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Characteristics of multiple-diseased elderly in Swedish hospital care and clinical guidelines: Do they make evidence-based priority setting a ''mission impossible''?

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Abstract

In Sweden, an expected growing gap between available resources and greater potential for medical treatment has brought evidence-based guidelines and priority setting into focus. There are problems, however, in areas where the evidence base is weak and underlying ethical values are controversial. Based on a specified definition of multiple-diseased elderly patients, the aims of this study are: (i) to describe and quantify inpatient care utilisation and patient characteristics, particularly regarding cardiovascular disease and co-morbidity; and (ii) to question the applicability of evidence-based guidelines for these patients with regard to the reported characteristics (i.e. age and co-morbidity), and to suggest some possible strategies in order to tackle the described problem and the probable presence of ageism. We used data from three sources: (a) a literature review, (b) a register study, based on a unique population-based register

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of inpatient care in Sweden, and (c) a national cost per patient database. The results show that elderly patients with multiple co-morbidities constitute a large and growing population in Swedish inpatient hospital care. They have multiple and complex needs and a large majority have a cardiovascular disease. There is a relationship between reported characteristics, i.e. age and co-morbidity, and limited applicability of evidence-based guidelines, and this can cause an under-use as well as an over-use of medical interventions. As future clinical studies will be rare due to methodological and financial factors, we consider it necessary to condense existing practical-clinical experiences of individual experts into consensus-based guidelines concerning elderly with multi-morbidity. In such priority setting, it will be important to consider co-morbidity and different degrees of frailty.

Keywords: priority setting, evidence-based guidelines, elderly, co-morbidity, cardiovascular disease, ageism.

Introduction

Evidence-based guidelines are supposed to support clinicians in clinical decision making (Fortin et al. 2006; Guyatt et al. 2000). By encouraging standardisation among health care providers, the aim is to optimise benefits to patients with specific diseases; the benefits have been well documented (National Committee for Quality Assurance 2003; Tinetti et al. 2004). Crucial parts of guidelines are randomised controlled trials (RCTs) and systematic reviews, which provide the most reliable data (Rothwell 2005). However, RCTs and systematic reviews primarily focus on internal validity (Alderson et al. 2004; Altman et al. 2001), while their external validity and generalisability, i.e. whether the results can be applied to patients in a specific clinical setting in routine practice, can be questioned (Braithwaite 2007; Green & Glasgow 2006; Rothwell 2005; Tinetti et al. 2004). Hence, many evidence-generating RCTs, which constitute the base of clinical guidelines, exclude elderly patients with multiple co-morbid conditions (American Heart Association Council 2007; Fortin 2006; The Swedish Council on Technology Assessment in Health Care 2003). Table 1 contains sets of exclusion criteria that are commonly

Table 1. Reported exclusion criteria, regarding age, co-morbidity and other conditions for patients with acute coronary syndromes, in five evidence-generating RCTs cited in two meta-analyses (Hoenig et al. 2006; Metha et al. 2005)

Study	Exclusion criteria
FRISC II	Increased risk of bleeding episodes
	Anaemia
	Other acute or severe cardiac disease
	Renal insufficiency
	Liver insufficiency
	Clinically relevant osteoporosis
	Other severe illness
	Anticipated difficulties with cooperation
	Advanced age (e.g. >75 years)
	Angioplasty in the past 6 months
	Hypersensitivity to randomised drugs
	Previous open-heart surgery
VINO	Any concomitant disease which may have possible influence on 1-year prognosis
	Lack of patient cooperation
	Coronary angioplasty or bypass surgery less than 6 months previously
TIMI IIIB	Percutaneous coronary angioplasty within 6 months
	Coronary artery bypass grafting at any time
	Pulmonary edema
	Systolic arterial pressure >180 mmHg or a diastolic pressure >100 mmHg
	Coexisting severe illness
	Receiving oral anticoagulants
(TACTICS)-TIMI 18	
See TIMI IIIB	
ICTUS	Age >80 years
	Primary percutaneous coronary intervention or fibrinolytic therapy
	Hemodynamic instability or overt congestive heart failure
	Use of oral anticoagulants in the past 7 days
	Percutaneous coronary intervention within the past 14 days

Table 1 (*Continued*)

Study	Exclusion criteria
	Recent trauma or risk of bleeding Hypertension despite treatment Weight greater than 120 kg Inability to give informed consent A contraindication to treatment with percutaneous coronary intervention or glycoprotein IIb/IIIa inhibitors

used in RCTs. Several of those co-morbid conditions can modify risks and benefits in elderly patients (American Heart Association Council 2007; Boyd et al. 2005; Braithwaite 2007). In fact, it has been suggested that adhering to guidelines in caring for elderly patients with several co-morbid conditions may have undesirable effects (Boyd et al. 2005).

