Introduction. Hospitals are known to be the most complex entities to manage. In fact, the main problem in healthcare are the expensive needs with limited resources. During the last years the complexity of the nurse manager role has gradually changed from assistance to management. However, nowadays the methods for quantifying the nurse managers' skills and performance are not available. The aim of this study is to implement a method to assess and measure the skills of the nurse managers. An innovative indicator to globally evaluate the features, the professional skills and their performance is described.

Methods. The authors started with an interview with the directors of all the nurses as the top experts of the nurse managers' technical skills. The purpose of this step was to understand what were the features of a valuable nurse manager. The methods identified three different aspects (qualitative, quantitative and relational) that were transformed in a single indicator. These parameters also enable to identify the strengths and weaknesses of each professional. An important implication of this score is the possible improvement of loss-making skills.

Results. A total of 18 centres, with their nurse managers, were evaluated in this study. All the results confirmed the judgment of the Healthcare Professions Structure Manager.

Conclusions. This assessment method, validated with these tests, evaluated the nurse manager's ability to deal with personnel, resources and patients and to quantify his/her organizational and welfare performances. It is useful for planning actions that allow nurse managers to improve their skills.

Introduction

The main problems in the healthcare are the expensive needs with limited resources. Furthermore, nowadays more attention is paid on the quality improvement of the output of each specific process. Quality is part of the daily routine for healthcare professionals [1]. Most of the interest on the quality of care has been developed as a response to the recent transformations of healthcare system [2]. Hospitals are known to be the most complex entities to manage [3, 4]. Quality can be improved without being measured, but its measurement plays an important role to achieve concrete results [5]. For this reason, during the last years, there has been a surprising increase of the international emphasis on the measurement of competencies and performance in healthcare occurred [6-8].

The nurse manager (NM) is responsible to achieve hospital strategic goals and to provide administrative and clinical support [9-11] but this role has gradually changed from assistance to management over the years [12, 13]. Recently, Europe has followed the model of the USA by implementing some performance indicators [14]. Merkely et al. [15] developed a nursing balanced scorecard to acquire or refine strategic approaches to measuring nursing performance. Krugman et al. [16] implemented a nurse manager (NM) performance profile to provide a comprehensive evaluation of staff and unit trend. Although several papers described the performance indicators and their correlation to the quality of care, the method to quantify the skills of NMs skills and their performance is still missing.

The purpose of this study is to describe the quantitative and qualitative assessment of the skills of NMs, and implement a method to assess and measure NM skills.

Methods

This study was conducted in level I hospital care from January to December 2015. Figure 1 shows the organizational charts of the nurses in this institution. The authors followed the method described by Fain et al. [17] (Fig. 2).

Study design

Phase 1

A literature review was conducted to identify the variables describing the skills of the NM. A list of hypothetically identified variables describing the skills of the NM has been validated with the interview of the director of nurses and technicians.
Three main aspects to include in the final assessment were:

- **qualitative items**;
- **quantitative items**;
- **complaints** reported to the Public Relation Office (PRO).

**Phase 2**

The design of the study is a quantitative research. The **qualitative items** (QL*) were strictly connected to patient safety and the quality of care and consisted of six features:

1. hygiene;
2. organization;
3. health;
4. drugs and narcotics;
5. kanban;
6. staff room (only for the wards).

All the defined qualitative items were assessed by the head of NM of each level (Fig. 1) through the objective evaluation template designed by the authors to critically detect all the parameters through physical inspection. Figures 3-8 show the evaluation template used in the setting of the present study by the head of NM of each level to conduct the inspection. The inspection started with the extractions of three random Hospital Discharge Registers (HDR). The correctness of the following parameters has been assessed: completing HDRs, use of devices according to the law, patient identification bracelets, therapy administration and management of prosthetics containers, presence of hand cleaning solutions and hygienic conditions. “Kanban” referred to the correct application of the hospital strategic project. The wards applied this lean technique to manage the product supply. The head of the nurses and the technicians customized the relative weight applied to each ward in order to have balanced data. All relative weights applied for the analyzed ward are reported in Table I.

Qualitative parameters were translated into a single qualitative indicator (QL*).

