Contract N° IST-2004-026968
Acronym: **K4CARE**

Knowledge-Based HomeCare eServices for an Ageing Europe

FP 6 Specific Targeted Research or Innovation Project
Thematic Priority 2: "Information Society Technology"

From Chronic Diseases to Geriatric Syndromes: Managing Complexity in K4CARE

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February, 2008
Rome, Italy
### Document Information

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<td><strong>project name:</strong></td>
<td>K4CARE</td>
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<tr>
<td><strong>contract no.:</strong></td>
<td>IST-2004-026968</td>
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<tr>
<td><strong>type of document:</strong></td>
<td>Internal</td>
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<tr>
<td><strong>file name:</strong></td>
<td>Update_the_state_of_the_art_in_DoW_2.doc</td>
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<tr>
<td><strong>version:</strong></td>
<td>2.0</td>
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A. Introduction

Age-related illnesses, which may be serious enough to make sufferers completely dependent on others, require long-term care. As a result, there is an increase in the pressure on the public sector for long-term care and an increasing awareness of the importance of chronic disease management and alternatives to hospital admission. Home care (HC) has been considered as a fundamental component of a network of long-term care facilities, capable of reducing institutionalization, expenses and risk of death. It is conceived as the integration of medical, social and familiar resources addressed to the same goal of allowing the care of the patient in his own environment. In order to obtain cost-effective results, HC has to be properly addressed to the patients who can derive the higher benefit: the typical HC Patient is an elderly patient, with co-morbid diseases and conditions, cognitive and/or physical impairment, functional loss from multiple disabilities, impaired self-dependency. In this frail elderly patient a large number of diseases present with well-known and highly prevalent atypical symptoms (e.g. immobility, instability, impaired cognition and incontinence), which are referred to as geriatric syndromes. The term geriatric syndrome primarily refers to one symptom or a complex of symptoms with high prevalence in geriatrics, resulting from multiple diseases and multiple risk factors.

To the benefit of such patient long term services of chronic care are required, capable of facing multifaceted requests and needs. While there is a substantial evidence base for managing individual diseases, we lack significant evidence about using this knowledge to care for the complex patient.

Several principles of high-quality chronic care have been outlined in the context of a chronic care model. This model endorses reliance on multidisciplinary teams of health care professionals, individually tailored evidence-based treatment plans to guide clinical decision making and the frequency of patients' planned visits, case management to meet the special needs of medically complex individuals with chronic disease.

Although novel models of chronic care have achieved varying levels of success, thus far most of these new approaches have focused on a single disease, a single site, a single transition, or a single provider. Rarely more than two of these innovations have been integrated into comprehensive, coordinated systems of care.

Realigning the focus of health services research to be more in line with the complex experience of patients is central to developing solutions that work. Understanding how to care effectively for persons with multiple chronic conditions is among the most important challenges our health care system faces.

The K4CARE project addresses such topics in the realm of HC. This document provides the knowledge base that has guided the K4CARE approach to chronic diseases and comorbidity and the choice of introducing in the K4CARE platform the concept of “syndrome” (better, geriatric syndrome) to integrate the management of chronic diseases of the HC patient.

B. From Aging to Chronic Diseases

B.1. The Epidemiologic Shift

Average life expectancy in the EU is one of the highest in the world and is continuing to rise. In 2000, it was 74.7 years for men and 81.1 years for women; in 2050, according to Eurostat's base scenario, it will be 79.7 and 85.1 years respectively. The share of the total European population older than 65 is set to increase from 16.1% in 2000 to 22% by 2025 and 27.5% by 2050; the share of the population aged over 80 years (3.6% in 2000) is expected to reach 6% by 2025 and 10% by 2050.