The Swedish National Board of Health and Welfare (Socialstyrelsen) has been commissioned since 2000 to draw up evidence-based guidelines to support priority setting in health care. The guidelines are expected to influence health care policy making as well as clinical decision making. They are to be based on the parliamentary resolution on priority setting that was launched in 1997 (Swedish Parliament 1997). The basic ethical principles are those of human dignity, need and solidarity and cost-effectiveness. The national initiative for priority setting started with heart disease. The first guidelines for the care of heart disease were published in 2004 and a second generation of these guidelines was published recently (The Swedish National Board of Health and Welfare 2008). Other medical areas have undergone a similar process, including cancer, cerebrovascular disease and chronic obstructive pulmonary disease.

The model for priority setting and drawing up guidelines can be described as a process with three major steps. First, current scientific knowledge is reviewed by experts. Then, medical conditions and medical actions are paired, forming so-called prioritisation objects. Each such object is finally ranked by experts on the basis of the following four aspects: valuation of the degree of severity of the medical condition (the needs of the patient group), the expected results of the action (patient's benefit-risk), the cost-efficiency of the category and the degree of evidence. Problems in constructing useable priority setting in a Scandinavian context

have been described (Social- og Helsedepartementet 1997), particularly when there is a lack of evidence, when the patient groups are not satisfactorily defined and when there is uncertainty about how different ethical values should be weighed, especially concerning the aims of health care. Elderly patients with multiple diseases represent all of these issues.

First, there is a lack of scientific studies on the effect of different treatments for diseases in elderly patients, especially those with multiple diseases (The Swedish Council on Technology Assessment in Health Care 2003). It is problematic to extrapolate from studies on younger populations without multi-morbidity due to the limited generalisability of the study results (Boyd et al. 2005; Braithwaite 2007; Green & Glasgow 2006; Rothwell 2005; The Swedish Council on Technology Assessment in Health Care 2003; Tinetti et al. 2004). Hence, the model for priority setting that is based on the ranking of *one medical action* for *one medical condition* does not seem well adapted to this population of patients. Regarding heart disease, interactions between normal biological ageing processes in the cardiovascular system, age-related pathology, sequelae of heart disease and co-morbidity contribute to the problem. Second, a generally accepted base of indicators of good ageing appears to be missing (Bowling & Iliffe 2006). This lack of consensus also concerns how we should weigh different ethical values and patient preferences when the aims of care and relevant end-points of scientific studies are identified and applied to the multiple-diseased elderly (Fried et al. 2002; Tsevat et al. 1998). Finally, there is no generally accepted definition of multiple-diseased elderly patients (Akner 2004).

The demographic prognosis for the Swedish population stresses the volume of the problem. Today 460,000 people are 80 years of age or older. In 25 years, this number is estimated to be 760,000 (Statistics Sweden 2004). The percentage of elderly and very elderly people in our hospitals will continue to grow, and many of them will have multiple diseases. In Sweden and in other Western countries, the most common diagnostic category for this patient group is cardiovascular disease (The Swedish National Board of Health and Welfare 2005; Wenger 2000). Regarding patients with acute coronary syndrome, studies and reviews have addressed the prognostic importance of acute and chronic co-morbid conditions (American Heart Association Council 2007; Lichtman et al. 2007; Taneva et al. 2004).

We believe that it is of value *per se* to study elderly people with multiple diseases in order to avoid stereotypical use of guidelines for priority setting that are not adapted to this population of patients. Otherwise, there will be a risk of ageistic policy and decision making. Further, if the national guidelines remain in force, there will be a need to develop the process of priority setting to include complex cases. Our core thesis is that since the results of studies on chronologically and biologically much younger patients, preferably without relevant co-morbidities, cannot *a priori* be extrapolated to multiple-diseased elderly patients, clinical guidelines are not *a priori* applicable for these patients.

Based on a specified appropriate definition of multiple-diseased elderly patients, the aims of this study are: (a) to describe and quantify inpatient care utilisation and costs, as well as patient characteristics, particularly regarding cardiovascular disease and co-morbidity; and (b) to question the applicability of evidence-based guidelines for these patients in Swedish inpatient hospital care with regard to the reported characteristics (i.e. age and co-morbidity), and to suggest some possible strategies in order to tackle the described problem and the probable presence of ageism.

Methods and Material

To obtain an operational definition, we conducted a literature review via secondary data sources (Cochrane Library and Clinical Queries), a meta-database (Google) and primary databases (Medline and CINAHL). The following search words were used: elderly, very elderly, frail elderly, frailty, multiple-diagnosed, multiple-diseased, multi-morbidity and co-morbidity. From the few definitions of multiple-diseased elderly that were found, one was chosen and the reasons for that choice are presented.