The quantitative items (QN*) measured the ability of NMs to organize the work of their center with the assigned staff. Each ward was compared with the ward of the same level according to intensive care model (Fig. 1). The management of the overtime hours of the nurses was assessed. The parameter was calculated by summing the two items: \( R^* \) and \( HO^* \). The ratio (R) between the days really worked by the nurses and the days of patient hospitalization was used as a parameter to compare

| Structure          | Hygiene | Organization | Health | Drug and narcotic | Staff room | Kanban |
|--------------------|---------|--------------|--------|-------------------|------------|--------|
| Wards              | 25%     | 30%          | 30%    | 25%               | 5%         | 5%     |
| Emergency department| 35%     | 15%          | 20%    | 30%               | 0%         | 0%     |
| Intensive Care Unit| 30%     | 10%          | 30%    | 30%               | 0%         | 0%     |
different wards (by number of beds and staff) of the same level (Fig. 9).

R compared the amount of time work nurses’ (hours of daily work) with the amount of time dedicated to the patients. A small ratio reflected a better performance of the NM and higher ratio a worse parameter.

Finally, the mean value of R for each level (µRL) and the standard deviation (σRL) were calculated. The Gaussian distribution method was used for the attribution of the score R* as shown in Figure 10. The range of R* was from 2.5 to 15 points: 2.5 points reflected a worse performance whereas 15 points an excellent performance comparing it to the average of the level.

This means that for each ward R* was calculated as the result of the distance (±σ) of it between the average (µ) for the belonging level (Fig. 10). Moreover, the overtime hours of each nurses for each ward (HO) has been considered. The overtime hour average for each level (µHOL) and the standard deviation (σHOL) of each level were calculated. Thereafter the score, HO*, was attributed using the Gaussian method (Fig. 10). The HO* score ranged from 2.5 to 15 points and also in this case 15 points meant an excellent performance whereas 2.5 a minimum value.

The quantitative items (QN*) was the sum of R* and HO* and it ranged from 5 (minimum value of performance) to 30 points (maximum value of performance). For clarity we converted QN* into a number in scale 0-100 with a proportion.

The last aspect of the analysis focused on commendations and complaints submitted to the Public Relation Office (PRO) by patients and their relatives. The PRO collected each day the voluntary opinions of the patients and of their relatives for each ward. A score was assigned depending on the number of commendations and complaints.

The number of commendations (C1) and complaints (C2) for each ward were summed up and the average of C1 and C2 for each level (µC1L and µC2L) was calculated with standard deviations (σC1L and σC2L) of each level. The relative scores, C1* and C2*, were attributed using the Gaussian method (Fig. 10). The same approach used for the quantitative item was used as showed in Fig. 10 with a range from 2.5 to 15 points. The indicator for this aspect was C* and it was the sum of C1* and C2* and ranged from 5 to 30 points. For clarity, C* has been converted in a number on a scale between 0-100 with a proportion.

The final performance indicator of each nurse manager’s P was calculated as the sum of QL*, QN* and C* and it was translated, for clarity, into a 0-100 scale through the proportion (P*).

Phase 3

The data collection for the qualitative aspect was conducted during the routine ward inspection (3 times a year) as prescribed by law. The survey, reported in Figures 3 to 8, was composed by four pages signed by the NM level (the inspector) and by the NM (the person inspected). Thereafter,
the results were anonymously reported by a secretary in a Microsoft Excel table that automatically converted the results in the vote. This excel file has been assessed by an industrial engineer. For each positive answer a point was assigned.

The quantitative aspect was calculated through the data provided by:

* the human resources office of the hospital. These data consisted of the nurses’ timesheets divided by those belonging to the ward.
* The informatics unit of the hospital. These data consist of the sum of the length of stay of the patients divided by those belonging to the ward.

The commendations and complaints data is a list of them divided by those belonging to the ward.

**Phase 4**

Three parameters for 18 nurse managers of the hospital were calculated following the method reported in Phase 2.

**Results**

A test on two different wards was conducted to verify the validity of the analysis. The two wards selected for the test were selected by the head of the nurses and technicians.
### Fig. 6. Drugs evaluation template.

