Complexity in hospital internal medicine departments: what are we talking about?

Roberto Nardi,[1] Franco Berti,[2] Antonio Greco,[3] Giovanni Scanelli,[4] Paolo Leandri,[1] Massimo Reta,[1] Magda Mazzetti,[1] Angelo Pasquale,[1] Gelorma Belmonte,[1] Mirco Magnani,[1] Stefania Frasson,[5] Concetta Baldo,[5] Gualberto Gussoni,[5] Giorgio Vescovo,[6] Micaela La Regina,[7] Mauro Campanini,[8] Ido Iori,[9] Giovanni Mathieu,[10] Antonino Mazzone,[11] Carlo Nozzoli[12]

[1]Azienda USL di Bologna, Ospedale Maggiore, Medicina Interna C, Centro di Reumatologia, Bologna; [2]Medicina Interna III, AO S. Camillo-Forlanini, Roma; [3]UO Geriatria, IRCCS "Casa Sollievo della Sofferenza", San Giovanni Rotondo (FG); [4]UOC Medicina Interna Ospedaliera, AOU Ferrara "Arcispedale Sant'Anna", Ferrara; [5]Centro Studi FADOI, Milano; [6]UOC Medicina Interna, Vicenza; [7]POU del Levante Ligure, ASL 5, La Spezia; [8]Medicina Interna II e d'Urgenza, Dipartimento Emergenza ed Accettazione, AO "Maggiore della Carità", Novara; [9]UOC Medicina Interna e Centro Emostasi e Trombosi, AO di Reggio Emilia "Arcispedale Santa Maria Nuova", Reggio Emilia; [10]Past director UOC di Medicina Interna, Ospedale E. Agnelli di Pinerolo (TO); [11]Dipartimento di Area Medica, UOC di Medicina Interna, Ospedale Civile, Legnano (MI); [12]Medicina Interna e d'Urgenza, AOU Careggi Firenze, Italy

ABSTRACT

Internal medicine (IM) patients are mostly elderly, with multiple complex co-morbidities, usually chronic. The complexity of these patients involves the intricate entanglement of two or more systems (*e.g.* body and disease, family-socio-economic and environmental status, coordination of care and therapies) and this requires comprehensive, multi-dimensional assessment (MDA). Despite attempts to improve management of chronic conditions, and the availability of several MDA tools, defining the complex patient is still problematic. The complex profile of our patients can only be described through the best assessment tools designed to identify their characteristics. In order to do this, the Federation of Associations of Hospital Doctors on Internal Medicine FADOI has created its own vision of IM. This involves understanding the different needs of the patient, and analyzing diseases clusters and the possible relationships between them. By exploring the real complexity of our patients and selecting their real needs, we can exercise holistic, anthropological and appropriate choices for their treatment and care. A simpler assessment approach must be adopted for our complex patients, and alternative tools should be used to improve clinical evaluation and prognostic stratification in a hierarchical selection of priorities. Further investigation of complex patients admitted to IM wards is needed.

Introduction

Modern medicine suffers from two main paradoxes: i) we are still practising acute care medicine in a world of chronic disease.[1,2] We defined *acute illness* as a *disease with an abrupt onset and usually a short course*, *an illness of short duration, rapidly progressive, and in need of urgent care*, *sudden onset and short course* regardless of drug intervention. A *chronic disease* was intended as *a prolonged illness, not resolving spontaneously, rarely cured completely, developing slowly and persisting for a long period of time, often for the remainder of the lifetime of the individual*; ii) traditional medical models have been found to be linear, restrictive and over-simplified.[3] The mismatch between the acute care-orientation of the delivery system and the chronic care needs has several consequences (Table 1).

Correspondence: Roberto Nardi, Azienda USL di Bologna, Ospedale Maggiore, Medicina Interna C, Centro di Reumatologia, Bologna, Italy.
E-mail: r.nardi@ausl.bologna.it

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Internal medicine patients

Internal medicine (IM) patients are mostly elderly. They have multiple co-morbidities, which are usually chronic, rather than self-limiting or acute diseases. Neither administrative indicators nor co-morbidity indexes, though validated in elderly patients, are able to completely define these *complex* patients or to allow physicians to correctly *manage* them. It is important to underscore the differences between the concepts of co-

morbidity and complexity, to discuss instruments for their measurement, and to highlight related implications, areas of uncertainty, and the responsibilities of internists in the assessment and management of inpatients on their wards on the basis of several clinical and management care characteristics. For the complex patients admitted to IM wards, internists not only need to find the best diagnosis and treatment, but also to apply a comprehensive assessment and both continuous and multi-disciplinary care. This will promote their good health and ability to function, and prevent or delay disability, frailty, and displacement from home and community. In fact, these are the true *every day job challenges* for internists[4,5] (Table 2) (Figures 1-3).

The challenge of defining patient co-morbidity

The common situation of people having more than one condition presents even more challenges[24] and patient co-morbidity could be described in different ways (Table 3).

A co-morbidity, as a pre-existing secondary diagnosis of the hospital patient, differs from a complication, a condition acquired during a hospital stay[32] (Table 4). Comorbidities are serious medical conditions that are not directly related to the primary diagnosis itself but that may involve any other major organ system. These are usually chronic rather than self-limiting or acute and easily treated conditions. In the REPOSI study, a *cluster of diseases* was defined as *two or more co-occurring specific chronic diseases*.[33] Feinstein defined comorbidity as *any distinct additional entity that has existed or may occur during the clinical course of a patient who has the index disease under study*.[34] In comorbidity, in which several pathological conditions in the same patient influence each other, it is necessary to hierarchize the *priority* for subsequent diagnostic and therapeutic decisions. Van den Akker *et al.* underline the difference between multimorbidity (*i.e.* the co-occurrence of multiple chronic or acute diseases and medical conditions in one person) and comorbidity as defined by Feinstein.[35] By definition, no index disease is used to investigate multimorbidity, whereas for research into comorbidity an index disease is obligatory[36] (Table 5).

Table 1. Failures related to the acute-chronic care mismatch.

Too many physicians and sub-specialists involved in the management of the same patient
Poor patient information, education and counseling for the patient, their family and/or caregivers
Under-diagnosis of the main chronic illness
Underestimation and inability to recognize precipitating factors in the destabilization of the main chronic illness
Over-diagnoses, overestimation of co-existing (sometimes mostly emphasized sub-specialties related) diseases, not able to modify the natural history of the main underlying disease
Inconsistent disease/patient monitoring
Poor co-ordination of care and duplication of some services/inappropriate omission of others
Medical errors, poor adherence to treatment, ADRs, conflicting advice

ADRs, adverse drug reactions.

Functional dependence

Mostly people live with chronic conditions rather than die from them.[37] In both the short and long term, symptoms and disability are the principal outcomes, and these become the focus of protracted personal and medical care.[38] The World Health Organization's International Classification of Impairments, Disabilities, and Handicaps (ICIDH) defines a taxonomy of disease impacts.[39] The ICIDH has three central concepts: impairment, disability, handicap. Another scheme developed by the sociologist Saud Nugi describes the relationships between four central concepts: active pathology, impairment, functional limitation and disability[40] (Table 6).