On the basis of the chosen definition, we extracted a population, diagnosed in 2005, of elderly with multiple diseases, focusing on those patients with at least one documented episode of a cardiovascular disease. The population was characterised through the Patient Register maintained by the National Board of Health and Welfare. The Patient Register is a comprehensive national register of the consumption of inpatient hospital care. It is based on the care providers' databases, which are based on information from the patients' records. It contains information concerning

patient characteristics, health care consumption, diagnoses and major procedures for each patient and episode of care. The annual rate of under-reporting during the last few years is estimated to be less than 1% for somatic health care. We estimated the costs of hospital care for the multiple-diseased elderly by using data from two epidemiological reports (The Swedish Association of Local Authorities and Regions 2005; The Swedish National Board of Health and Welfare 2005), and the national database on cost per patient (the KPP database). Cost per patient is a method used to calculate the cost of each patient and episode of hospital care. There were 601,000 care episodes in the database in 2005. Approximately 43% of the total number of episodes of somatic hospital care was included.

Our estimation of the hospital care costs was based on three presumptions. (1) We presumed that the age-related cost per day of hospital care for a multiple-diseased elderly patient was similar to that of any individual 75 years of age or older. We used a template, derived from the KPP database and based on the age interval-related cost per day of hospital care: the cost per day in the age interval 75–84 years was 7220 Swedish Kronor (SEK), the cost per day in the interval 85 years or older was 5895 SEK (1 Euro = 9.40 SEK). (2) Furthermore, we presumed that the distribution of hospital care episodes for the two age intervals to be of the same proportion for those 83% of the multiple-diseased elderly patients who had manifested a cardiovascular disease (and for whom we had detailed information) as for the total number of multiple-diseased elderly patients. The pattern of hospital care consumption of the former subgroup was similar to that of all multiple-diseased elderly patients. (3) In addition, we presumed that the distribution of episodes of hospital care for the two age intervals (about which we had information) was of the same proportion as the distribution of days of hospital care for the two age intervals.

Results

Definition and Previous Attempts at Characterisation

We found no generally accepted definition of multiple-diseased elderly, although several articles focused on elderly with multiple co-morbidities.

Important risk factors in elderly patients are the number of co-morbid conditions (multi-morbidity), the degree of cognitive impairment of the patient, the degree of disability and lack of social support. The prognosis depends to a great extent on the patient's biological age, which in turn largely depends on the type and degree of co-morbidity. Accordingly, the patient's relative fitness and frailty seems to be a more appropriate predictor of risk and prognosis than is chronological age (Mitnitski et al. 2002; Rockwood et al. 2005, 2006). However, this concept, like the frailty index concept and frail elderly concept, the latter often defined as ''older adults or aged individuals who are lacking in general strength and are unusually susceptible to disease or to other infirmity'', does not seem sufficiently distinct as the basis for a quantitative study. The WHO's International Classification of Functioning, Disability and Health (ICF), which focus on needs, function and activity, participation and surrounding factors (Cieza et al. 2006), is not yet in common use. Several articles on co-morbidity and co-morbidity of the elderly were noted, many of them addressing challenges in the context of evidence-based medicine (Bierman 2004; Boyd et al. 2005, 2007; Cieza et al. 2006; Fortin et al. 2006; Karlamangla et al. 2007; Lichtman et al. 2007; Starfield 2006; Taneva et al. 2004; Tinetti et al. 2004).

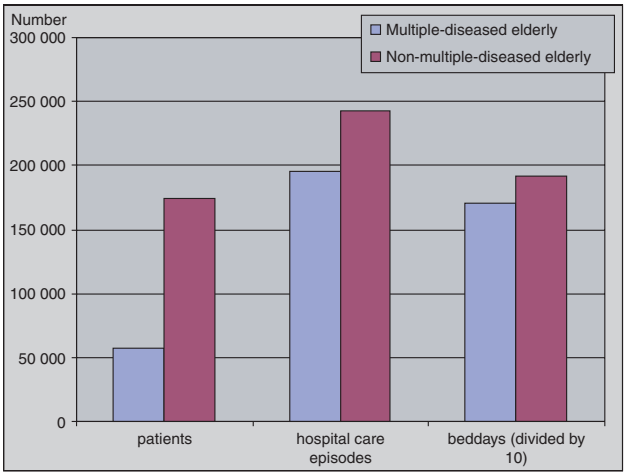
In a Swedish context, we found three definitions. In 2002, the Centre of Epidemiology at the National Board of Health and Welfare formulated the following definition: ''Individuals 75 years old or older, who during the past 12 months have received inpatient hospital care three or more times and who have three or more diagnoses in three or more diagnostic groups according to the classification system ICD-10'' (The Swedish National Board of Health and Welfare 2002). The definition has some shortcomings. The criterion concerning the number of formal diagnoses in the hospital probably leads to an underestimation of the number of elderly in society with multiple diseases. Primary care and elderly care in the municipalities are not considered. Further, multi-morbidity is not always completely documented in the patients' records. The Stockholm Gerontology Centre (Stiftelsen Äldrecentrum) has proposed a similar definition (Gurner & Thorslund 2001), with the difference that the criterion ''...diagnoses in three or more diagnostic groups...'' has been omitted. Consequently, more patients would be expected to be included. Faced with the above

