The correct setting to improve the quality of health care process: a retrospective study in Internal Medicine Department

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ABSTRACT

The definition of the role of hospitals and communities in terms of the response to patients' health care needs is essential in the Lombardy region health-care reform development (LR. 23/2015). The stratification of patients according to clinical severity and care complexity for adequate clinical health care, is achieved by delineating care settings, staff standards, required technical equipment and crucial aspects of clinical pathways. An observational and retrospective study at Manerbio Hospital Internal Medicine Unit (IMU) was carried out to define: i) characteristics of IMU patients; ii) role of IMU physician in management of poly-pathological patients; iii) alternative organizational models. After a Literature review, clinical severity was defined by modifying early warning score, complexity and co-morbidities by cumulative illness rating scale (CIRS) and by intensity of care through care intensity index (IIA). All medical records of patients admitted in the first quarter of 2016 were analyzed. A total of 393 medical records were examined: 199 M/194 F, median age 81 years. Critical patients (requiring continuous monitoring using advanced equipment): 27% of the sample (10% with intensive care transfer criteria). Co-morbidity: between 5 and 6 active diseases for most of the sample; 53% with CIRS between 7 and 12. Elevated care intensity (IIA) was found in 46% of the sample, remaining constant throughout hospital stay. Medium stay: 9.35 days. 27% of IMU patients needs sub-intensive care. About a quarter of patients has unresolved social problems contributing to acute presentations in the emergency room. Agreement on appropriate links between hospital and community care structures is advisable to reduce hospital stay, adequately responding to patients' needs.

Introduction

The definition of the role of hospitals and communities in terms of the response to patients' health care needs[1] is essential in conforming to social and health reforms at national level and particularly in Lombardy (L.R.N. 23/2015). Patients stratification according to clinical severity and care complexity is fundamental in assuring adequate health care management, and is achieved by delineating care settings, staff standards, required technical equipment and crucial aspects of clinical pathways. Hospitals organized according to different care intensity levels are characterized by two key concepts: care complexity[2] and clinical severity,[3] which are diverse but complementary aspects of the same organizational model. According to Moiset (2003)[4] care complexity modulates the degree of operator workload in order to respond to patient care needs. Care intensity is measured according to different elements: the gravity and the instability of the disease, level of additional nursing care, the time required to perform nursing actions, the number of necessary procedures, the technology needed to provide assistance, professional knowledge and the necessary training level.[5] Clinical severity is given by the level of clinical instability, namely the level and number of abnormal physiological parameters per diagnosed disease.[6] This organizational model must take into account specifics of the nursing approach, mostly in terms of care needs and the autonomy of the patient.[7]

Various care intensity and care complexity classification instruments are present in the literature, which are both used to assess the number of critical issues of each patient at the time of admission, and to monitor significant developments during hospital

length of stay.[8] Little experimental research available in the literature has been dedicated to assessment of clinical care intensity using appropriate instruments for the evaluation of care complexity. A multi-center, observational, prospective study published in 2011 in Lombardy,[9] showed that modified early warning score (MEWS)[10] (Figure 1), cumulative illness rating scale (CIRS)[11] (Table 1) and care intensity index (IIA)[12] are key complementary tools, with MEWS and IIA assessing information on different aspects of critical illness which can be integrated to effectively interpret patient needs by predicting the level of care intensity that will be required.

Aims

The overall aim of this study was to determine clinical severity and care complexity of patients admitted to Manerbio Hospital Internal Medicine Unit (IMU) to plan organization and improve quality of care.

Specific aim: i) definition of the characteristics of the patients admitted to Internal Medicine; ii) the role of the IMU physician in the management of patients suffering from chronic diseases with multiple pathologies;[13] iii) to propose alternative organizational models that may improve performance.

The study got the approval from the Institutional

Category	3	2	1	0	1	2	3	Score
Systolic blood pressure (mmHg)	≤70	71-80	81-100	100-199		>200		
Pulse rate (bpm)		≤40	41-50	51-100	101-110	111-129	>130	
Respiratory rate (bpm)		≤9		9-14	15-20	21-29	>30	
Temperature (C°)		≤35		35-38,4		>38,5		
AVPU score				Alert	Reacting to voice	Reacting to pain	Un-responsive	

AVPU score: A, alert; V, responding to voice; P, responding to pain; U, unresponsive.

Figure 1. Modified early warning score.

Table 1. Cumulative illness rating scale.