Functional dependency refers to persons dependent in at least one activity of daily living (ADL) or instrumental activity of daily living (IADL). The ADLs are bathing, dressing, eating, getting in or out of bed or chair (transferring), mobility, using the toilet, and continence. The IADLs are preparing meals, shopping, managing money, using the telephone, doing light housework, doing heavy housework, and getting outside. Approaches to disability are summarized in Table 7.

Frailty

Future studies should consider how complexity and frailty overlap.[45] Frailty is not easy to define and there is no single generally accepted clinical definition of frailty. The terms *complexity* and *frailty* are often used with a meaning for both additive when they should instead be considered separately.[46] As a condition, frailty has a high risk of a negative outcome and a worsening quality of life that is frequently associated with disability and socio-economic problems. In the frail patient, vulnerability is summarized in his or her susceptibility to actual or potential stressors that may adversely affect outcomes. Frail patients are less resilient and their ability to return to a restorative level of functioning by using compensatory and coping mechanisms is compromized.[11] Recalling the complexity concept, Rockwood *et al.* defined frailty as *a vulnerable state of health, arising from the complex interaction of medical*

Table 2. Attributes for clinical management of internal medicine patients.

Attributes	Meaning and features
Comorbidity, multimorbidity, burden of morbidity	Most people admitted in IM wards have more than one condition, with several more challenges for their management (see further text for each patient's characteristics definition)
Iceberg diseases, unreported needs	Elderly people tend to not report and/or underestimate symptoms and underlying problems, both for fear of the consequences and the risk of hospitalization
	In the *global assessment* of the patient we can often find some not overt or unrecognized diseases and conditions, but in themselves able to modify the natural clinical course and prognosis
	Some common underlying diseases may be related to unreported needs (Figure 1)
Severity of illness	Refers to the extent of physiological failure or organ system loss of function
Risk of mortality and end-of-life care	Refers to the likelihood of dying. In our patients the problem of end-of-life care often arises, not only in the final days or hours of their lives, but more broadly, in defining which best medical care is needed, when a terminal illness or terminal condition has become advanced, progressive and incurable
Prognosis	Refers to the probable outcome of an illness, including the likelihood of improvement or deterioration in the severity of the illness, the likelihood for recurrence, and the probable life span
Treatment difficulty	Refers to patient management problems that a particular illness presents to the healthcare provider
	Such management problems are associated with illnesses without a clear pattern of symptoms, illnesses requiring sophisticated and technically difficult procedures, and illnesses requiring close monitoring and supervision
In hospital AEs[6-8]	Examples of AEs: falls, nosocomial infections, sepsis, drug ADRs, bed restraints, pressure ulcers, bedridden syndrome, etc, with possible consequences after hospitalization such as: longer hospital stay, cascade events, need of further nurse/medical intervention, loss of independence, repeated hospitalization or death
Contextual errors and failures in individualizing patient care[9]	A contextual error occurs when a physician overlooks elements of a patient's environment or behavior that are essential to planning appropriate care; inattention to contextual information, such as a patient's transportation needs, economic situation, or caretaker responsibilities, can lead to contextual error, which is not currently measured in assessments of physician performance
	Error rates (as a measure of complexity) are associated with not only volume, but diversity, variability, and time limitations as well[10]
Need for intervention	Relates to the consequences, in terms of severity of illness, that lack of immediate or continuing care would produce
Clinical (in)stability	Stability refers to a patient's ability to maintain a steady-state equilibrium,[11] compliant with normal physiological functions
	It is related to the presence (absence) of vital functions (ABC: airways, breathing, circulation), blood pressure, body temperature, heart and respiratory rate impairments, altered state of consciousness
	By considering five simple physiological parameters (systolic blood pressure, pulse rate, respiratory rate, body temperature and level of consciousness) with MEWS is possible, even once on admission, to predict a worse in-hospital outcome[12]
Resource availability	Refers to resources available for the patient, the family, and the community brought to a situation: resources are personal, psychological, spiritual, social, technical and financial
Resource intensity	Refers to the relative volume, professionals (nurses, doctors, others) and services, types of diagnostics, therapeutics, monitoring and bed availability used in the management of a particular illness
	It also takes into account the amount of provided care, weighted by its diversity and variability[13]
Complexity of nursing care	Breathing, oro-tracheal tube, non-invasive ventilation, etc.; means of venous central or peripheral access; nutrition (enteral, parenteral) and hydration; urinary and gut elimination; personal hygiene; posture and movement of the patient; rest and sleep; cardiovascular function; safe environment; interaction and communication; advanced dressings and medications; therapeutic and diagnostic procedures; monitoring; management devices and instruments

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Table 2. Continued from previous page.

Attributes	Meaning and features
Difficult patients	Some patients (sometimes their families) are hostile, too aggressive, too dependent, unco-operative, hysterical, suspicious and so can be difficult and frustrating to the physician[14]
DHDs[15,16]	In addition to the nature and severity of the diseases, DHDs are conceived as situations involving an economic, human and organizational burden exceeding patients' and their families' capacities, inducing hospital bed blocking, discharge delays and longer LOS
	Patients are at high risk of a poor outcome after discharge (*i.e.*, unscheduled hospital readmission), requiring the involvement of primary care/out-of-hospital services
Unscheduled hospital readmissions	The number of patients discharged from an acute care hospital and readmitted to any acute care hospital within 30 days divided by the total number of people who were discharged alive from acute care hospitals[17]
	Readmission rate after a given time
Multidimensional comprehensive assessment	Defines the state of health an elderly person through careful analysis of functional capacity and their needs at various levels: biological and clinical, psychological, social, environmental, functional
	It is useful in defining priorities of care, as a judgment of *frailty* or *robustness* of each individual patient, for which decision may or may not be taken with diagnostic and therapeutic, invasive interventional and/or preservative and/or palliative measures, as appropriate
Decision making	Any *bed side* decision would be taken upon an appropriate clinical judgment, according to evidence-based current guidelines (if disposable and validated)
	We have to select *robust* patients from those needing mostly conservative/palliative care
	A multi-dimensional comprehensive assessment may useful in selecting *fit* or *compromized* and *frail patients*, also according to a *gut feeling based* practice, exercised as defined realistic end-points, mostly in cancer patients[18] (Figure 2)
Care management and communication issues[19]	The aging population demands a healthcare system that can manage multiple aspects of care across multiple settings and providers
	Patient reports to parent/caregiver that medicines are not given; patient is verbally abusive to staff
	Patient may also be non-adherent to treatments/medications
	The medical team has changed multiple times, as well as the plan of care
	There are multiple consulting services involved
	Patient has been to numerous hospitals and numerous doctors for the same diagnosis
	Patient has not had follow up or it has been inconsistent and only in times of medical emergencies
	Communication and co-ordination are essential tools for the care of complex patients.
Discharge planning	A comprehensive range of services is not enough: It is necessary to guide people through the healthcare system[20] (Figure 3)
Post-discharge management	Identifying patients at risk for prolonged hospital stay and in need of discharge planning resources
Continuity of care	Continuity of care is commonly defined as a connected and coherent series of healthcare events, or seamless care.[21] For the healthcare professional it means having all the necessary information about the patient at the point of care (*informational continuity*) and co-ordinating actions with other providers to deliver services in a complementary and timely manner along a recommended care pathway (*management continuity*). Continuity of care also requires good care relationships between the patient and attending team (*relational continuity*)[22]
	Complementary strategies are needed, supporting clinicians to provide personalized, comprehensive continuity of care, especially in socio-economically deprived areas[23]

IM, internal medicine; AEs, adverse events; MEWS, Modified Early Warning Score; DHDs, difficult hospital discharges; ADRs, adverse drug reactions; LOS, lengths of stay.