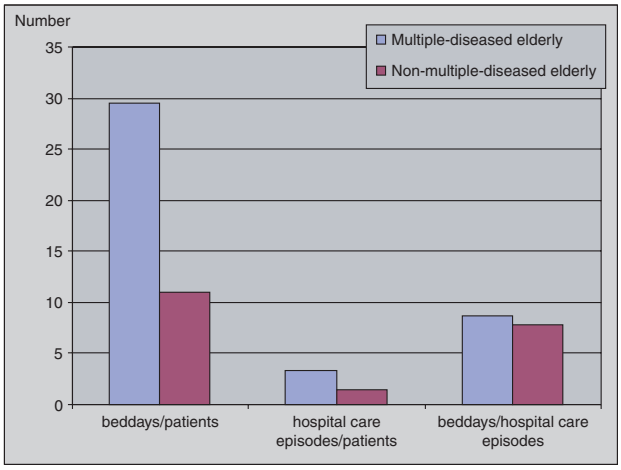
mentioned disadvantages, and considering that several organ systems can fail at the same time, the following definition of ''multi-failing elderly'' has been proposed by the Gerontology Centre: ''Patients above the age of 75 years with some diagnosis or several diagnoses, problems with reduced mobility and energy, and with a need for rehabilitation and/or function supporting actions over a long period of time. On the whole, this means a fragile, rapidly changing life situation, with a need for recurrent re-evaluation of care-, nursing- and rehabilitation actions''. Although this definition seems expressive and clinically relevant, like the definition of the frail elderly, it is not useable in the context of a register study. In spite of its disadvantages, we found the definition formulated by the National Board of Health and Welfare to be useable. Each of the three dimensions contributes to a relevant delimitation of a population with complex needs. The chronological age limit of 75 years is arbitrarily chosen, but it recurs in other tentative definitions. A vast majority of patients who fulfil the criteria, not least that of recurrent hospital care, would truly have multiple and complex needs. Furthermore, our search study resulted in several articles that showed a relation between the number of diagnoses/deficits of a patient and his or her prognosis (Mitnitski et al. 2002; Rockwood et al. 2005, 2006). Finally, the definition is precise and useable on a population level.

Hospital Care Consumption

The initial search was as follows: all patients aged 75 years or older, with at least one episode of hospital care during 2005 and with at least two more episodes of hospital care during the previous 12 months, and with diagnoses from at least three different chapters of the ICD-10 classification. The result was that in 2005 there were 57,872 unique multiple-diseased elderly patients who consumed inpatient care. In 2005, those patients had 195,900 hospital stays for a total of 1,709,446 days. The average number of hospital care episodes per patient per year was 3.4, the number of days per patient per year was 29.5, and the number of days per episode was 8.7. Their consumption can be compared to that of patients aged 75 years or older who do not fulfil the rest of the definition (Figure 1). Of the total number of hospital care episodes of patients aged 75 years old or older, the percentages of multiple-diseased elderly were 48% for internal medicine,

Figure 1. Comparison of the annual hospital care consumption of the multiple-diseased elderly patients with that of 75 years old or older patients, not defined as multiple-diseased elderly





42% for surgery and 52% for geriatrics. The contribution of each speciality to the care consumption of this patient group is shown in Figure 2. In all, 81% of the patients consumed at least one care episode in internal medicine.

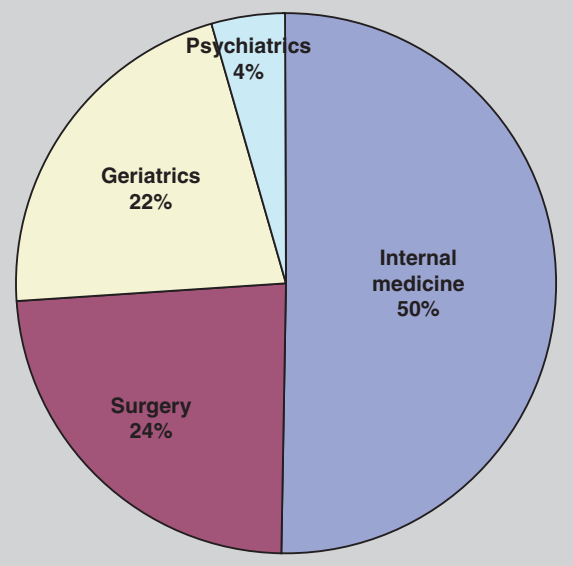
If the criterion in the definition for the minimum number of episodes had been two instead of three, with the rest of the definition unchanged, 87,382 patients would have been included. If the criterion had been only one episode, 109,036 patients would have been included.

