Health called "Reorganization of surgical activity for care setting and complexity of care" that involved all the Regions, the Autonomous Provinces and 34 Pilot Hospitals located in Italy [6].

At the end of this three-year project, the Guidelines describing the path of the surgical patient were produced [6]. The responsibilities, the elements of risk, the working tools and the different activities that guarantee the correct functioning of all the pathways

were identified [7]. One of the specific objectives was the definition of indicators related to operating room shared at national level. These indicators were divided into three categories according to their use: pre-operative phase, intra-operative phase and post-operative phase [6].

The objective of the analysis is to support healthcare structures in their decision-making process through performance monitoring [8]. In fact, the structured and systematic measurement of internal performances, in particular those related to operating rooms, allows to make the process more efficient both from an economic and organizational point of view [9].

In particular, in order to do this, a set of indicators was provided to Italian healthcare structures as a starting point to implement a systematic measurement process [10-13].

The selected set of indicators was reported in the table below.

TABLE 1  
SET OF INDICATORS TO MONITOR THE PERFORMANCE OF OPERATING ROOMS (SOURCE: PERMANENT CONFERENCE FOR RELATIONS BETWEEN THE STATE, THE REGIONS AND THE AUTONOMOUS PROVINCES OF TRENTO AND BOLZANO, 2020) [6]

Indicators	Formula
Start-time tardiness (Indicates the average delay of beginning of the first surgery of the day compared to scheduled). [min]	$= (\text{Actual start of the surgical procedure of the first surgery of the day}) - (\text{Scheduled start of the surgical procedure})$
Under utilization (Indicates the average time interval during which the OR is not occupied in the available hours (because the last patient of the day left earlier than planned)). [min]	$= (\text{Scheduled time of end SLOT}) - (\text{Exit from the OR})$
Turnover time (Indicates the average time between a patient's exit from the OR and the entry of the next). [min]	$= \text{Patient exit time from OR} - (\text{Next patient entry})$
Saturation of OR (Expresses the saturation of the scheduled sessions and then the OR time actually occupied (i.e. when the patient is present in the room) in core activity compared to the OR time assigned) overruns must be excluded. [%]	$= \frac{(\text{Room utilisation time})}{(\text{Time available})}$
Mean surgical time (Indicates the average duration of the surgery). [min]	$= \frac{(\text{End of the suture}) - (\text{Beginning of incision})}{}$
Out-of-Hours Surgery (Measures the volume of percentage of surgeries performed outside of the scheduled operating room schedule during the evening, night, weekends and holidays). [%]	$= \frac{(\text{Out-of-Hours Interventions})}{(\text{Total interventions})}$
Consistency of waiting lists (patients stratified by: Priority class, Regimen (ordinary, day surgery, outpatient surgery), Operating unit). [patient]	$= \text{Summary of patients on the waiting list}$

Waiting Time (Allows you to know the average time before the patient is admitted for surgical treatment). [days]	$= \frac{(\text{Date of admission}) - (\text{Date of inclusion in waiting list})}{}$
Number of patients over threshold (Allows to know the number of citizens operated after having exceeded the waiting time foreseen by the assigned Priority class). [patient]	$= \text{Summation of the number of patients admitted with a waiting time greater than the time provided by the Priority Class}$
% patients sent to the ICU (Indicates the number of patients sent to the ICU and allows for a history on with to plan). [%]	$= \frac{(\text{Number of patients sent to intensive care})}{(\text{Total patients operated on})}$
Rate of re-injury in OR (can be assessed 7, 15, or >30 days after surgery; Indicates the number of post-surgical complications that result in re-injury). [%]	$= \frac{(\text{Number of patients returned to OR})}{(\text{Number of interventions performed})}$

The remainder of the paper is organized in four sections. Section 1 presents the context and the objective of the paper, Section 2 describes the literature review carried out to structure the survey, Section 3 shows the main results that emerged from the survey and Section 4 reports the paper's conclusions.

## II. MATERIAL AND METHOD

A literature review was performed in order to investigate the KPIs already used to monitor the performance of the surgical pathway.

Literature analysis was performed through a review of scientific articles and books. Data source included: Google Scholar, Researchgate, Pubmed, Scopus, ProQuest, Espacenet and university databases.