Figure 1. Iceberg diseases and unreported needs in the elderly.

GROUP 1 "FIT"	GROUP 2 "COPRIMISED"	GROUP 3 "FRAIL"
▪ Organ function +	▪ Organ function -	▪ Organ function - -
▪ Functional status +	▪ Functional status -	▪ Functional status - -
▪ Life expectancy +	▪ Life expectancy =	▪ Life expectancy - -
▪ Co-morbidity -	▪ Co-morbidity +	▪ Co-morbidity
▪ Risk of toxicity -	▪ Risk of toxicity +	▪ Risk of toxicity + +
DECISION MAKING		
"GO GO"	"SLOW GO"	"NO GO"
▪ Classical endpoints ▪ Standard treatment	▪ Special endpoints ▪ protocols	▪ Other specific endpoints ▪ Quality of life ▪ Palliative care only

Figure 2. Fitness of old cancer patients: from gut feeling to assessment based decision making.[18]

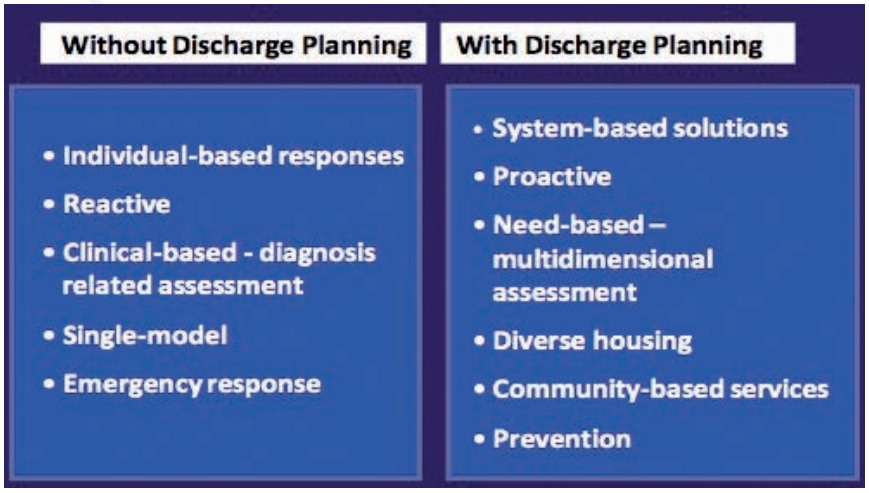

Figure 3. Discharge planning: a cultural comparison.

and social problems, resulting in a decreased ability to respond to stress, and associated with a decline in functional performance.[47] In the *old* or *very old* or *old-old* elderly, frailty is the condition in which the complexity of the patients makes the prognosis unfavorable and particularly burdensome from point of view of care. The frail elderly person, in general, is a weak subject of advanced or very advanced age, with disabilities at different levels and presence of associated geriatric syndromes. Frailty describes a phenotype of older people with comorbidities and clinical instability, disability and risk of adverse events, with a high incidence of hospitalization or death. Essentially, frailty is defined by severe reductions in reserves and resistance to stress caused by the cumulative decline of most physiological systems, and creating an additional burden to the normal aging process. From a more strictly clinical point of view, frailty of the elderly is characterized by high susceptibility to develop diseases (often with atypical clinical course, decreased motor skills, and propensity to immobility and rapid fluctuations in the subject's state of health), tendency to *cascade*, risk of adverse events and complications, reduced ability to improve and difficulties of recovery (*failure to thrive*), the need for constant medical treatments, frequent and repeated hospitalizations, need for continuing care, and a higher risk of mortality (Table 8).

The multidimensional assessment of the patient forms the base index of frailty (Figure 2). The Canadian Study of Health and Ageing has introduced the Clinical Frailty Scale that includes assessment of confirmed illnesses, patient motivation, control of symptoms, functional status and degree of dependence.[48]

The global clinical-social prognosis in hospitalized patients is assessed by the Flugelman's index. This evaluates seven parameters: mobility, sphincter control, mental competence, feeding ability, presence of

Table 3. Defining the co-morbidity in a patient.

Huntley and colleagues conduct a systematic review that highlights the utility and shortcomings of existing measures of multimorbidity[25]
In another systematic review, Fortin *et al.* find huge differences in the rates of multimorbidity measured in the population and in primary care[26]
Bayliss and colleagues examine two different approaches to gauging morbidity and find that both subjective and objective data are needed[27]
As the Goodman's editorial states, this is *an enormous health system challenge that demands our urgent attention*[28]

Table 4. Some definitions of co-morbidity.

The concurrent existence and occurrence of two or more medically diagnosed diseases in the same individual, with the diagnosis of each contributing disease based on established, widely recognized criteria[29,30]
The co-occurrence of multiple diseases in one person[31]

Table 5. Comorbidity, multimorbidity, burden of morbidity.

Comorbidity	Additional presence of a disease in relation to a specific index disease in an individual
Multimorbidity	Presence of multiple diseases in an individual
Clusters of diseases	Two or more co-occuring specific chronic diseases
Burden of morbidity	The overall impact of different diseases in an individual taking into account their severity

Table 6. Definitions and relationships among disease, active pathology, impairment, disability, handicap and functional limitation.