Multiple-diseased patients with at least one episode of a manifested cardiovascular disease (from the ICD10-chapter Diseases of the Circulatory Organs) were quantified. In 2005, there were 47,986 such unique patients (83% of the total number of multiple-diseased elderly patients), and they manifested a total of 163,588 episodes of hospital care. In 110,266 of those episodes at least one diagnosis of a cardiovascular disease was registered. Their pattern of hospital care consumption was similar to that of all multiple-diseased elderly patients. The distribution of these care episodes over the three main types of Swedish hospitals was as follows: small hospitals 30%, mid-sized hospitals 41%, and regional hospitals 29%.

Characteristics of Multiple-diseased Elderly Patients with at Least One Manifested Care Episode for Diagnosed Cardiovascular Disease

The distribution of patients by age intervals and sex is presented in Figure 3. Number of health care episodes was distributed according to age intervals as follows: 75–79 years: 51,356; 80–84 years: 57,158; 85–89 years: 37,867; and 90 years or older: 17,207. To survey the most common morbidity of the multiple-diseased elderly with a manifested cardiovascular disease, we conducted a datasearch at the ICD10 section level. The 25 most common diagnostic sections are shown in Figure 4. Quantitatively, cardiovascular diseases dominated, i.e. heart failure and arrhythmias (I30-I52), ischaemic heart disease, hypertension, status and rehabilitation after cardiovascular interventions (Z80-Z99 and Z40-Z54), cerebrovascular insults and peripheral arterial diseases. Regarding other diseases, the following were noted: diabetes, chronic diseases of the lower respiratory tract (particularly COPD and asthma), anaemias, metabolic diseases (e.g. thyroid disorders), renal insufficiency, infections (urinary, pulmonary, septic and influenza), cognitive and mental diseases (e.g. dementia),

Figure 2. Relative contribution of each speciality to the total consumption of hospital care episodes by the multiple-diseased elderly

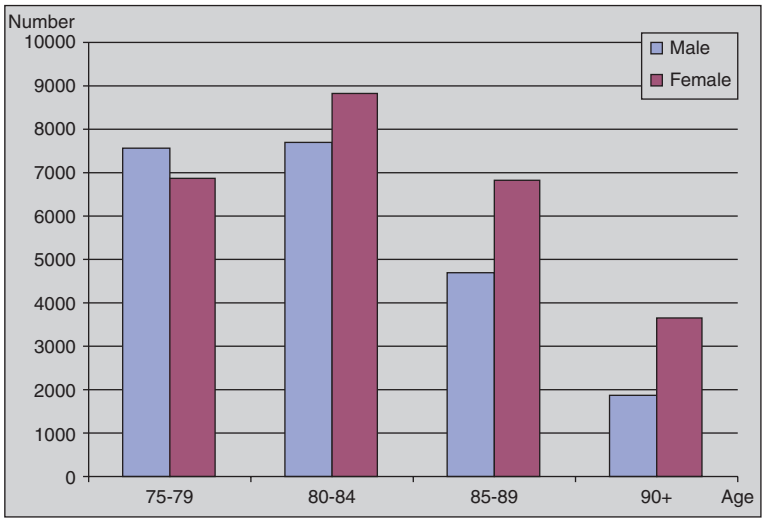


gastric and bowel diseases and injuries, and pain in the hip region. It should be stressed that malignant diseases would be on the list if the different types (particularly prostatic cancer and breast cancer) were added together.

Estimation of the Annual Cost of Swedish Hospital Care for Multiple-diseased Elderly

We considered the subgroup of patients with a manifested episode of a cardiovascular disease, constituting 83% of multiple-diseased elderly, as representative of the total population. Consequently, the total annual cost

Figure 3. Distribution by age and sex of multiple-diseased elderly patients with at least one diagnosis of a cardiovascular disease



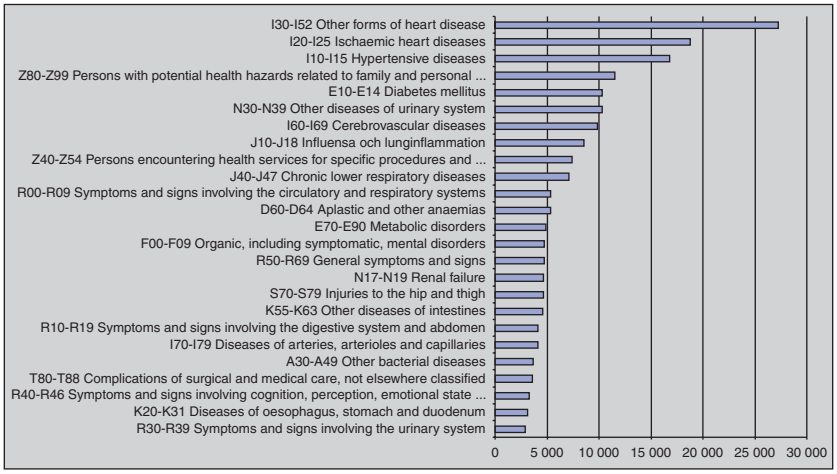
of Swedish hospital care for the multiple-diseased elderly was estimated according to presumptions (1), (2) and (3) (see Methods and Material):