For the research, the English and Italian keywords used were: “key performance indicator”, “healthcare”, “KPI”, “performance measure”, “hospital performance”, “operating room”, “performance management”, “performance model”, “performance system”, “operation management”.

In particular, some of the keywords were used to construct search strings. These were constructed, first, using mainly the "OR" operator, which allowed for a larger number of results. Later, the "AND" operator was added to the same string, which allowed for a more targeted selection.

Articles and books deemed most relevant to the analysis were selected, both in English and Italian language.

On the basis of literature evidence, a dashboard was created, selecting also 11 most important KPIs from Permanent conference for relations between the State, the Regions and the autonomous provinces of Trento and Bolzano, 2020 [11-13].

Between April and May 2021, an online survey was structured to investigate the KPIs really monitored by Italian hospitals for the surgical pathway. This was made and revised before it was sent out.

A draft of the survey was made containing the main questions extracted from the literature arranged in a logical order of the topics covered. Once the most relevant topics were established, the survey was revised by a group of 5 experts with a clinical and managerial background. They tested the survey in order to verify its comprehensibility, clarity, and consistency of content with respect to the set objectives. The dashboard was also tested, in the real world practice by some members of the Italian Association of Healthcare Management Engineers (InGeSan) working in reference hospitals [14].

After this test phase, the invitation to participate was sent to 398 Italian healthcare organizations.

It was given the option to submit the survey even partially completed, omitting the answer to questions that the reader did not want or know how to answer.

The survey was focused on the operating room setting and intended to collect quantitative data (such as the number of operating rooms and beds present in the hospital, etc.), and qualitative data (such as the tools used to monitor the performance, the professional devoted to this activity, etc.) [5].

The respondents were also asked to evaluate the KPIs dashboard, specifying, for each KPI, the current use or the intention to use in the future.

The figure below shows the flow chart reporting the main phases of methodology.

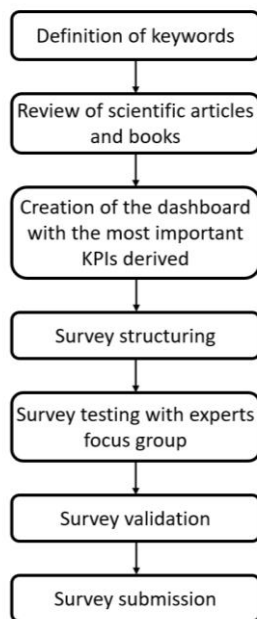


Fig. 1. Methodology flow chart

### III. RESULTS

The sample was composed by 42 hospitals (in particular 88% public structures, 7% accredited private structures, 5% private structures). The 31% of the sample had more than 15 operating rooms, the 26% until 5 operating rooms, the 24% between 6 and 10 operating rooms and the remaining 19% between 11 and 15 operating rooms.

The data concerning the number of operating rooms was useful to correlate the responses obtained to the survey with the size and complexity of the responding structure.

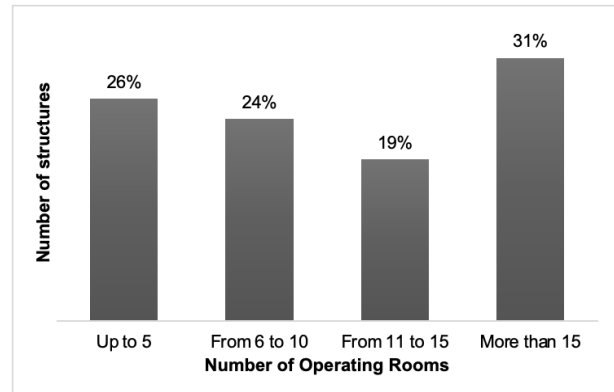


Fig. 2. Number of Operating Rooms

Considering the two variables the total number of ordinary beds and the number of operating rooms in the hospitals, results showed that most hospitals with more than 900 beds have more than 15 operating rooms, while, as expected, structures with few beds (from 0 to 300) have a lower number of rooms.