| DRUGS                                                                 | YES | NO |
|---------------------------------------------------------------------|-----|----|
| Are cupboard without stains or dust?                               |     |    |
| Are cupboard closable?                                              |     |    |
| Are in the cupboard expired drugs?                                 |     |    |
| If the answer is YES, how much are they?                           |     |    |
| Is the therapy cart without stains or dust?                        |     |    |
| Are on the therapy cart expired drugs?                             |     |    |
| Is the cart without stains or dust?                                |     |    |
| Are on the cart expired drugs?                                     |     |    |
| Are cart wheels clean and functioning?                             |     |    |
| Are multidose containers closed after use?                         |     |    |
| Reconstituted drugs and eye drops:                                 |     |    |
| 1. Do they show the reconstitution date?                           |     |    |
| 2. Are they kept in the fridge?                                    |     |    |
| Are they kept within the expected time after opening?              |     |    |
| Are drugs that require refrigeration kept in the fridge?           |     |    |
| Are there sample of medicines?                                     |     |    |
| Are samples and/or drugs for clinical trials kept separately?      |     |    |
| Are there concentrated potassium solutions?                         |     |    |
| Are there concentrated potassium solutions already diluted and ready to use? |     |    |
| Are concentrated potassium solutions kept separately from the other drugs? |   |    |
| Is the cupboard containing the concentrated potassium solutions closed? |     |    |
| Does it show the alarm signal attached to the operational instruction? |     |    |
| Is at the moment of the inspection the diluted potassium solutions infusion going on by the staff of the ward? |     |    |
| If the answer is YES, is the content and the dosage reported on the bottle? |     |    |
| If the answer is YES, for the administration is an infusion pump or a flow precision regulator used? |     |    |
| Are cupboard for medical devices without stains or dust?           |     |    |
| Are cupboard for medical devices closable?                         |     |    |
| Are there expired medical devices?                                 |     |    |
| If the answer is YES, how much are they?                           | from 1 to 5 | from 5 to 10 | more than 10 |
| NARCOTICS                                                           |     |    |
| Are substances being tested kept in a locked closet all the time?  |     |    |
| Are all the loading and unloading movements recorded in the appropriate register within the scheduled time (24 hours)? |     |    |
| Does the accounting hold correspond to the real one?               |     |    |
| Are there expired drugs to be returned to the pharmacy (waiting for collection stored separately in an envelope)? |     |    |
| Is the register filled in with legible calligraphy?                |     |    |
| Is the register compiled in all its parts as required by the company procedure? |     |    |
| Is the register signed by the Director of the Structure?           |     |    |
| Are any corrections countersigned?                                 |     |    |
| Are partial administrations correctly managed according to Law 15/02/95? |     |    |

### Fig. 7. Kanban evaluation template.

| CUPBOARDS AND KANBAN CONTAINERS                                      | YES | NO |
|---------------------------------------------------------------------|-----|----|
| Are there cupboards and/or Kanban container in the ward?            |     |    |
| If the answer is YES, is there only clean and orderly material?     |     |    |
| Does the material contain correspond to that described in the check-list affixed inside the closet (type and quantity)? |     |    |
| Do open packages of multidose products (gloves, disinfectants, lotions, etc.) show the opening date? |     |    |
| Is the cupboard's cleaning with sodium hypochlorite and/or alcohol carried out once a week? |     |    |
| Is the cleaning documented on the specific sign-in sheet with the date? |     |    |
| Are there rigid containers for the sharp components?                |     |    |
| Are there stains, organic residues, waste, butts, writings or anything else in the dressing room for staff? |     |    |
| Are there stains, organic residues, waste, butts, writings or anything else in the dressing room for staff? |     |    |
| Are there stains, organic residues, waste, butts, writings or anything else in the refreshments area? |     |    |
Ward 1 was hypothesized to be the most well managed of the hospital and ward 2 the worst one. The method proposed by the authors reflects exactly this situation because ward 1 achieved a total result of $P_{1*}$ of 83/100 instead ward 2 obtained a $P_{2*}$ of 46/100.

After this initial test, the analysis was extended to all the other departments: inpatient wards, Emergency department and intensive care unit. The ward names and the names of the NMs were converted in anonymous form for the conduction of this study. A total of 18 structures, with related NMs, were evaluated in this study. Four of these structures belong to Level 1, 5 to Level 2_surgical, 4 to Level 2_medical and 5 to Level 3. Final results are ordered in a classification reported in Table II.