1,133,939 days × SEK 7220/day (75–84 years) + 575,506 days × SEK 5895/day (85 years or older) = SEK 11,579,652,000 and subsequently SEK 11,579,652,000/60,764,000,000 = 19.1% of the total cost of Swedish hospital care.

Discussion

We did not find any generally accepted definition of multiple-diseased elderly in Sweden or elsewhere. In our register study, we used and analysed a definition stipulated by the National Board of Health and

Figure 4. The most common diagnostic sectors of the multiple-diseased elderly patients with a manifested cardiovascular disease



Welfare. The definition's three dimensions made it useable for quantifying and characterising patients on the hospital population level.

Of unique patients aged 75 years or older who consumed hospital care in 2005, 25% were multiple-diseased elderly patients. Of all hospital care consumed by patients aged 75 years or older, these patients consumed 45% of all episodes of care and 47% of all days of care. This is in agreement with earlier estimations (Akner 2004). Given the chosen definition, elderly patients with multiple diseases consume almost three times as many days of care per year as the other patients aged 75 years or older. Following the definition, the difference depends on the greater number of episodes of care per patient per year (3.4 vs. 1.4) rather than on the greater number of days of care per episode (8.7 vs. 7.9). There is a significant overlap between the different medical specialities from which our studied population consumes hospital care. This reflects the population's multi-morbidity, including medical and surgical diagnoses, and heterogeneous profile of

needs. However, 81% of the patients consumed at least one care episode in internal medicine, which was the dominant speciality from a quantitative point of view. Regarding types of hospitals, 71% of the multiple-diseased elderly patients with a known manifestation of a cardiovascular disease were cared for in mid-sized (county hospitals) or smaller hospitals.

Given the presumptions (1–3), the total annual cost of Swedish hospital care for the multiple-diseased elderly was estimated at SEK 11.5 billion, i.e. 19% of the total cost of Swedish hospital care. An estimation based on a cost template per care day leads to a significantly higher cost than a model based on a cost template per case episode. The reason for this is that the number of hospital care days per episode is significantly higher for the studied population than for the average hospital care population (8.7 vs. 5.9 days). Because of our first presumption (1) and the chosen definition in itself, the result will nevertheless probably constitute an underestimation of the total cost.

Patient characteristics included an average age of 83 years, with a median of 82 years. Women dominated quantitatively in the very oldest age strata. Of the multiple-diseased elderly patients with at least one hospital care episode in 2005, 83% manifested a cardiovascular disease. The most common non-cardiac co-morbidities were as follows: diabetes, infections (urinary, pulmonary, septic and influenza), cerebrovascular diseases, chronic diseases of the lower respiratory tract (chronic obstructive pulmonary disease and asthma), malignant diseases, anaemias, metabolic diseases (e.g. thyroid disorders), cognitive and mental diseases (e.g. dementia), renal insufficiency, injuries to the hip and thigh, gastric and intestinal diseases and injuries (e.g. liver insufficiency) and peripheral arterial diseases.

The reported characteristics, i.e. regarding age and co-morbidities, of multiple-diseased elderly patients clearly deviate from those of study populations in clinical studies that constitute the evidence base. In fact, several of the most prevalent co-morbid conditions of the multiple-diseased elderly patients constituted exclusion criteria in the most frequently cited studies on heart disease (see Figure 4 and Table 1). Most evidence-generating RCTs, which constitute a crucial part of evidence-based guidelines and priority setting, have preferably included

biologically much younger patients, i.e. chronologically younger patients with less co-morbidity.

Elderly individuals with multiple diseases are often mentioned in different clinical, administrative and political contexts, but there have been few attempts to describe their care consumption and characteristics. We used the Patient Register, a unique Swedish population-based register of high quality, and the relatively new national database on cost per patient, the KPP database. We found only one Swedish cost of illness (COI) study on this population with a similar aim, although it was based on a different definition and a different, i.e. local, context (Jönsson & Gurner 2001). Further, we could describe and quantify patient characteristics, i.e. age, sex and co-morbidity, in the context of cardiovascular diseases. The reported characteristics imply limited applicability of clinical guidelines for this patient group, which could constitute an important and growing example of ageism. We believe that describing co-morbidity is an important first step in any future attempt at categorisation and priority setting for this population, since co-morbidity can influence the benefit-risk ratio of a certain medical action for a certain medical condition (American Heart Association Council 2007; Boyd et al. 2005; Braithwaite 2007; Tinetti et al. 2004).