ICIDH			
Disease	**Impairment**	**Disability**	**Handicap**
The intrinsic pathology or disorder	Loss or abnormality of psychological, physiological or anatomical structure or function at organ level	Restriction or lack of ability to perform an activity in normal manner	Disadvantage due to impairment or disability that limits or prevents fulfillment of a normal role (depends on age, sex, socio-cultural factors) for the person
Sociologist's Saud Nugi			
Active pathology	**Impairment**	**Functional limitation**	**Disability**
Interruption or interference with normal processes, and efforts of the organism to regain normal state	Anatomical, physiological, mental or emotional abnormalities or loss	Limitations in performance at the level of the whole organism or person	Limitations in performance of socially defined roles and tasks within a socio-cultural and physical environment

ICIDH, International Classification of Impairments, Disabilities and Handicaps.

pressure sores, medical condition and family status. The sum of the scores of all parameters makes up the prognostic index. The index offers a simple and relatively accurate tool for the assessment of the prognosis of elderly patients. The score of 17 or more has a bad prognostic significance (such as still hospitalized or deceased) with 92% sensitivity, 83% specificity, and 94% predictive value.[49]

Definition of complexity

What makes our patients complex and how can we measure their complexity? These questions still have to be answered.[50] Defining and measuring patient complexity has important implications for how care is organized, how the management recognizes the workload of nurses and physicians, and how resources are allocated. *In order to redesign our healthcare systems to more effectively care for complex patients, we need to understand better exactly who they are*.[51]

The concept of complexity lacks a precise definition. It presents a specific challenge in clinical decision-making and processing the patient in ways that go beyond standard routine care.[52] Complexity is the quality of being intricate and compound. It refers to the degree of complication of a system or of a system component, determined by such factors as the number and intricacy of interfaces, the number and intricacy of conditional branches, the degree of nesting, and the types of data structures.[53,54] According to these meanings, complexity in a patient involves the intricate entanglement of two or more systems (*e.g.* body diseases, family-socio-economic status, therapies). In complexity, the interaction of multiple different factors in the same patient (social, medical, family, therapy, etc.) and its consequence have to be assessed in a multidimensional approach. Research to identify the profile of clinical complexity and instability of the resident in nursing homes graded clinical complexity by applying twelve frailty correlated clinical indicators, such as more than 4 drugs/die, malnutrition, artificial nutrition, dehydratation, tracheostomy and/or any other stoma, bladder catheter, urinary incontinence, pressure ulcers, any other skin

Table 7. Approaches to disability.[41]

ADL	ADLs are elementary tasks that allow getting around with minimum autonomy and independence, including any daily activity we perform for self-care, work, homemaking, and leisure. There are two major groups of ADL: *basic* activities related to self-care, such as bathing, dressing, eating, voluntary control of sphincters, grooming and walking; and *instrumental* activities, such as light housework, preparing meals. taking medications, shopping for groceries or clothes, using the telephone and managing money. This model was used to develop the Katz ADL index[42] and the Barthel index,[43] which is still a standard rating scale to measure disability
WHO *environmental* approach to *functional disability*	This is a biopsychosocial/integrative approach, considering three main components: body functions and structures, activities and participation and contextual factors (environmental and personal factors). *Independence* is defined as the *ability to perform an activity with no or little help from others, including having control over any assistance required rather than the physical capacity to do everything oneself*[44]

ADL, activities of daily living; WHO, World Health Organization.

Table 8. Prognostic consequences related to frailty.

Higher susceptibility to develop acute illnesses, mostly expressed with atypical clinical features (mental confusion, urinary incontinence, postural instability and falls, etc.)
Reduced mobility to immobility, with frequent weakness and adynamy, not fully justified by each disorder present
Rapid fluctuations of health performances
Marked tendency to develop complications (failure cascade)
Higher risk of adverse iatrogenic/hospital/healthcare related events
Slow resilience, however, almost always partial
Failure to thrive, often associated with increased incidence of infections, cell-mediated, depression, hip fractures, pressure ulcers, increased post-surgery mortality
Frequently required medical intervention, repeated hospitalizations, need for continuity of care
Hospital discharge delay
Higher risk of mortality

ulcer, falls, oxygen therapy.[55] In a primary care setting, physicians defined approximately one-quarter of their patients as complex, with older, more experienced physicians and those working in community health centers reporting higher proportions. Compared to non-complex patients, complex patients were older, more often women, and had more clinic visits to many different providers. Complex patients also had more medicines prescribed, including prescriptions for anti-psychotic medicines, were more likely to miss appointments, and were more likely to live in neighborhoods with lower income and education levels.[51]

Regardless of its definition, the complexity of the patient involves some important practical implications[56] (Table 9).

The *bedside* Internist's professionalism in managing complex patients should be based on best care patterns with growing levels of competence (Table 10).[58]

Unscheduled hospital readmissions and post-discharge management

Rehospitalizations are prevalent and costly. Unscheduled hospital readmissions may be due to new acute disease/new diagnosis, relapse or progression of the most important clinical disease, re-activation of a comorbidity or failure to recover after a previous discharge.[4] The conceptual *models* of considering re-hospitalizations, as patients' characteristics in and/or out of hospital healthcare are reported in Figures 4 and 5.[59] In 11,855,702 hospitalized Medicare patients discharged from a hospital, one-fifth (19.6%) were readmitted within 30 days and 34% within 90 days. Within one year 67.1% of patients who had been discharged with medical conditions and 51.5% of those who had been discharged after surgical procedures were re-hospitalized or had died. Among patients who were re-hospitalized within 30 days after a surgical discharge, 70.5% were re-hospitalized for a medical condition. Among all heart failure (HF) patients, 64.6% were readmitted. The most frequent diagnosis for re-hospitalization were HF, pneumonia, chronic ostructive pulmonary disease (COPD), septicemia.[60] Predicting the risk of death or unplanned readmission after discharge from hospital to the community may depend on several factors. In a recent study, the most important variable for the risk of readmission was the length of stay (LOS) (where the risk was higher when the LOS was less than two days), the route of admission (the risk of readmission was higher for those admitted via an outpatient visit), the department of treatment (IM), undiscovered comorbidities and complications caused by chronic illness, and the category of principal diagnosis (neoplasms being more susceptible to readmission).[61] On the contrary, a longer LOS may be considered as a negative prognostic factor: in the *LACE index*, unscheduled hospital readmissions are assessed as the length of stay (L), acuity of the admission (A), comorbidity of the patient (measured with the Charlson comorbidity index score) (C), and use of emergency department (measured as the number of visits in the six months before admission) (E) (Table 11).[62]

The Blaylock Risk Assessment Screen (BRASS) is administered on admission and identifies patients at risk for prolonged hospital stay and in need of discharge planning resources. This is assessed by the nursing team to identify, shortly after hospital admission, those patients who are at risk for prolonged hospital stay and in need of discharge planning resources, in order to reduce or prevent post-discharge problems. The index contains 10 items: *age, living situation/emotional support, functional status, cognition, behavior pattern, mobility, sensory deficits, previous admissions/emergency room (ER) visits, active medical problems and drugs.* A total score can range from 0 to 40. The index categorizes patients into three groups based on the total score. Scores ranging from 0 through 10 suggest that the patient is at low risk for having post-discharge problems and thus has little need for discharge planning (low-risk group). Scores ranging from 11 through to 20 suggest that the patient's problems are more complicated and require extensive planning to prevent problems after discharge (medium-risk group). Scores above 20 suggest that the patient's problems are so great that extensive discharge planning is required and that the patient is at risk for a discharge destination other than home (high-risk group).[63]

Proposals carried out for assessment of the complexity of the medical patients in internal medicine wards