1. Cardiac disorders (only heart)	1 2 3 4 5
2. Hypertension (the severity is assessed, the involved organs are considered separately)	1 2 3 4 5
3. Vascular disorders (blood, vessels, bone marrow, spleen, lymphatic system)	1 2 3 4 5
4. Respiratory disorders (lungs, bronchi, trachea)	1 2 3 4 5
5. Pathologies of eye, ear, nose, throat, larynx	1 2 3 4 5
6. Upper gastro-intestinal disorders (esophagus, stomach, duodenum, biliary tree, pancreas)	1 2 3 4 5
7. Lower gastro-intestinal disorders (intestine, hernias)	1 2 3 4 5
8. Liver disorders	1 2 3 4 5
9. Kidney disorders	1 2 3 4 5
10. Genito-urinary disorders (ureters, bladder, urethra, prostate, genitals)	1 2 3 4 5
11. Muscle, skeletal and integumental disorders	1 2 3 4 5
12. Pathologies of the peripheral and central nervous system (not dementia)	1 2 3 4 5
13. Endocrine-metabolic disorders (including diabetes, infections, sepsis)	1 2 3 4 5
14. Psychiatric-behavioral disorders (dementia, depression, anxiety, agitation, psychosis)	1 2 3 4 5

1: absent; 2: mild; 3: moderate; 4: serious; 5: very serious
Severity index: average of the scores of the first 13 categories (excluding the category psychiatric/behavioral pathologies)
Comorbidity index: number of categories in which a score higher than or equal to 3 is obtained (excluding the category psychiatric/behavioral pathologies)

Review Board of Brescia Spedali Civili with identification number N.P.0.

Materials and Methods

The study was structured according to three levels:
- Literature review, for the purpose of identifying patients care needs classification instruments.[14] The databases used were: PubMed, Cinhal and SBBL (Biomedical and library system of Lombardy) looking at studies and articles published from 2000 to 2016.[15] Following analysis of experience in Italy in organizing operational units according to care intensity, MEWS,[16] CIRS[11] and IIA[17] were chosen.
- Data collection, reviewing medical records of the patients admitted during the first quarter of 2016 to Manerbio Hospital IMU.
- Assessment of outcomes and definition of the characteristics of patients admitted to Internal Medicine according to intensity and complexity of care.

Sample selection

All medical records of male and female patients admitted from 1st January 2016 and discharged up to and including 31st March 2016 to Manerbio Hospital IMU were analyzed. No exclusion criteria were applied. Clinical severity was calculated according to the MEWS and CIRS scale, care complexity was calculated according to the IIA index. Both medical and nursing records were analyzed in order to collect all necessary information. Medical evaluation was based on medical history, home medications, diagnostic and therapeutic treatment of the patient (in particular specialist consultations, diagnostic and experimental investigations such as gastroscopy, bronchoscopy, placement of drainage, paracentesis, *etc*.). The following information was obtained from the records: overall clinical picture, medical history, physical examination, clinical assessment and therapy during the hospital stay, consultant reports and investigation reports. The assessment of care needs was obtained from the initial nursing evaluation (Conley scale - assessment of fall risk, Braden scale - pressure sore risk, Barthel scale - degree of autonomy in activities of daily living), monitoring of vital signs, nursing records and, where possible, records of routine medication administration.[18,19]

Data collection

Data were collected from the medical records archive of the Manerbio Hospital, from May 2016 to August 2016. 393 medical records were analyzed, and 27 medical records were found to be missing. Clinical severity and care complexity were estimated for each patient. Clinical severity was obtained from MEWS and CIRS scales. MEWS was assessed on the first day of admission to the IMU and then three days after, however CIRS was only assessed on admission as detectable changes occur over a longer period of time. Care complexity levels were determined from evaluation of nursing requirements on the 1st and 3rd day using the IIA index.

Although the initial assessment was systematically performed, in certain cases the second assessment was impossible due to death or the transfer of the patient to another unit.

Limitations

These include the method of data collection as all of the information was obtained from the analysis of the medical records, and not from direct patient assessment during hospitalization. Moreover, the sample was obtained through consecutive patient recruitment within a given period of time.

Analysis of results

Considering the explorative and descriptive nature of the study, a formal power study was not conducted. The sample size was, however, composed of a sufficiently representative number of cases to allow stratification of patients in terms of critical issues, necessity for continuous monitoring, necessity of hospitalization or of other healthcare settings of differing intensity.

As regards data analysis, descriptive statistics (average, median and relative distribution parameters) were reported for continuous variables whereas number and percentage distribution (n, %) were calculated for the various categorical variables.