However, the population's diagnostically heterogeneous nature and co-morbidity limit the diagnosis-related cost-estimation. It would have been possible to do a more precise estimation by combining data about individual patients in the Patient Register with the information in the KPP database. This would have had potential ethical implications, and in addition, such a detailed estimation was beyond the scope of this article. Further, our rough estimation of the cost of hospital care for multiple-diseased elderly patients is not in itself aimed at guiding priority setting or assessing cost-effectiveness. Instead, it constitutes an aspect of this population that, to our knowledge, has been very rarely studied. The definition's three dimensions made it useable for quantifying and characterising patients on the hospital population level; however, on the clinical level another, more need-focused definition is recommended.

Regarding the reported health care utilisation, and taking into account the multimorbidity and the complex needs of the studied population, the average number of days of care per episode seems relatively low compared

to the number of care episodes. Between 1992 and 2003, the percentage of people aged 80 years or older increased by 22%, while hospital beds were reduced by 50% (The Swedish National Board of Health and Welfare 2004). It should be mentioned that the average age of patients at Swedish medical clinics is 75 years and the average age of patients at geriatric clinics is 80 years (The Swedish Council on Technology Assessment in Health Care 2003). A large part of the studied population is cared for in small and mid-sized hospitals; this could be related to the present trend in Sweden of closing smaller hospitals. Such structural changes could affect the care of patients in special need of generalist competence and continuity of care.

The most common diagnoses of elderly with multiple diseases are found among the cardiovascular diseases. Earlier studies have shown that these diagnoses are expressions of underlying chronic cardiovascular diseases, which become acute prior to and in connection with hospital care episodes. Considering the basis of the data search, the resulting quantitative predominance of cardiovascular diseases was expected. In addition, there are causal connections between several of the registered diagnoses, e.g. heart failure is often caused by ischaemic heart disease; high blood pressure and diabetes mellitus are well-known risk factors for cardiovascular diseases. In our data search, we did not find any Swedish studies on the specific issue of co-morbidity of elderly patients with cardiovascular disease. A few non-Swedish studies have addressed the topic (Bierman 2004; Flood et al. 2007; Lichtman et al. 2007; Taneva et al. 2004, 2004). In summary, the most common co-morbidities reported among elderly patients with cardiovascular disease in those studies were similar to those reported in our study. The Patient Register and a corresponding report cited in the manuscript (The Swedish National Board of Health and Welfare 2005) provide information about reported numbers of health care episodes related to specific diagnosis groups. Among all patients 75 years of age or older who received hospital care in 2005, the 15 most common diagnosis groups were as follows: cerebrovascular diseases, infectious diseases, malignant diseases, myocardial infarctions, heart failure, heart arrhythmias, gastric and bowel diseases, hip fractures, diabetes and other metabolic diseases, chronic obstructive pulmonary disease and asthma, uro-genital diseases (e.g. renal insufficiency), haematological diseases

including anaemias, arthrosis, spine diseases, neurological diseases, cognitive and mental diseases (e.g. dementia). Considering the most common diagnostic sections reported in multiple-diseased elderly patients, it seems reasonable to conclude that non-multiple diseased patients 75 years of age or older manifest quite similar proportions of the most common reported diseases. However, given the stipulated definition of multiple-diseased elderly patients, the individual patients of this group manifest more diagnoses and more treatment episodes on average.

Very elderly patients and patients with major and/or multiple co-morbid conditions are often excluded from evidence-generating studies that constitute the base of clinical guidelines (e.g. American Heart Association Council 2007; Boyd et al. 2005; Braithwaite et al. 2007; Fortin et al. 2006; Rothwell 2005; Tinetti 2004; Wright et al. 2003) (see Table 1). To a large extent, multiple-diseased elderly cardiac patients in Swedish hospital care would have met one or more exclusion criteria in these studies; see Figures 3 and 4 regarding characteristics, i.e. age and co-morbid conditions, of the studied population. The average age of patients in the cited evidence-generating studies is 62 years (Mehta et al. 2005), while the reported average age among multiple-diseased elderly patients is 83 years. And more importantly, there is an evidently heavier burden of co-morbidities among these patients. Since the results of studies on chronologically and biologically much younger patients, preferably without relevant co-morbidities, cannot *a priori* be extrapolated to multiple-diseased elderly patients, clinical guidelines are not *a priori* applicable for these patients. In addition to this main methodological-rational argument addressing limited external validity and generalisability, there is also increasing knowledge of interactions between age-related pathology and normal biological aging processes, which modify clinical presentations and responses to treatments, making extrapolating counterintuitive (Fitchett & Rockwood 2002). Further, there is a growing knowledge of co-morbidity as a modifier of prognosis and/or effect (American Heart Association Council 2007; Anpalahan & Gibson 2008; Boyd et al. 2005; Braithwaite et al. 2007; Braunstein et al. 2003; de Groot 2002; Fitchett & Rockwood 2002; Lichtman et al. 2007; Rockwood et al. 2005; Taneva et al. 2004) and there are studies and reviews arguing against *a priori* application of present clinical guidelines for multiple-diseased elderly patients (e.g.