The demographic shift leads to an epidemiologic shift. Increasing longevity and increasing survival to acute accidents and diseases – in addition to the increase in the numbers of elderly people – imply an increased prevalence of chronic morbidity and disability. Most prevalent diseases are represented by cardiovascular disease, cerebrovascular disease, chronic obstructive pulmonary disease, osteoarthritis, cognitive disorders. In the U.S. population, based on data from the Medicare Current Beneficiary Survey, the most prevalent individual conditions among the over-65 population include: arthritis (57%), hypertension (55%), pulmonary disease (38%), diabetes (17%), cancer (17%) and osteoporosis (16%)6.

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5. WHO - Global Burden of Disease Project www.who.int/evidence/bod
More than 50% of UK care home residents have dementia, stroke or other neurodegenerative disease. The care needs of people in care homes are largely determined by progressive chronic diseases. Over 70% of care home placements are related to dementia, stroke and Parkinson’s disease. These findings are likely to be representative of the clinical profile and patterns of dependency in residential and nursing care homes more generally across the UK.

In US in 2004, 97% of private health plans had disease management programs for diabetes, 86% for asthma, 83% for heart failure, and 70% for ischemic heart disease; State Medicaid programs have also begun implementing similar disease management programs.

These pathologies are leading causes of mortality and disability: major chronic diseases are responsible for 85% of deaths and 70% of the disease burden in the European Region.

C From Chronic Diseases to Comorbidity

C.1 Approaching Comorbidity

Despite the conceptual attractiveness of the disease management approach, evidence of clinical and cost-effectiveness remains limited. One explanation could be that, typically, we study experience with health care results, including health care costs and quality, as if these conditions occur in isolation, one at a time. Despite the depth of research into specific chronic conditions, there is little information about the prevalence of multiple chronic conditions (MCC), and the health and cost impacts of specific combinations of chronic conditions. Patients with complex conditions, especially those with multiple or severe chronic conditions, incur a large proportion of spending in any health care system. A variety of mechanisms – emphasizing patient self-management, care coordination, and evidence-based guidelines – may help to control costs for those patients while improving or maintaining quality. New disease management systems need to be developed to reflect the multiplicity of health care needs of the growing number patients with more than one chronic condition.

C.2 Prevalence of Comorbidity

The prevalence of comorbidity (defined as the concurrence of multiple health conditions in the same person) is highly prevalent in aging societies and is expected to increase even more with the further ageing of the population. The number of persons who have not just a single chronic condition, but multiple co-occurring chronic conditions, is large and growing: almost 1/2 of people with a chronic disease have multiple chronic conditions. Data from the Cambridgeshire centre of the UK Medical Research Council Cognitive Function and Ageing Study provide evidence of rising levels of ill-health, as measured by the prevalence of self-reported chronic conditions, in the newer cohorts of the young-old. Moreover, there is a significant increase in the number of conditions reported between cohorts, with more participants reporting three or more conditions in the new cohort (14.2% vs. 10.1%). It is estimated that more than 120 million persons in the United States have a chronic health condition, and 24% of those have three or more conditions. A persons’ risk of having more than one chronic condition increases with age: 62% of Americans over 65 have MCC. With the aging of the population, the number of Americans with MCC is projected to be 81 million by 2020. The Institute of...
Medicine’s report “Crossing the Quality Chasm” noted that 23% of Medicare beneficiaries have 5 or more chronic conditions.\(^22\)

### C.3 Services and Management of Comorbidity

MCC is a condition that requires the attention of multiple health care providers or facilities and possibly community home-based care. A patient with MCC presents to the health care system with unique needs, disabilities, or functional limitations.\(^23\)

The use of health services shown by people with comorbid conditions is more complex than would be suggested by a one-disease approach: comorbidity appears to increase the use of medical care as well as long-term care and home care. It is suggested, for instance, that the factors that best explain the greater utilization of health-care services by elderly women versus men are the number of chronic diseases and health related quality of life.\(^24\)

Persons with multiple chronic conditions are particularly vulnerable to suboptimal quality of care\(^25\) and single-disease-oriented disease management programs have the potential to further fragment care. MCC patients tend to use services more frequently and to use a greater array of services than other consumers of care: the number of different physicians seen annually by the average Medicare patient with a chronic condition ranges from 4 with 1 condition to 14 with 5 or more. As the number of providers involved in patients’ care increases, patients are likely to find it increasingly challenging to understand, remember, and reconcile the instructions of those providers.\(^26\) This makes coordination of care more difficult for individuals with MCC.