Patients' characteristics

A total of 393 clinical files were analyzed, of which 199 cases were males and 194 females. The median age of the whole sample was 81 years of age, the lowest age was 19 years and the highest 100 years. A percentage of 93% of patients were aged more than 70 years and 37% were aged more than 85 years. Figure 2 and Table 2 illustrate the patient age distribution.

Evaluation by modified early warning score scale

On initial evaluation (day 1) the average MEWS score was 1.85 (median=1, range 0-11) and on the second (day 3) the average was 0.71 (median=0, range 0-9). Considering a critical cut-off point of 5, on initial evaluation 10% of patients (6% males) were found to

be in critical condition, whereas only 3% (1% males) were critically ill on the third day. However, according to a study by Subbe *et al*.,[10] bringing the cut-off point down to ≥3 could better predict a negative trend in the clinical course, and therefore identify patients whose clinical condition is at greater risk of declining. Assuming this cut-off point, the clinical condition of 27% of patients (16% male) and 6% (3% male) would be considered critical on initial and secondary evaluation respectively. In 36 cases, the second evaluation was not performed as the patients were no longer present in the IMU for various reasons including death, discharge or transfer to another department or structure.

Figures 3 and 4 illustrate the comparison between MEWS scores at the two different time points according to gender.

The variation in MEWS scores appears to distinguish the patients into three categories; those whose condition improved (181 patients 50.7%);

Table 2. Age ranges.

Age	Frequency	%
0-49	27	7%
50-74	96	24%
75-84	124	32%
85>	146	37%
Total	393	100%
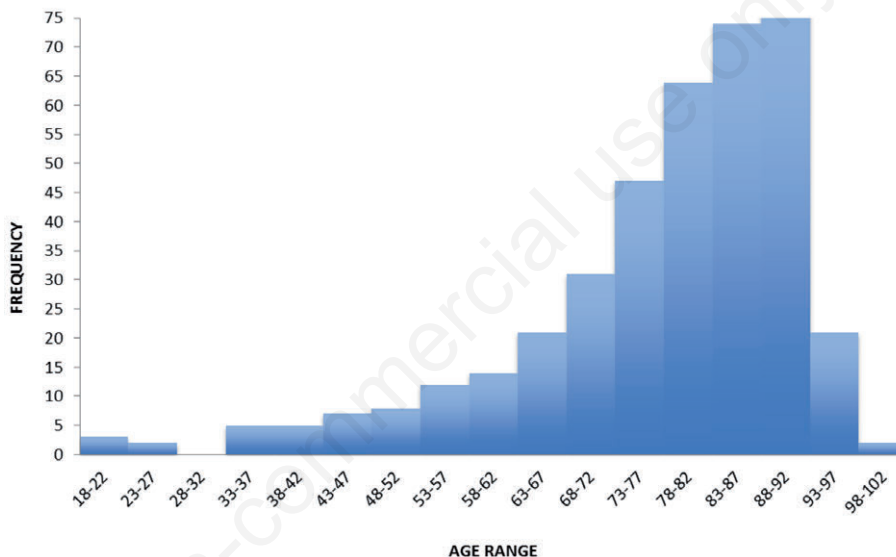
Figure 2. Patients' age distribution.
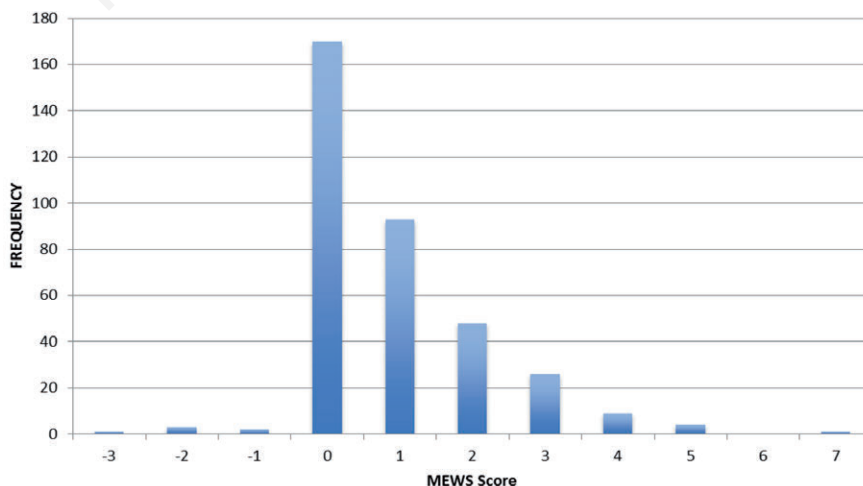
Figure 3. Initial modified early warning score (MEWS) evaluation.

those whose condition remained unchanged (170 patients 40.7%); and finally, those whose condition worsened (6 patients 1.7%). Overall, between the first and second evaluation clinical condition tends to improve, with only 1.7% actually deteriorating in the acute phase.