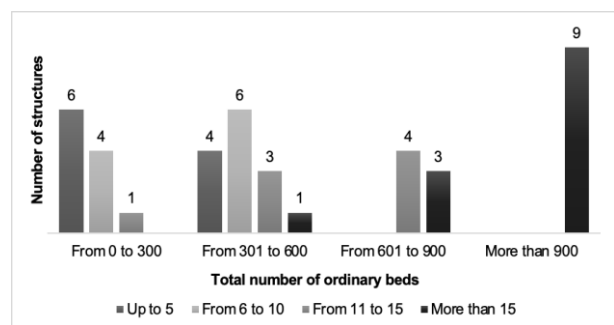


Fig. 3. Correlation between the number of Operating Rooms and the total numbers of total beds

Within the sample, public structures presented a greater number of operating rooms. In particular, only public structures have more than 15 operating rooms, while private structures have a reduced number of operating rooms (from 6 to 10 operating rooms).

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TABLE 2  
NUMBER OF OPERATING ROOMS DIVIDED BY THE TYPE OF THE HOSPITALS

Number of Operating Rooms	Nature of the structure		
	Public	Private	Private accredited
Up to 5	9	0	2
From 6 to 10	8	2	0
From 11 to 15	7	0	1
More than 15	13	0	0
Total	37	2	3

Results showed that a Department or an Office completely devoted to the activity of monitoring KPIs of operating room was instituted in 30 hospitals participating in the survey (representing the 72% of the sample).

The office in charge of measuring KPIs in operating rooms is Management Control (23% of the sample), Operations Management Office (18%), Management Control with Medical Direction (16%), the Medical Direction (15%). The 13% of sample declared to have not a real office devoted to this activity, but rather, individuals, such as: nurses, operating room managers, statistical employees or multi-professional groups, informally or not formally established. Moreover, in the remaining 15% of the structures dedicated office did not exist and indicators were not monitored.

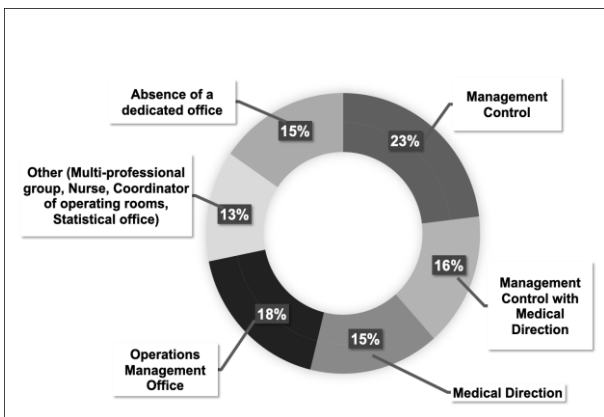


Fig. 4. Office in charge of the measuring operating room KPIs

The professional figures involved in the monitoring of performance indicators are heterogeneous and there are often only a few units for each type of training background [15]. Indeed, none hospital has more than six workers performing the same profession within the same office. Almost all of the responding structures indicated the presence of a small number of workers (from 1 to 2), as physicians, nurses, management engineers, and economists. This fact suggested that the

role of the clinical engineer in this context is not present. From the results of the analysis, it is possible to affirm that the offices of Management Control and Operations Management, should have a heterogeneous group of workers to balance the clinical-sanitary component with the technical-scientific one.

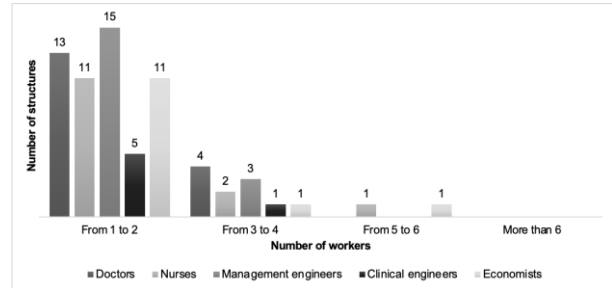


Fig. 5. Number and types of figures in the office that monitor the KPIs in Operating Rooms

The analysis showed that the most widely used tools for monitoring the performance of operating rooms are Information Systems (used by 69% of structures), 10% do not use specific tools and the remaining minimal part uses other tools such as: Data warehouse, Excel, Operator Logs, etc.

The 76% of the sample stated that the use of operating room performance indicators leads to maximizing the efficiency of the surgical pathway. The remaining 24%, on the other hand, stated the opposite. In particular, these structures are: Scientific Institutes for Research Hospitalization and Health Care, Local Health Units, Hospitals and Territorial Health Companies. All of them are public and have a number of beds less than 600. Therefore, it is possible to conclude that in smaller healthcare structures there is still a strong resistance and aversion to internal performance measurement.

