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Analysis of multimorbidity in individual elderly nursing home residents. Development of a multimorbidity matrix

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ABSTRACT

The chronic multimorbidity in individual elderly people is rarely documented in its entirety in present medical records, neither as cross-sectional overview nor as longitudinal time-course of various health problems. This obviously hampers an integrated clinical analysis. This work was aimed at evaluating the chronic multimorbidity in individual elderly patients and developing a method to map, quantify and grade the prevalence of the multimorbidity. An explorative study in 70 nursing home residents (55 women), mean age 85 was performed. Information on health problems was obtained through history, clinical examination and medical records. A 19-item multimorbidity matrix that maps, quantifies and grades the chronic morbidity in individual patients is presented. The 70 residents exhibited 275 different health problems; the top 3 items being neuropsychiatric, cardiovascular and gastrointestinal ones. The residents had a mean of 17 different chronic health problems and were prescribed a mean of 6.6 continuous medications per day. There was a significant correlation between the number of continuous drug prescriptions and both quantitative and graded multimorbidity-scores. The presented multimorbidity matrix provides a useful taxonomic overview over the health situation in individual multimorbid elderly and constitutes the basis for ongoing work to develop and renew the electronic health record into an "interactive health analysis system".

1. Introduction

Age is by far the strongest risk factor for the development of health problems. Thus, a large and growing group of elderly people develop several simultaneous chronic diseases and persistent consequences of injuries, e.g., stroke, fractures, etc. (Guralnik, 1996). This situation is designated 'multimorbidity', defined as any co-occurrence of diseases. Other terms used to describe this situation are comorbidity, multiple pathology or disease clustering (Van den Akker et al., 1998; Gijsen et al., 2001). Multimorbidity has been reported to occur in up to 78% of subjects aged 80 and over (Van den Akker et al., 1998).

Patients with multimorbidity with accompanying need for integrated clinical analysis are common in generalist medicine specialities such as internal medicine, geriatric medicine and general practice (family medicine). However, current medical records do not support a presentation of a comprehensible cross-sectional overview of clinical multimorbidity (type and degree of health problems) and how the course of various health problems and measurements develop over time, but rather serve as a diary where symptoms and signs of various acute, subacute and/or chronic health problems are dealt with as they appear. The described situation is true for patients of all ages, but becomes especially problematic in care of the elderly.

Similarly, in scientific studies in geriatric medicine/care of the elderly, the patient population is characterized by age, gender, physical function, mental function, admissions to hospital, etc. Sometimes there is also a description of some major diseases among the patients. However, there is rarely any attempt to provide a detailed description of the clinical problem burden from the individual patient's perspective.

There is no existing gold standard to categorizing and assessing multimorbidity. It has been expressed in different ways: (i) by describing the co-occurrence of specific diseases in individuals with an index disease, (ii) by counting the number of diseases present in one individual or (iii) by a comorbidity index that combines the number and severity of the diseases (Gijsen et al., 2001). It remains to be established in multimorbidity research and medical recording how the simultaneous occurrence of acute and chronic diseases, complications to diseases and treatment, as well as consequences of injuries should be structured and visualized to best describe an individual's total burden of disease at a certain point in time.

A recent systematic review identified 13 different methods of measuring comorbidity (De Groot et al., 2003) of which some have been validated regarding various outcome variables in the elderly such as medication usage, functional disability, acute

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hospitalization and mortality (Miller et al., 1992; Waldman and Potter, 1992; Parmelee et al., 1995; Incalzi et al., 1997; Patrick et al., 2001; Buntinx et al., 2002; Rozzini et al., 2002). One of these methods was proposed as a way to distinguish biological from chronological aging (Linn et al., 1968). Another type of validation is measure of the physical illness burden at autopsy (Conwell et al., 1993).

The focus of these multimorbidity scales was usually not clinical analysis, but rather an epidemiological one: to describe health problems in different patient populations in order to determine and predict disability, morbidity and mortality for health care planning purposes and policies. It has even been claimed that inclusion of diagnoses and other health problems that are not predictive limits the use of such scales (Inouye et al., 2003). The complexity of studying complex chronic health problems has recently been discussed in depth (Whittle and Bosworth, 2007).