**Discussion**

This study was carried out for the increasing attention on the role of NM into clinical nursing skills [18]. A proof of this is that a literature review has been conducted on this topic [19]. According to Boomer et al. [20] the NMs play an essential active role for the growth of the performance of the nursing staff. In fact, a deep association exists between the leadership of the NM and the nurse performance [21]. The staff members are strongly influenced by their leader’s practices who can

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**Table II**

| STAFF ROOM                                                                 | YES | NO |
|---------------------------------------------------------------------------|-----|----|
| 1. Does the floor show stains, remains of food, other waste or water?     |     |    |
| 2. Does the wall show spots, cobwebs, grease marks? Is it peeling?        | YES | NO |
| 3. Does the ceiling show spots, cobwebs or moisture spots?                |     |    |
| 4. Do windows show spots or visible marks of grease or other?             |     |    |
| 5. Do switches show spots or visible marks of grease or other?            |     |    |
| 6. Is the refrigerator free of odors and water leaks? Is the freezer free of ice packs? |     |    |
| 7. Is the temperature of the refrigerator included in the range __________ and recorded on the appropriate card? | YES | NO |
| 8. Are there expired food items, visibly damaged or unpackaged, inside the refrigerator? | YES | NO |
| 9. Are the foods of the patients separate from those of the staff?         |     |    |
| 10. Are there unpleasant odors in the room?                               | YES | NO |
| 11. Do staff’s room closets show stains, grease marks, dust or food residues? |     |    |
| 12. Is the food trolley working?                                          | YES | NO |
| 13. Are aprons for distribution free of stains?                           | YES | NO |
| 14. Does the staff wear apron and headgear during the food distribution?  |     |    |
| 15. Does packages for food transport arrive intact in U.O.?                | YES | NO |

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**Fig. 8. Staff room evaluation template.**

**Fig. 9. R formula.**

$$R = \frac{\text{Days really worked by the nurses}}{\text{Days of patients' hospitalization}}$$

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**Fig. 10. Gaussian distribution for the assignment of the points for the quantitative and the relational aspect.**
make the difference in their performance [21]. A successful leader achieves important results for the team whereas an incapable one is unable to encourage the group. Krugman et al. [16] studied the method to implement a NM profile in order to improve the unit performance. In addition, Krugman et al. [16] underlined how... “Traditional methods of evaluating NMs, such as meeting budget targets, employee ratings, or facility benchmarks, may not provide a complete picture of performance”. A 1-page 2-sided visual graphic picture of quality data has been used in this paper to develop the manager profile. Many parameters have been measured from different databases including specific nurse scale. All these parameters have been reported in the poster. The result of this work is, on the one hand, an extremely detailed report and, on the other, not immediately understandable results such as the final outcome implemented in the present work (Tab. II). In fact, an in-depth study of the document is required to understand all the data. In addition, much strictly nursing performance has been reported instead of performance directly related to the NM. Moreover, all the NMs are evaluated in the same way without characterising the skill required for the different wards. It is essential that each NM is valued with a key performance indicator and a related target value fitting with the actually required skills according to the ward or to the emergency department directed by the NM. In this paper the head of the nurses of the hospital customized it. Furthermore, the present method allows to assess the ability of the NM to manage personnel, resources and patients and to quantify his/her organizational and welfare performances. This partition of the evaluation into the three parameters has allowed to highlight the different characteristics of each NM and the most effective areas besides those where improvement is needed.

Another applicability of the present system was to plan actions to improve personal skills and to identify strengths and weaknesses. In addition, from the NM point of view, the hospital requests have been quantified. Monitoring their own performance year by year, head nurse could understand if they were on the right way to improving their professionalism. This study has some limitations, especially in the aspect concerning commendations and complaints. The latter are spontaneously expressed by patients and family members. Unfortunately, the PRO collects all the commendations and complaints but, at the moment, it is not able to separate the reason of the reporting. In other words, a patient can report a complaint for the collapsing infrastructures or for the bad manner of a doctor. In the method showed all the complaints and the commendations are attributed to the skills of the NM. In a future study the authors will also implement a method to evaluate the performance of the nurse and technician managers of different structures in reference to operating rooms, labs and ambulatory care. With this article, we hope also to increase interest on performance indicators for NMs and stimulate research activities on their validity in different national set-ups in Europe.

### Conclusions

In this study the authors implemented a unique NM performance indicator. This indicator is formed by quantitative and qualitative items. This method allowed to numerically quantify the technical skills of NM.

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Conflict of interest statement

None declared.

Authors’ contributions

IC and CP conceived, designed and coordinated the research. IC defined the feature to evaluate the skill of an NM and CP implemented the index and the tool to assess it. IC customized the relative weight applied to each ward. LC and FG calculated the index and assessed the literature review. IC evaluated the results. CP wrote the manuscript. PC reviewed the manuscript. All Authors revised the manuscript and contributed to improving the paper. All authors read and approved the final manuscript.

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