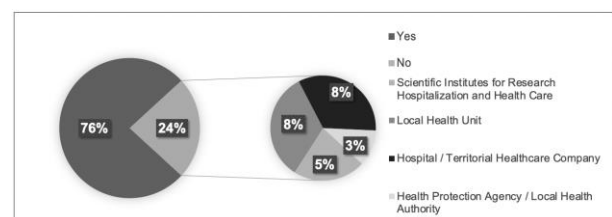


Fig. 6. Has the use of indicators led to a maximization of the surgical path?

The set of indicators in Figure 1 was proposed in the survey and all the structures involved in it indicated which KPIs they currently use, which they would like to use, and which they do not use. The most commonly used indicators are: Average Surgical Time (86%) and Saturation of Operating Room (76%), probably due to the ease of data collection. These are followed by those relating to Turnover Time (70%), Start-time Tardiness (62%) and Consistency of Waiting Lists (57%). In these cases, it can be seen that the number of structures that

use them is in clear majority compared to those that do not.

The indicators with higher percentages of non-use were: Percentage of Patients Sent to Intensive Care (46%) and Rate of Re-entry to the Operating Room (41%). However, facilities would like to use them in the future. This is because these indicators depend primarily on the specific health condition of the patient who is to be operated on rather than the surgical performance.

The indicators: Under Utilization, Out-of-hours Surgery, Wait Time, and Number of Patients Over Threshold, show a lower rate of utilization than the other indicators but still higher than the rate of non-utilization and possible future utilization. This is because the data is not easily collected and the indicators need more time to be measured.

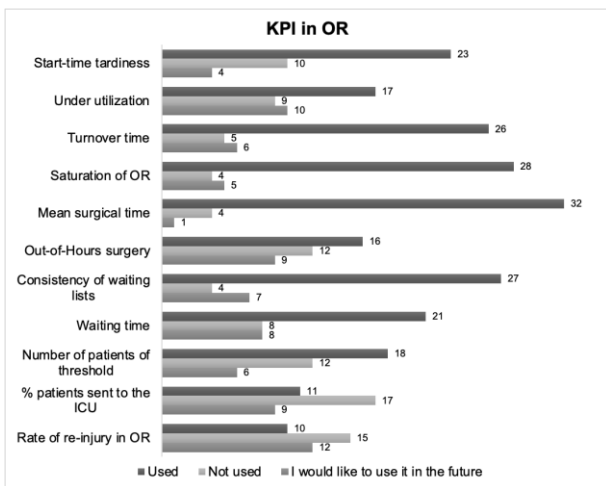


Fig. 7. Set of performance indicators in the Operating Room

#### IV. CONCLUSIONS

The research found that performance measurement in the hospital sector is a practice that is not yet established but is continually evolving. The measurement of performance indicators is not standardized in most hospitals [16]. Often, sporadic measurements activities are conducted but little feedback on the practical corrective actions are implemented.

After a careful analysis on the topic of performance measurement in healthcare, through the study of literature and the distribution of the survey, it is possible to affirm that the majority of Italian hospitals are aware of the importance that a systematic measurement can have on results in terms of efficiency.

In particular, the analysis of the survey has shown that there are not always offices in charge of measuring KPIs, and in some cases these activities are carried out by the Management Control and Operational Management offices. The professional figures involved in monitoring the indicators are mainly those with a healthcare background and still few with a management/economic background [15].

These measurements require heterogeneous skills, so the presence of a multidisciplinary team would be preferable to balance the technical component that measures the indicator, with the clinical-health component that implements corrective actions [17]. In addition, it is possible to say that the majority of healthcare structures are in favor of using, if not yet present, the proposed indicators for performance measurement.

In fact, the analysis shows that the majority of healthcare structures indicated that they plan to use the indicators in the future.

The main limitation of the analysis is related to the size of the sample as the healthcare structures that participated represent about 11% of those to which the survey was sent. This could be due to the fact that the survey dealt with very specific topics to which not all facilities were amenable to sharing information.

Another limitation of the analysis relates to the composition of the sample analyzed. The survey, in fact, was sent exclusively to Italian healthcare structures. Therefore, the idea of extending the analysis outside Italy could be considered, in order to better understand which KPIs are used to monitor the performance of operating rooms.

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