American Heart Association Council 2007; Boyd et al. 2005; Braithwaite et al. 2007; Fortin et al. 2006; Tinetti 2004). Those who argue in favour of extrapolating evidence to these patients should indeed bear the burden of evidence.

The term ''ageism'' has been minted and used to denote prejudices against other age groups (Butler 1969; Tornstam 2006, 2007). Stereotypical views can cause discrimination against the elderly within health care (Bowling 1999; Bowling et al. 2006). Attitudes among health care professionals, as well as a weak evidence base due to a lack of scientific studies, may contribute to this phenomenon. In addition, the results of our study indicate that the problem with limited applicability of clinical guidelines is particularly striking in the context of multiple-diseased elderly in hospital care. Models for priority setting in practice have been based on the ranking of *one* medical action for *one* medical condition, which does not seem to be adapted for use in elderly patients with multiple diseases and complex needs. Nevertheless, in the clinical setting, decisions are made daily regarding these patients. In fact, the evidence base is weakest for the age groups (75+) that most frequently receive different kinds of treatments (The Swedish Council on Technology Assessment in Health Care 2003). Over-treatment as well as under-use of interventions can follow lack of evidence, *both* of them with potentially deleterious consequences for the elderly. In the absence of both relevant studies generating results that are possible to apply to these patients, as well as applicable guidelines, there is a risk of arbitrary and unfair care. It is most likely that priority setting for the oldest patients is currently suboptimal and should be improved. If probable ageism in clinical research and policy making could be reduced, then ageism in clinical practice would be easier to disclose and control.

From the perspective of priority setting, it is obviously not sufficient to consider organ specific benefit and risk; instead, the total benefit and risk of a medical action must also be considered. Co-morbidity can influence the benefit-risk ratio of a particular medical action regarding a particular medical condition in different ways and directions. For a multiple-diseased elderly individual with acute cardiovascular disease, e.g. acute coronary syndrome (ACS), some of the most common listed co-morbid

conditions could potentially be of great interest from the perspective of priority setting and clinical decision making.

There is obviously a great need for medical research and structured discussions of ethical values. We would like to confront physicians, e.g. cardiologists, with authentic cases representing elderly multiple-diseased patients, in order to evaluate their decision making in practice, especially the possible role of their attitudes. We hypothesise that these attitudes, given the present evidence base, cause an under-use of interventions like coronary angiography for chronologically aged patients and an over-use of the same interventions for biologically aged patients with severe frailty and/or clinically relevant co-morbidity. Further, prospective trials with few exclusion criteria that assess co-morbidities, cognitive status, frailty (Rockwood 2005) and patient preferences would be desirable. In the future, however, such studies may be rare due to methodological and financial factors. We suggest a trial to condense existing practical-clinical experiences of individual experts into consensus-based guidelines concerning elderly with multi-morbidity. A first step would be to identify tentative patient categories, with each category having the same index diagnosis, e.g. acute coronary syndrome without ST elevation (NSTE ACS), but with different patterns of co-morbidity and different degrees of frailty. Then benefit-risk ratios regarding especially crucial interventions such as coronary angiography could be estimated for each category, thus forming a basis for priority setting that is adapted to complex cases. We are fully aware of the difficulties of such an approach. But what are the alternatives?

Conclusions

In conclusion, given our stipulated definition, the multiple-diseased elderly constitute a large and probably growing population in Sweden and throughout the industrialised world (Thorslund et al. 2005). They have major, multiple and complex needs, which results in a large utilisation of inpatient hospital care. They often have manifested cardiovascular disease and multiple co-morbidities. These patients are not only elderly and have a large *number* of medical conditions, which follows from the mentioned definition, but also to a great extent they have *specified co-morbid conditions*,

which constituted exclusion criteria in the relevant studies. There is a relationship between reported characteristics, i.e. age and co-morbidity, and limited applicability of evidence-based guidelines, and this can cause an under-use as well as an over-use of medical interventions. More medical research and ethical discussions are strongly needed regarding this population. Further, we recommend that any model for priority setting that concerns the multiple-diseased elderly should be adapted; to be able to categorise these patients and to rank the prioritisation objects, further knowledge of different patterns of co-morbidity and degrees of frailty is crucial.

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