Evaluation by cumulative illness rating scale score

The CIRS score is more suitable for monitoring changes over longer periods of time compared to the MEWS, and therefore it was applied only on admission to the IMU. This scale provides an index of severity (CIRS-SI) and an index of comorbidity (CIRS-CI). The former is a product of the average score of the first 13 categories (excluding categories referring to psychiatric illness) and assumes continuous variables; the latter, on the other hand, represents the number of categories with a score greater than or equal to 2 (referring to the first 13 categories only) and assumes discrete values.

Figure 5 represents the distribution of CIRS-SI scores, and demonstrates that in the majority of cases the index value ranged from 1.54 to 2.08 with a median of 1.85.

CIRS-CI values distribution is illustrated in Figure 6. In the majority of cases the point score lies between 5 and 6 and 53% with CIRS between 7 and 12.

Evaluation by care intensity index

IIA evaluation was carried out on the first and third day of patient admission. As previously noted regarding evaluation of clinical severity, in 36 cases care complexity evaluation on the third day was not possible as patients were no longer present in the IMU. The IIA is composed of 10 different care aspects, each given a score of between 1 and 4 points based on the level of patient autonomy in that given care aspect.

The highest value obtained for each care aspect is detailed in Table 3. The last line refers to the number
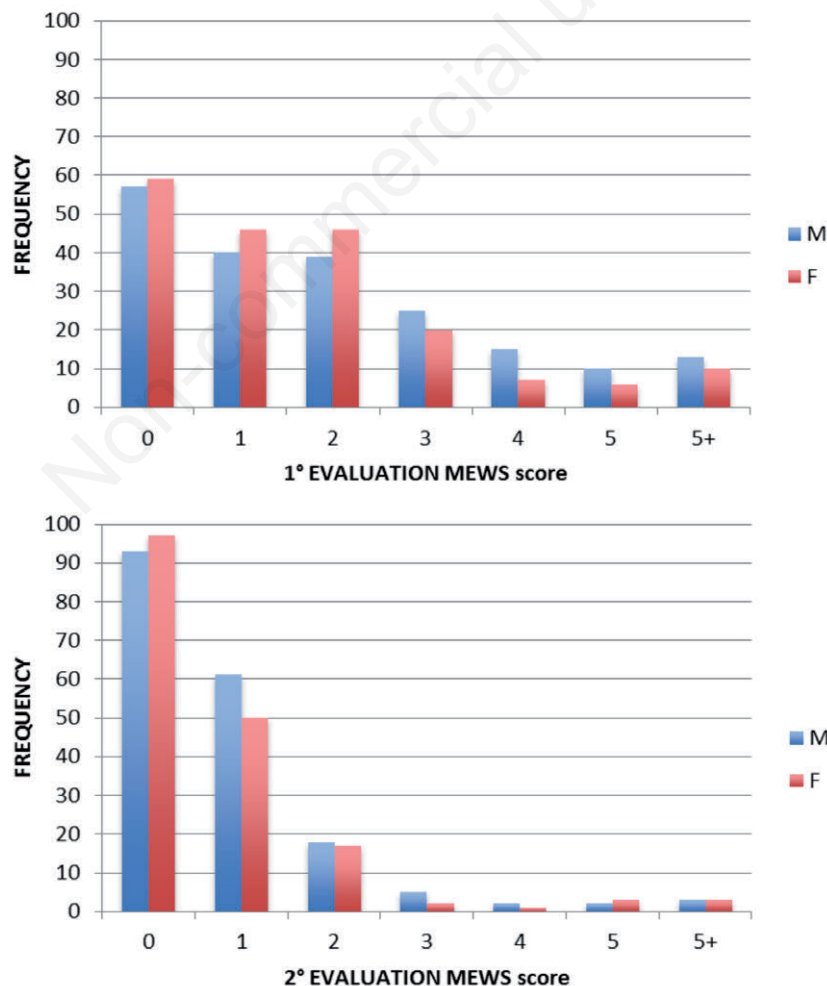
Figure 4. Comparison between first and second modified early warning score (MEWS) evaluation according to gender.

Table 3. 1° and 2° care intensity index score evaluation.