Different tools have been proposed to evaluate the complexity of medical patients. Some elements have already been validated. The Comprehensive Geriatric Assessment (CGA) for defining 1-year mortality in complex patients is a useful tool and was introduced by Pilotto *et al.* with the Multidimensional Prognostic Index (MPI). This considers clinical, cognitive, functional, nutritional, and social parameters by using six standardized scales and information on medications and social support network, for a total of 63 items in eight domains. An MPI was developed from CGA data by aggregating the total scores of the eight domains and expressing it as a score from 0 to 1. Three grades of MPI were identified: low risk, 0.0-0.33; moderate risk, 0.34-0.66; and severe risk, 0.67-1.0.[64] In COPD patients, we recently confirmed the relevant level of comorbidity in such a chronic disease, with more than two-

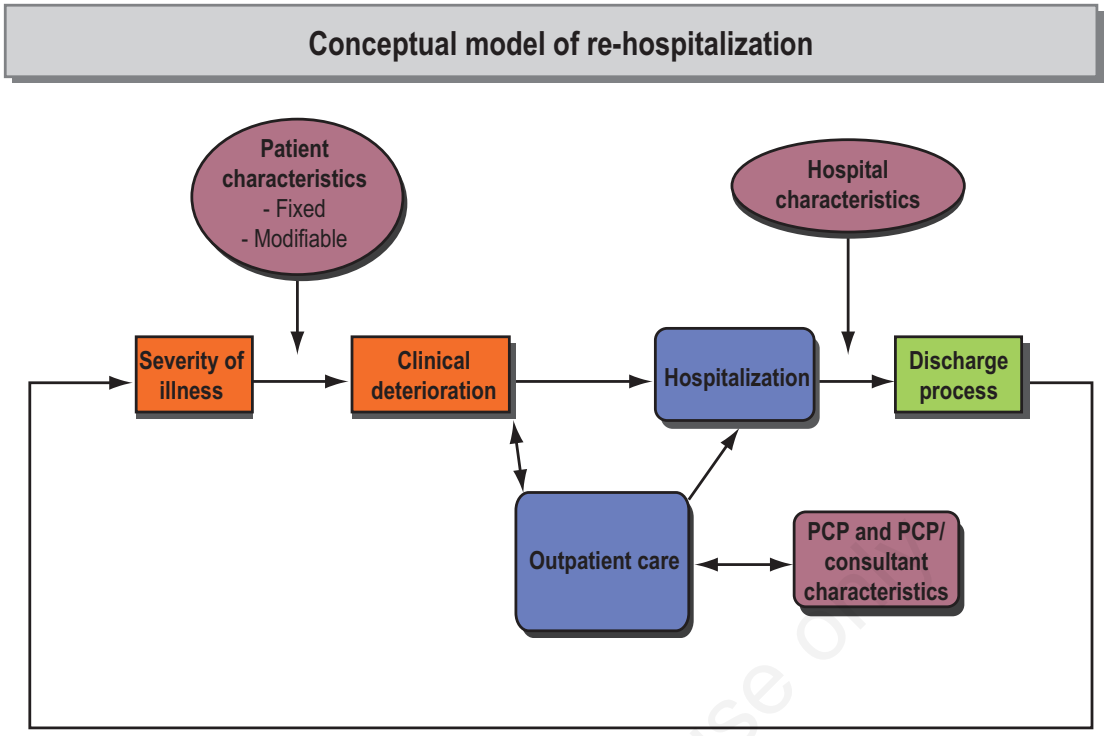

Figure 4. Factors influencing re-hospitalizations. PCP, primary care physician.

Table 9. Bed-side implications related to the complexity of the hospitalized patient in internal medicine practice.

Avoiding any *decision making* delay, under the burden of a state of uncertainty
Exercising a comprehensive global assessment in patients admitted in IM wards
Searching for comorbidities (both as overt and/or underlying *iceberg* diseases)
Identifying frail patients and those with functional deficits
Rightly using guidelines according to a clinical judgment
Exerting the ability of a *global direction* in the management of active/secondary problems
Selecting the treatments really necessary, by constructing the *hierarchy* of priorities
Exercising capacity of advocacy, *i.e.* the ability to represent the concerns of the patient, family and community, helping resolve related ethical and clinical issues
Predicting the summative patient characteristics that allow doctors and nurses to expect a certain trajectory of illness
Tailoring a targeted treatment, by defining clinical endpoints upon a multidimensional comprehensive assessment of the patient
Avoiding, if possible, a hospital discharge delay, by planning the tailored program management for the *difficult patient*
Considering the possibility of absence of a fragmented co-ordination of care, owing to shared interventions by several specialists
Considering the consequent risk of poor adherence to treatment
Implementing a proactive interaction with multiple subspecialists in ongoing care and holistic interrelationships across healthcare systems
Facilitating a self-management of chronic diseases
Facilitating the contribution of family components and caregivers in decision-making, such as the plan of care and the outcomes
Considering the need of *co-management* for a shared responsibility, authority and accountability in the management of complex surgical hospitalized patients by hospital medicine physicians (internists and or hospitalists)[57].
Managing the risk of errors and of the higher risk of iatrogenic damage (polypharmacy, drug interactions, ADR, incompatibilities, contraindications)

IM, internal medicine; ADR, adverse drug reaction.

thirds of patients with moderate to severe prognosis if stratified according to the MPI score.[65] The PROFUND index of the Spanish Society of Internal Medicine (SEMI) considers the following variables: demographic (age), clinical (presence of neoplasia, dementia, disabling dyspnea, and delirium in last hospital admission), laboratory (hemoglobin), functional (Barthel Index), socio-familial (no caregiver or caregiver other than spouse), and care (number of hospitalizations in last 12 months). This prognostic