In Sweden, the concept of multimorbidity in the elderly is usually dealt with as multi-impairment with a focus on health care consumption and health care resource utilization. The National Board of Health and Welfare (2002) has defined multimorbidity in Swedish elderly as follows: "Persons aged 75 years and older, who during the last 12 months have been in receipt of inpatient care on 3 or more different occasions and on those occasions have had 3 or more different disease diagnoses registered according to the ICD-10" (WHO, 1994).

The above-mentioned group-level and care provider perspective does not aim to present the full health problem picture of individual elderly people for clinical use. As a consequence the true prevalence and incidence of multimorbidity in elderly people is not known (see also Section 4).

The aim of the present study was twofold: (i) to systematically evaluate the presence of current, chronic health problems including consequences of injuries in elderly nursing home residents from each resident's perspective. (ii) To design a multimorbidity analysis tool that can provide an overview of an individual's current clinical health problems including previous diseases and injuries that may still have a bearing on the integrated clinical analysis and to include in the clinical analysis system a mode of scoring the number and degree of multimorbidity.

2. Subjects and methods

2.1. Setting

The study was performed at a nursing home in Sundbyberg, a suburb of Stockholm, Sweden in 2001–2002, and comprised 70 residents living in separate small apartments in a total of six wards. The residents had complex combinations of chronic diseases and consequences of injuries resulting in various functional impairments and the need for functional support and nursing care. The yearly mortality rate was around 30%. During the study, all 70 residents were in stable clinical condition. All individuals, or their relatives, when necessary, signed an informed consent to participate in the study. Ethical approval was obtained from the Ethics Committee at the Karolinska Institute in Stockholm.

2.2. Time in nursing home

Time in the nursing home was calculated as the number of months the individual had lived in the nursing home before the assessment.

2.3. Clinical examination

All residents underwent a clinical examination (history and physical examination) by the author. The family members and contact people were encouraged to participate during the examination. Body weight and body height were measured and body mass index (BMI) calculated as previously described (Akner and Flöistrup, 2003). Cognitive function was assessed using the mini-mental state examination (MMSE) (Folstein et al., 1975). Activities of daily living (ADL) were analyzed using the Katz score (Katz and Akpom, 1976).

2.4. Medical records

Based on the information from the clinical analysis, and after written permission from the patients (or relatives when necessary), copies of all relevant medical records were ordered from primary care (usually going back to 1985–1990 when computerized records were introduced in primary care centers in Sweden) and from care episodes in hospitals and other forms of inpatient care (e.g., rehabilitation units) for the same time period.

2.5. Renal function

Serum creatinine was analyzed at the Department of Clinical Chemistry at the Karolinska University Hospital within ± 1 week from the clinical examination. As an index of the glomerular filtration rate (GFR), the creatinine clearance was predicted (GFRp), using the Cockcroft and Gault (1976) equation, which is based on age, gender and current measurements of body weight and serum creatinine. Although widely used, this prediction equation has not been specifically validated in elderly people. Furthermore, since the equation predicts creatinine clearance, it overestimates the true GFR already at normal renal function and even more so with progressing renal insufficiency (Perrone et al., 1992).

2.6. Multimorbidity matrix

For each resident a multimorbidity matrix was constructed based on the following material: Patient history, physical examination, GFRp, and all available medical records from primary and secondary care during the last 15 years. For each resident, all observed persistent or chronic health problems considered to have a bearing on the current clinical situation from the individual resident's perspective were placed in a categorizing matrix consisting of 19 items (left column of Table 1). The 19 items were chosen based on the author's clinical experience and preferences and resembles the chapters in a textbook in internal medicine or geriatric medicine. In the format presented here, the multimorbidity matrix does not include physical disabilities such as problems related to gait, balance, physical endurance and ADL. Nor does it include health-related quality of life, social interactions, health care consumption, etc.

2.7. Quantitative and qualitative multimorbidity score

2.7.1. Individual quantitative score (number)

All current individual health problems were listed under the respective item. The 19 quantitative item subscores for each resident were then added producing an individual total quantitative multimorbidity score.

2.7.2. Individual qualitative score (grade)

The combined health problems within each of the 19 items were subjectively ranked by the author into four grades: 0 = no, 1 = mild, 2 = moderate and 3 = severe health problems, depending on the degree of assessed clinical importance to each individual. The maximum obtainable graded score was $19 \times 3 = 57$ points. The 19 qualitative item subscores for each resident were then added producing an individual total qualitative multimorbidity score. The individual total quantitative and qualitative multimorbidity scores