IIA	1° Evaluation IIA				2° Evaluation IIA			
	M	%	F	%	M	%	F	%
1	56	14%	43	11%	57	16%	41	11%
2	58	15%	57	15%	56	16%	56	16%
3	54	14%	64	16%	47	13%	53	15%
4	31	8%	30	8%	24	7%	23	6%
Total	199	51%	193	49%	184	52%	173	48%

IIA, care intensity index.
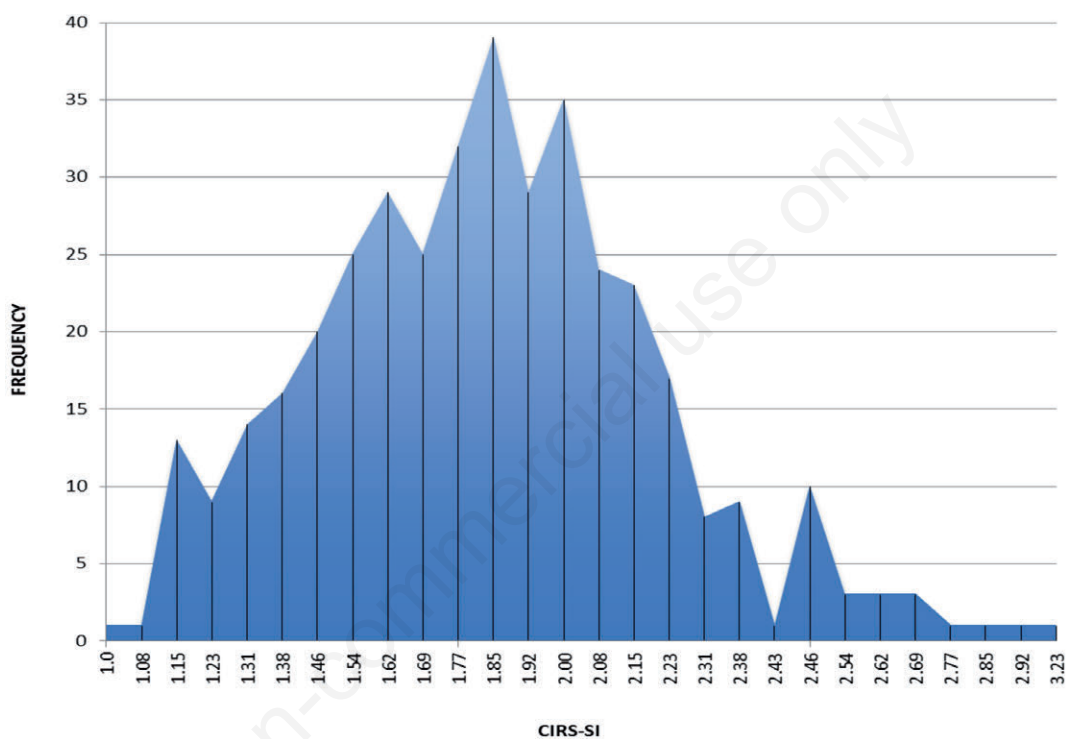
Figure 5. Cumulative illness rating scale-severity index (CIRS-SI) distribution.
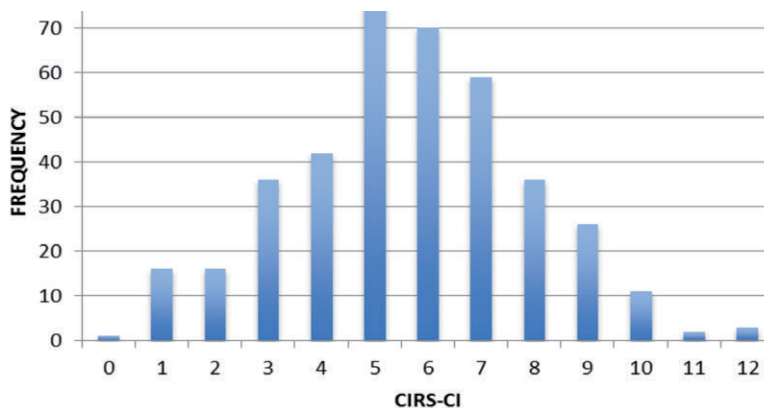
Figure 6. Cumulative illness rating scale-comorbidity index (CIRS-CI) distribution.

of times the parameter is indicated; the total IIA score attributed to each patient is the one recurring with greatest frequency. Initial IIA evaluation indicated that 46% of patients were attributed a moderate (3) to high (4) score correlating with moderate or high dependence. On follow-up evaluation (day 3) IIA scores of between 3 and 4 decreased to 41%.