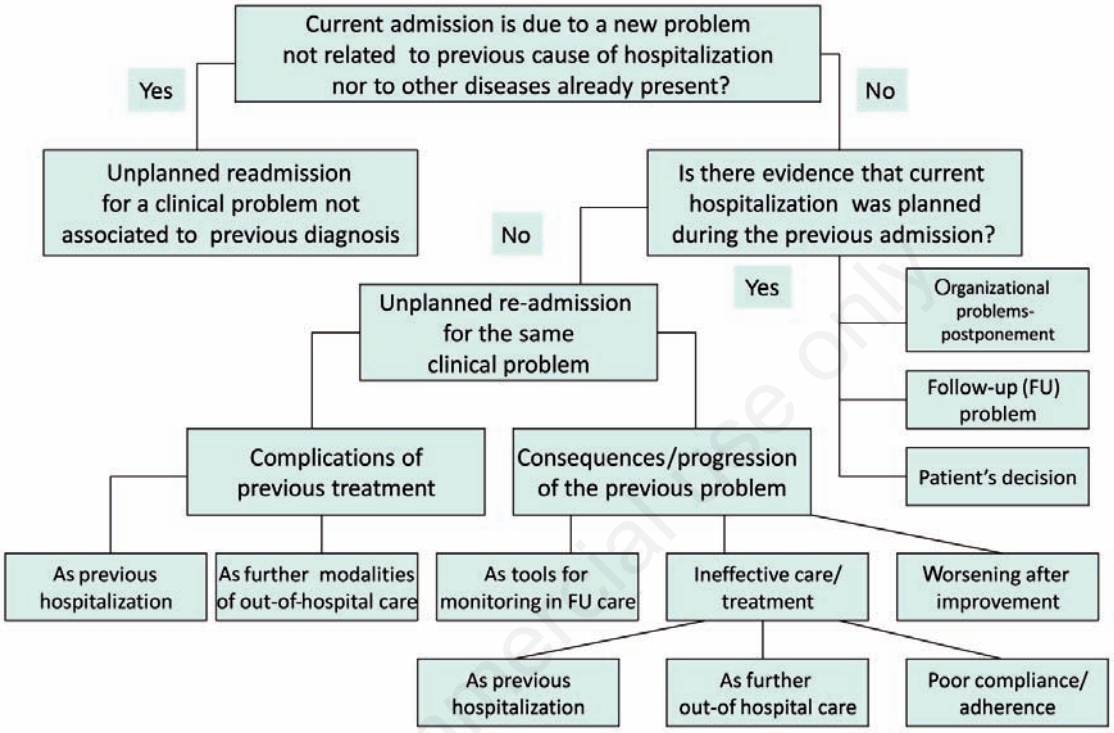

Figure 5. The model analysis of unscheduled hospital re-admission.[59]

Table 10. Some potential bed side decision making patterns of internal medicine doctors.

Basic professionalism	Optimal professionalism	Excellent professionalism	Distinctive professionalism
Knowing how to make decisions in a global manner: questioning and examining patients, reasoning as to what they present with, not omitting the psychodynamic aspects and emotions, explicit and also implicit willingness, actual needs, socio-economic and familial context, possible comorbidities, functional limitations or cognitive dysfunctions and alterations of the emotional sphere	Knowing how to carry out both inductive and deductive methods of clinical reasoning	Innovating and implementing protocols	Possessing a apecific professional competence-certified according to excellence criteria to be made available – as an added value – to the local hospital, in the interest of the patient
Knowing how to utilize the methods of EBM	Knowing the entire path of evidence-based practise, guidelines, clinical governance, audit	Knowing how to describe the process of health technology assessment and its instruments	Knowing how to identify and research the MID or MCID in clinical trials
Knowing how to identify the difference between guidelines and diagnostic-therapeutic paths	Critically evaluating protocols and knowing how to apply them to the actual patient	Critically evaluating a study protocol	
	Knowing how to distinguish statistical significance from clinical relevance	Applying EBM to actual patient using the PICO methods	
	Knowing the limits of EBM in IM and its integration with clinical experience	Conducting a clinical audit	

EBM, evidence-based medicine; IM, internal medicine; PICO, patient intervention comparison outcome; MID, minimally important difference; MCID, minimal clinically important difference.

index provided an accurate and transportable method of stratifying 1-year death in risk in polypathological patients.[66]

Are the doctors' rounds important for the global bedside assessment of the complex internal medicine patient?

The current hospital organization tends to emphasize the improvement of care processes, as pre-ordained tools, mostly upon *guidelines*, *clinical paths* and standards of care concerning a single disease.

We are firmly convinced that the treatment of the person according to his *real* needs is the true keystone of quality of care. This should be based on a multi-dimensional comprehensive assessment, and by exploring their complexity characteristics for which they are *different* from *normal and/or usual, standard* cases, as represented in randomized clinical trials.[67] *The medical ward round is a fundamental, yet all too often neglected, component of daily clinical activity. In the complex ward environment, the daily process of reviewing patients requires careful preparation, prioritization, attention to detail and continuous re-evaluation. Furthermore, all medical ward rounds should be tailored to the needs and wishes of the individual patient, promoting shared decision-making and self-management. Implicit in the recommendations outlined by this document is the depth of cultural change and clinical engagement required to deliver high-quality care. All healthcare professionals have a responsibility to protect and prioritize quality, patient experience and safety on medical ward rounds*.[68]

Conclusions

IM patients are mostly elderly, with multiple complex co-morbidities, usually chronic, often frail, some potentially unstable (*i.e.* requiring monitoring support, oxygen delivery therapy, treatment with fluid infusion and in a coma and/or state of shock, etc). Although several indices have been proposed to classify co-morbidities, co-morbidity cannot in itself explain all of the characteristics of the elderly patient admitted to an IM ward.[69] More attention should be paid by hospital management to the IM departments and to recognizing the complexity of their patients' needs; however, it is difficult to provide firm evidence for this. In recent years, budgetary pressures on hospital care, according to related structural and/or administrative indicators, assessing the complexity of case mix on the basis of the mere nosological encoding, have not allowed the internists' clinical practice to be evaluated other than with regards to their complex patients. Furthermore, many interventions carried out in IM departments are complex in that they involve multiple interacting components and are delivered in different ways and circumstances. But there are no means to measure these.

Table 11. Modified LACE tool.

Attribute	Value	Points	Prior admit.	Present admit.
*L*enght of stay	Less 1 day	0		
	1 day	1		
	2 days	2		
	3 days	3		
	4-6 days	4		
	7-13 days	5		
	14 or more days	6		
*A*cute admission	Inpatient	3		
	Observation	0		
*C*o-morbidity*	No prior history	0		
	DM no complications, cerebrovascular disease, Hx of MI, PVD, PUD	1		
	Mild liver disease, DM, with no organ damage, CHF, COPD, cancer, leukemia, lymphoma, any tumor, cancer, moderate to severe renal dz	2		
	Dementia or connective tissue disease	3		
	Moderate or severe liver disease of HIV infection	4		
	Metastatic cancer	6		
*E*mergency room visits during previous 6 months	0 visits			
	1 visits			
	2 visits			
	3 visits			
	4 or more visits			
	Take the sum of the points and enter the total →			

Letters in italics (L,A,C,E) stand for the acronym of LACE tool. admit., admittance; DM, diabete mellitus; Hx, history; MI, myocardial infarction; PVD, peripheral vascular disease; PUD, peptic ulcer disease; CHF, congestive heart failure; COPD, chronic ostructive pulmonary disease. *Co-morbidity points are cumulative to maximum of 6 points.

Table 12. Stable complex, unstable, critically ill and frail patient definitions.