The comparison of variation in the IIA scores on initial and follow-up evaluation are illustrated in Figure 7 and Table 4. In the majority of cases no significant variation occurred within 72 h of admission.

Correlation between modified early warning score and care intensity index scores

A comparison of the evolution of MEWS and IIA scores is illustrated in Table 5. Of note, although the MEWS data indicate a trend towards improvement (50,7% of cases), the IIA for the most part remains stable (91% cases). Furthermore, the IIA worsens in 6% of cases compared to the MEWS, in just 1.7% of cases.

As regards the patients considered to be in critical condition according to the MEWS scale using both cut-off points, Table 4 demonstrates the correlation with the IIA at both time points.

On initial evaluation, the majority of patients in critical condition according to the MEWS scale were recorded to have a moderate-high or high IIA score.

On the second evaluation, however, the number of critical patients falls significantly; notwithstanding

Table 4. Variation in care intensity index score.

Variation in IIA	N° of patients	%
Improved	10	3%
Stable	324	91%
Worsened	23	6%
Total	**357**	**100%**

IIA, care intensity index.
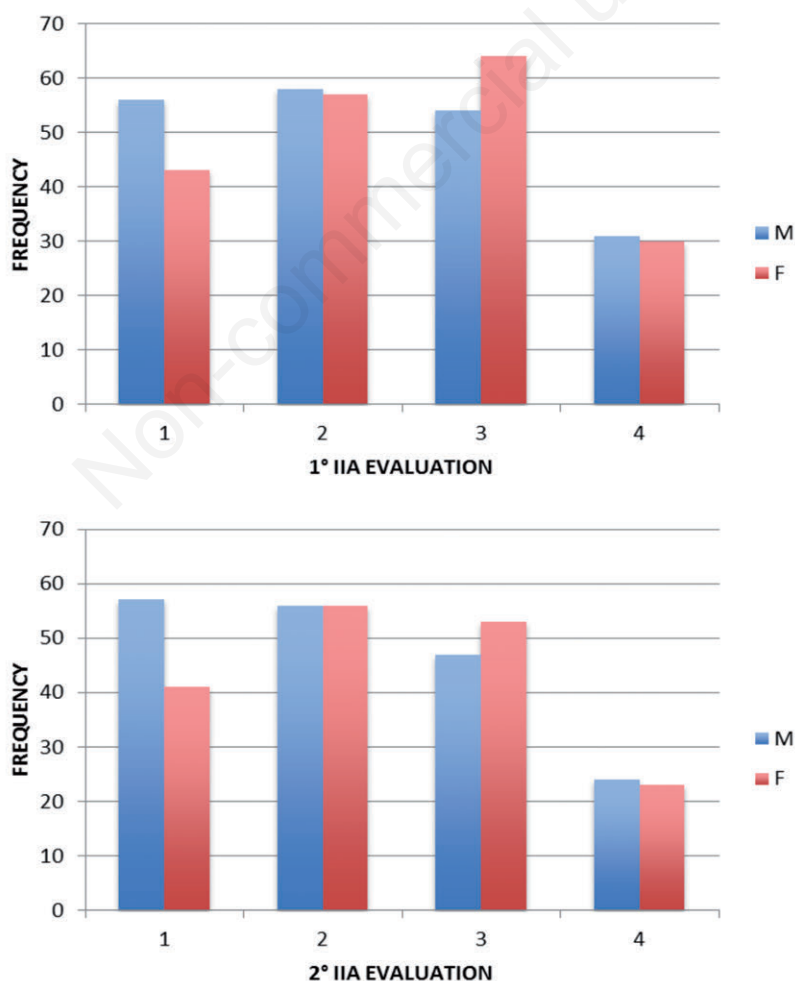
Figure 7. 1° and 2° care intensity index (IIA) score evaluation.

this almost all of the patients were assigned a moderate-high or high IIA score.

Correlation between cumulative illness rating scale-comorbidity index and care intensity index scores

Considering that most patients admitted to the Internal Medicine Department presented multiple pathologies, an analysis of the correlation between the CIRS-CI and the IIA is particularly relevant.

Patients with a comorbidity index between 0 and 5 represented 47% of the total and registered an IIA of prevalently 1 or 2, or low or low-moderate severity, with just 10 patients having a score of 4 (total dependence) (Table 6).

The lower part of Table 6 shows the number of patients with a comorbidity index between 6 and 12. Of these 207 patients (96 males and 111 females), 62% had an IIA score of 3 or 4 that is a moderate or moderate-high intensity level of care. Just 20 patients had an IIA score of 1. The increasing level of dependence as the number of comorbidities rises can therefore be clearly observed.

Level of nursing assistance required from care intensity index analysis

Care intensity index, as previously illustrated, is composed of 10 care aspects, corresponding to level of nursing assistance required. The following Table 7 shows the analysis of the score of each care aspect, at

both time points. The patients are subdivided according to gender; during the first evaluation 199 males and 194 females were screened, while during the second 184 males, and 173 females were evaluated.

Table 5. Correlation between modified early warning score and care intensity index scores.

1° Evaluation	MEWS ≥3		MEWS ≥5	
IIA	**M**	**F**	**M**	**F**
1	13	3	0	0
2	11	7	3	0
3	22	18	9	8
4	17	15	11	8
Total	63	43	23	16
2° Evaluation	**MEWS ≥3**		**MEWS ≥5**	
IIA	**M**	**F**	**M**	**F**
1	1	0	0	0
2	2	0	1	0
3	3	2	1	2
4	6	7	3	4
Total	12	9	5	6

MEWS, modified early warning score; IIA, care intensity index.

Table 6. Correlation between cumulative illness rating scale-comorbidity index and care intensity index scores.

	CIRS-CI												
	0		**1**		**2**		**3**		**4**		**5**		
IIA	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**Total**
1	1	0	9	5	6	4	10	12	10	3	11	8	79
2	0	0	1	1	1	2	3	6	10	10	15	8	57
3	0	0	0	0	1	2	3	2	4	4	13	11	40
4	0	0	0	0	0	0	0	0	0	1	5	4	10
Total	1	0	10	6	8	8	16	20	24	18	44	31	186
	CIRS-CI												
	6		**7**		**8**		**9**		**10**		**11**		**12**		
IIA	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**Total**
1	4	5	5	2	0	4	0	0	0	0	0	0	0	0	20
2	15	14	9	6	2	6	2	3	0	1	0	0	0	0	58
3	3	16	12	13	7	6	8	5	2	3	0	0	1	2	78
4	10	3	5	7	5	6	3	5	2	3	1	1	0	0	51
Total	32	38	31	28	14	22	13	13	4	7	1	1	1	2	207

CIRS-CI, cumulative illness rating scale-comorbidity index; IIA, care intensity index.

The role of the Internal Medicine Unit physician

The study results highlight that 27% of IMU patients need sub-intensive care. Moreover, about a quarter of patients have unresolved social problems contributing to acute presentations in the emergency room. The role of the IMU physician seems increasingly focused on the management of acute and critical patient in addition to diagnosis. Evidence from the research also demonstrates the growing presence of social problems, which make discharge of patients difficult and requires additional skill on the part of the internist in creating links between hospitals and the community. Formation of an agreement on appropriate pathways between hospital and nursing homes is advisable in order to reduce hospital stay and to adequately respond to patients' needs.

Alternative organizational models

In view of these elements, considering some changes to the current organizational structure would appear appropriate: foremost the creation of a high intensity unit, dedicated to the most critical and unstable patients, based on clinical judgement. In this module vital parameters would be monitored continuously to provide tighter control over clinical conditions and to facilitate timely intervention as complications arise.

Secondly, consideration should be given to re-organizing nursing care, specifically by attempting to assign assistance duties of clinically stable patients with complex care needs to support staff, in order to allow nursing staff to devote more time to critical patients. Obviously, this may require a substantial investment in terms of resources and personnel; however, there data

may be considered a convincing starting point for a more in-depth analysis into how current management practices of Internal Medicine Units may be revised to improve the quality of the service.

Limitations of the study

It is a retrospective study on a limited number of patients and the data were acquired by consulting the medical records and not visiting patients directly. However, it was evaluated by the Brescia Spedali Civili Institutional Review Board (IRB) obtaining a positive opinion, given the rigor with which the data were collected and processed and the importance of acquiring composite data both on clinical and care.

Discussion

Aim of this research was to evaluate whether organization of IMU in terms of patient care intensity was possible[20,21] in order to better respond to patient needs in a continuum from the emergency department to the ward.[22] Data analysis shows that most patients admitted to this unit are elderly and present multiple pathologies: 93% were older than 70 years and 37% were more than 85 years old. Comorbidities were also evaluated using the CIRS-CI index, and on a scale of 0 to 12 in which 12 is the highest number of comorbidities, 53% of patients scored on the high end of the spectrum, between 7 and 12, with the majority of the patients scoring between 5 and 6. The fragility of patients with complex clinical presentations dealt with in this context is clearly evident. Both clinical stability and complexity of care were calculated for each patient, which revealed that on initial evaluation

Table 7. Assistance need analysis care intensity index score during Internal Medicine hospitalization.