Stable complex patient	Unstable patient	Critically ill	Frail elderly
Normal state of consciousness. No alteration of any vital sign; ABC (airways, breathing, circulation) is not compromized. Body temperature, heart and respiratory rate and blood pressure are normal. Multi-organ complex, systemic disease or multiple (somewhere underlying but not clinically overt) co-existing diseases and/or contextual factors (bio-psychosocial, environmental and personal problems) may be present in the same patient. *Considering* some problematic patient's characteristics, such as: - Difficult hospital discharge; - Diseases intrinsically burdened by a poor prognosis, such as malignant tumors; - Medically complex surgical patients; - Frailty characteristics, as further factors in defining the vulnerability and complexity of a patient; - Potential instability factors as causes of unscheduled readmission hospital rate	Patient with impaired: - consciousness, - vital functions: - ABC (airways, breathing, circulation), - blood pressure (hypotension: SBP <90 mmHg despite filling); - body temperature, - heart rate, - respiratory rate. *Considering* the need to monitor the patient according to its vital signs to detect early signs of clinical deterioration	Patient with a condition of current or recent acute failure of an organ and/or system, or of more organs or systems, with consequent possible risk to life, which requires continuous observation and personalized sub-intensive/ intensive) care. *Considering* the need to monitor the patient according to its vital signs to detect early signs of clinical deterioration	Vulnerable patient with reduced functional reserve, where the complexity of problems, (biological, clinical, functional, psycho-emotional and/or social and family related) can lead to an increased risk of: adverse *cascade* events, failure to thrive, impairment of quality of life and a poor prognosis. *Considering* some of the most often frequent geriatric syndromes: delirium, cognitive dysfunction, functional dependence, falls, chronic pain, polypharmacy, depression, urinary/fecal incontinence.

Therefore, we need to demonstrate on the basis of a comprehensive evaluation that the typology of our patients as *complex* requires effort and resources that are difficult to be quantified by routine assessment. In other words, we have to describe and profile the real complexity of the patient admitted to IM wards and the increasingly heavy workload for all of us, nurses and doctors (Table 12). By definition, internists are able to make clinical judgment; this includes clinical reasoning and decision making about real patient needs, critical thinking, and a global grasp of the situation presented, together with acquired skills. On the basis of a multidimensional assessment, we can decide what type of intervention to offer our patients, such as intensive, conservative/frugal or palliative levels of care. By exploring the real complexity of our patients and selecting their real needs, we can exercise holistic, anthropological and appropriate but also *frugal* medical treatment of the person, *i.e.* IM. In its principles, we can found the cultural and methodological tools to face the challenge of complexity.[70] IM doctors will continue to pursue what has always been the internist's task: the resolution of complex and ill-defined patient problems into proper diagnoses and therapeutic options, taking care of inpatients with a wide range of medical illnesses.[71] It is our intention to further investigate this complex issue, using additional assessment tools, because we are convinced that we need extra validated instruments for assessing the complexity of our patients.

References

1. Kane RL. The chronic care paradox. J Aging Soc Policy 2000;11:107-14.
2. Kane RL. Changing the face of long-term care. J Aging Soc Policy 2005;17:1-18.
3. Weiner H. The illusion of simplicity: the medical model revisited. Am J Psychiatry 1978;135:27-33.
4. Nardi R, Scanelli G, Corrao S, et al. Co-morbidity does not reflect complexity in internal medicine patients. Eur J Intern Med 2007;18:359-68.
5. Nardi R, Corbetta L, Muratori M, et al. Metodologia clinica, strumenti di valutazione e gestione dei pazienti anziani affetti da BPCO e comorbilità croniche. Ital J Med 2011;5:S171-8.
6. Bernardini B, Meinecke C, Zaccarini C, et al. Adverse clinical events in dependent long-term nursing home residents. J Am Geriatr Soc 1993;41:105-11.
7. Bernardini B, Meinecke C, Pagani M, et al. Epidemiology of adverse clinical events (ACES) as a dynamic measure of geriatric care management. Aging 1995; 7:191-3.
8. Nobili A, Licata G, Salerno F, et al. Polypharmacy, length of hospital stay, and in-hospital mortality among elderly patients in internal medicine wards. The REPOSI study. Eur J Clin Pharmacol 2011;67:507-19.
9. Weiner SJ, Schwartz A, Weaver F, et al. Contextual errors and failures in individualizing patient care. Ann Intern Med 2010;153:69-75.
10. Croskerry P, Shapiro M, Campbell S, et al. Profiles in patient safety: medication errors in the emergency department. Acad Emerg Med 2004;11:289-99.

11. Biel M. Reconceptualizing certified practice. Aliso Viejo, CA: AACN Certification Corporation; 1997.
12. Cei M, Bartolomei C, Mumoli N. In-hospital mortality and morbidity of elderly medical patients can be predicted at admission by the modified early warning score: a prospective study. Int J Clin Pract CME 2009;63:591-5.
13. Katerndahl DA, Wood R, Jaén CR. A method for estimating relative complexity of ambulatory care. Ann Fam Med 2010;8:341-7.
14. Steiger WA. Managing difficult patients. Ann Intern Med 1965;62:1083.
15. Meschi T, Fiaccadori E, Cocconi S, et al. [Analysis of the problem of difficult hospital discharges in the University Hospital of Parma]. Ann Ital Med Int 2004;19:109-17. [Article in Italian]
16. Nardi R, Scanelli G, Tragnone A, et al. Difficult hospital discharges in internal medicine wards. Intern Emerg Med 2007:2:95-9.
17. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the medicare fee-for-service program. N Engl J Med 2009;360:1418-28.
18. Wedding U. Endpoints and their relevance to older people, cancer and palliative care and work of EORTC. Elderly Task Force EORTC. Brussels: University of Jena; 2012.
19. Sieben-Hein D, Steinmiller EA. Working with complex care patients. J Pediatr Nurs 2005;20:389-95.
20. Department of Health. Modern standards and service models - National service framework for older people, March 2001. London: Department of Health; 2001. Available from: http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_4071283.pdf
21. Haggerty JL, Reid RJ, Freeman GK, et al. Continuity of care: a multidisciplinary review. BMJ 2003;327:1219-21.
22. Haggerty JL. Ordering the chaos for patients with multimorbidity. BMJ 2012;345:e5915.
23. Barnett K, Mercer SW, Norbury M, et al. Epidemiology of multimorbidity and implications for healthcare, research, and medical education: a cross-sectional study. Lancet 2012;380:37-43.
24. Stange KC. In this issue: assessing and acting on complexity. Ann Fam Med 2012;10:98-9.
25. Huntley AL, Johnson R, Purdy S, et al. Measures of multimorbidity and morbidity burden for use in primary care and community settings: a systematic review and guide. Ann Fam Med 2012;10:134-41.
26. Fortin M, Stewart M, Poitras M, et al. A systematic review of prevalence studies on multimorbidity: toward a more uniform methodology. Ann Fam Med 2012;10:142-51.
27. Bayliss EA, Ellis JL, Shoup JA, et al. Association of patient-centered outcomes with patient-reported and ICD-9-based morbidity measures. Ann Fam Med 2012;10:126-33.
28. Goodman RA, Parekh AK, Koh HK. Toward a more cogent approach to the challenges of multimorbidity. Ann Fam Med 2012;10:100-1.
29. Akker M, van den Buntinx F, Knottnerus JA. Comorbidity or multimorbidity: what's in a name? A review of literature. Eur J Gen Pract 1996;2:65-70.
30. Fried LP, Ferrucci L, Darer J, et al. Untangling the concepts of disability, frailty, and comorbidity: implications for improved targeting and care. J Gerontol A Biol Sci Med Sci 2004;59:255-63.
31. Guralnik JM. Assessing the impact of comorbidity in the older population. Ann Epidemiol 1996;6:376-80.
32. Canadian Institute for Health Information Partnership for Health Informations Standards. WHIC Chronic Disease Management Infostructure. CDM data standards; Fall 2005. Symposium. Available from: http://secure.cihi.ca/cihiweb/en/downloads/WHIC_CDM_Management_Infostructure_CDM_Data_Standards_Peter_Sargious.pdf
33. Nobili A, Marengoni A, Tettamanti M, et al. Association between clusters of diseases and polypharmacy in hospitalized elderly patients: results from the REPOSI study. Eur J Intern Med 2011;22:597-602.
34. Feinstein AR. The pre-therapeutic classification of comorbidity in chronic disease. J Chronic Dis 1970;23:455-68.
35. van den Akker M, Buntinx F, Metsemakers JF, et al. Multimorbidity in general practice: prevalence, incidence, and determinants of co-occurring chronic and recurrent diseases. J Clin Epidemiol 1998;51:367-75.
36. de Groot V, Beckerman H, Lankhorst GJ, Bouter LM. How to measure comorbidity: a critical review of available methods. J Clin Epidemiol 2003;56:221-9.
37. Rothenberg RG, Koplan JP. Chronic disease in the 1990s. In: Breslow L, Fielding JE, Lave LB, eds. Annual review of public health. Vol. II. Palo Alto, CA: Annual-Reviews Inc.; 1990. pp 267-296.
38. Verbrugge LM, Jette AM. The disablement process. Soc Sci Med 1994;38:1-14.
39. World Health Organization. The International Classification of Impairments, Disabilities, and Handicaps (ICIDH) defined a taxonomy of disease impacts by the World Health Organization. Geneva: World Health Organization; 1980.
40. Nagi SZ. Disability concepts revised: implications for prevention. In: Pope AM, Tarlov AR, eds. Disability in America: toward a national agenda for prevention. Washington, DC: National Academy Press; 1991. pp 309-327.
41. Salvador-Carulla L, Gasca VI. Defining disability, functioning, autonomy and dependency in person-centered medicine and integrated care. Int J Integr Care 2010;10:e025.
42. Katz S. Assessing self-maintenance: activities of daily living, mobility, and instrumental activities of daily living. J Am Geriatr Soc 1983;31:721-7.
43. Mahoney FI, Barthel DW. Functional evaluation: the Barthel index. Md State Med J 1965;14:61-5.
44. World Health Organization. A glossary of terms for community healthcare and services for older persons. Ageing and Health Technical Report, Vol. 5, WHO/WKC/Tech.Ser./04.2. Kobe (Japan): WHO Centre for Health Development; 2004. Available from: http://www.who.int/kobe_centre/ageing/ahp_vol5_glossary.pdf Accessed: 14 April 2009.
45. Cerimele JM, Peccoralo LA. Defining patient complexity. Ann Intern Med 2012;156:606-7; author reply 607.
46. Olde Rikker MG, Schers HJ, Melis RJ. Defining patient complexity. Ann Intern Med 2012;156:606; author reply 607.
47. Rockwood K, Stadnyk K, Carver D, et al. A clinimetric