Dimension of IIA score	Prevalent value I detection	Prevalent value II detection	No. of patients I time point	No. of patients II time point
1. Cardiocirculatory function	2	2	169	152
2. Respiratory function	3	2	162	135
3. Feeding and hydration	2	2	217	135
4. Voiding	3	3	159	137
5. Hygiene	4	4	142	113
6. Movement	4	4	133	103
7. Rest	2	2	228	202
8. Communication	1	1	234	223
9. Safe environment	1	1	158	156
10. Diagnostic and therapeutic procedures	3	3	190	202
Total			393	

IIA, care intensity index.

using the IIA scale 46% of patients were mostly or totally dependent on nursing assistance, fractionally diminishing to 41% of patients on the second evaluation 72 h later. On analysis of each individual aspect of the index, it becomes clear that factors including assistance in voiding, personal care and hygiene, as well as assistance during diagnostic and therapeutic procedures, most greatly influenced the care burden.

As regards the evaluation of clinical stability, using the MEWS scale, on initial evaluation 10% were determined to be in critical condition at a cut-off of 5, rising to 27% if 3 is considered the cut-off point. Regardless, almost all patients considered to be in critical condition were found to need moderately high to high levels of assistance according to the IIA, indicating that a significant number of patients may be identified on admission as requiring intense medical care and targeted nursing assistance.

Having said that, it is worthwhile pointing out that some of these critical patients, identified by the MEWS scale, were actually in the terminal phase of their illness, and therefore would not benefit from admission to an internal medicine ward, where other services such as home palliative or hospice care would be more appropriate.

Furthermore, when comparing the variation between the first and second evaluation reveals that, although the condition of 50.7% of patients improves according to the MEWS scale, the care complexity score remains completely stationary in 91% of cases, meaning that levels of nursing assistance remain high in the first 72 h despite improving clinical stability.

Taking into account all of these elements, the possibility of modifying current organizational schemes must be considered; firstly the creation of a high intensity area dedicated to critical, highly unstable patients may be appropriate, allowing close monitoring of vital signs in order to exert better control over the clinical scenario and intervene as required in a timely manner.[23] Secondly reorganization of nursing care in such a way as to assign support staff to clinically stable patients with complex care needs, in order to allow nursing personnel to dedicate greater attention to critical patients, should be considered.

As this would require major investments in terms of both economic and staff resources, this study may be considered a valid starting point for a more in-depth analysis on bringing about organizational change within this clinical unit.

Conclusions

A percentage of 27% of patients admitted to IMU require sub-intensive levels of assistance,[24,25] emphasizing the utility of monitoring systems to assess initial condition and subsequent global progress in improving patient management.

A monitoring system using wireless technology for patients admitted to the Internal Medicine ward at Manerbio Hospital was started in March 2017[26] and is ongoing to assess the IMU new picture and reduce clinical risks. In order to guarantee optimal management of patients in critical condition, appropriate equipment upgrades and amplification of staff are essential in improving overall performance and reducing average duration of hospitalization, and therefore costs, through addressing complications in a timely manner.

Almost a quarter of patients admitted to the IMU have social and ongoing health problems which tend to be strictly addressed in the context of the specific issue, acute or chronic as it may be, necessitating presentation to the Emergency Department (ED). This often consists of offering transfer to step-down care structures, and therefore integrating the appropriate and timely transfer of patients to such structures so as to reduce hospital stay while responding adequately to patients ongoing needs is imperative. These include: i) transfer to a hospice/step-down or long-term care structure directly from the Brief Observation Unit of the ED; ii) activation of preferential pathways which permit rapid transfer of stable patients with elevated care needs to an appropriate non-hospital setting; iii) implementation of a partnership between public and private healthcare structures to move towards activation of low intensity residential structures; iv) pilot hospital at home and domiciliary projects; v) use of wireless monitoring systems in both the home and residential structure setting; vi) integration of General Practitioner services in follow-up programs as regards chronic conditions at risk of exacerbations.

Finally, provision for pilot studies will be useful to evaluate the passage of patients affected by chronic illnesses from the acute setting to low intensity residential care settings once the sub-acute phase has passed in order to better define the characteristics of these care paths, and the possibility of instituting experimental intermediary support structures (also in the form of a public-private structure partnership) during the waiting period prior to accessing community long-term care.

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