evaluation of specialized geriatric care for rural dwelling, frail older people. J Am Geriatr Soc 2000;48: 1080-5.
48. Rockwood K, Song X, MacKnight C, et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173:489-95.
49. Flugelman MY, Ben David Y, Harats N, Eliakim M. A simple prognostic index for hospitalised geriatric patients. Gerontology 1986;32:272-6.
50. Turner BJ, Cuttler L. The complexity of measuring clinical complexity. Ann Intern Med 2011;155:851-2.
51. Grant RW, Ashburner JM, Hong CS, et al. Defining patient complexity from the primary care physician's perspective: a cohort study. Ann Intern Med 2011;155: 797-804.
52. Weiss KB. Managing complexity in chronic care: an overview of the VA state-of-the-art (SOTA) conference. J Gen Intern Med 2007;22:374-8.
53. Evans T, Michael W, Marciniak J. Software quality assurance and management. New York, NY: John Wiley & Sons Inc; 1987.
54. Wilson T, Holt T, Greenlagh T. Complexity and clinical care. Br Med J 2001;323:685-8.
55. Lopez S, Sibilano A, Stefanoni MG, et al. Clinical complexity and clinical instability among the nursing home residents. G Gerontol 2009;57:23-32.
56. Fried LP, Ferrucci L, Darer J, et al. Untangling the concepts of disability, frailty, and comorbidity: implications for improved targeting and care. J Gerontol A Biol Sci Med Sci 2004;59:255-63.
57. Siegal E. A structured approach to medical comanagement of surgical patients. Ital J Med 2012;6:347-51.
58. Nardi R, Mathieu G, Berti F, et al. Evaluation models and items of clinical competence for the hospital physicians in internal medicine. Ital J Med 2011;5:S3-13.
59. Ludke RL, MacDowell NM, Booth BM, Hunter SA. Appropriateness of admissions and discharges among readmitted patients. Health Serv Res 1993;3:501-25.
60. Jencks SF, Williams MV, Coleman EA. Re-hospitalizations among patients in the Medicare fee-for-service program. N Engl J Med 2009;360:1418-28.
61. Lee EW. Selecting the best prediction model for readmission. J Prev Med Public Health 2012;45:259-66.
62. van Walraven C, Dhalla IA, Bell C, et al. Derivation and validation of an index to predict early death or unplanned readmission after discharge from hospital to the community. CMAJ 2010;182:551-7.
63. Mistiaen P. Predictive validity of the BRASS index in screening patients with post-discharge problems. J Adv Nurs 1999;30:1050-6.
64. Pilotto A, Ferrucci L, Franceschi M, et al. Development and validation of a multidimensional prognostic index for one-year mortality from comprehensive geriatric assessment in hospitalized older patients. Rejuvenation Res 2008;11:151-61.
65. Nardi R, Baldo C, Gussoni G, et al. Chronic obstructive pulmonary disease, comorbidities and complexity of the patients: study design and preliminary results of the complexico study from the scientific society FADOI. XI EFIM Congress, 24-27 October 2012, Madrid, Spain.
66. Bernabeu-Wittel M, Ollero-Baturone M, Moreno-Gaviño L, et al. Development of a new predictive model for polypathological patients. The PROFUND index. Eur J Intern Med 2011;22:311-7.
67. Nardi R, Fabbri T, Belmonte G, et al. Internal medicine, complexity, evidence based medicine, almost without evidences. Ital J Med 2009;3:191-200.
68. Royal College of Physicians, Royal College of Nursing. Ward rounds in medicine: principles for best practice. London: RCP; 2012.
69. Nardi R, Scanelli G, Borioni D, et al. The assessment of complexity in internal medicine patients. The FADOI Medicomplex Study. Eur J Intern Med 2007;18:283-7.
70. Coaccioli S. Medicine of complexity: the modern internal medicine. Clin Ter 2010;161:9-11.
71. Huddle TS, Heudebert GR. Internal medicine training in the 21st century. Acad Med 2008;83:910-15.