The Institute of Medicine’s report “Crossing the Quality Chasm”\(^27\) highlights the problem with health system fragmentation and stresses the need for health care systems that promote continuity of care and integration of services, since the vast majority of extant clinical guidelines and disease management programs focus on a single condition, although the experience of multiple chronic illnesses is the reality for many patients – particularly among the elderly. Even Wagner’s Chronic Care Model, which emphasizes coordination of care around chronic illness, focuses primarily on single illnesses, not multiple chronic conditions,\(^28\) so that its relevance and effects on multiple chronic conditions remain to be explored.

A specific workgroup of the US Veteran Administration has discussed the need to identify a patient as complex: this type of patient is one for whom clinical decision making and required care processes are not routine or standard. For complex patients, many recommendations from evidence-based medicine are unlikely to apply in a straightforward manner because of “exceptions” such as: multiple interacting chronic conditions, other co-morbid conditions that complicate the management of the focal chronic disease, and socioeconomic factors such as the absence of adequate family caregivers or other support systems.\(^29\)

The fact that most disease management programs focus on management of a single chronic condition raises concerns about whether they may undermine coordination of care for patients with multiple chronic conditions,\(^30\) thereby introducing new inefficiencies and potential threats to quality of care.\(^31\)\(^32\)\(^33\) Furthermore, by focusing on a single illness, programs fail to account for the synergistic impact of chronic conditions occurring in combination. It has been shown that patients with comorbid conditions are less likely than others to receive standard therapy for their index condition and to receive treatment for unrelated disorders.\(^34\) Braunstein et al.\(^35\) found that the occurrence of hospitalizations for ambulatory care sensitive conditions increased among elderly heart failure patients when they suffered from other comorbidities. Hospitalizations for ambulatory care sensitive conditions are considered preventable by good primary care.\(^36\) It is reasonable to hypothesize that clinicians systematically vary in the provision of indicated services when

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\(^{28}\) Wagner EH, Austin BT, Von Korf M. Organizing care for patients with chronic illness. Milbank Quarterly 1998;76:511–44.


C.4 Costs of Comorbidity

As discussed above, there is a strong association between comorbidity and the volume and variety of health care services that are used. The consequence is that comorbidity has been reported in a variety of studies to be associated with an increase in the costs and utilization of health services. Recent studies have shown that the cost of care for people with multiple chronic conditions is significantly higher than for those with a single condition. For example, patients with more than one chronic condition are estimated to account for 78% of all Medicare spending.

For instance, in one study, the cost of care for people with two or more chronic conditions was found to be significantly higher than for those with one condition. The results support the idea that care for patients with multiple conditions is more expensive. Among people with more than one chronic condition, the cost of care is estimated to be more than twice as high as for people with a single chronic condition.

Recently, some private health plans have shifted toward intensive case management programs aimed at high risk patients with multiple complex conditions, often using predictive modeling applications to identify members whose past utilization suggests they are likely to generate high health care costs in the future.

C.5 Clusters of Comorbidity

Several observers have argued that current strategies, including disease-specific health guidelines, may not be suitable in many cases to optimizing care of individuals with MCC. Instead, it is argued, guidelines need to be tailored to clusters of illnesses in ways that acknowledge not only the biology of those clusters, but also the special challenges and threats to quality of care associated with MCC in general and specific clusters in particular.

The Congressional Budget Office reports that among high-cost Medicare beneficiaries (e.g., the 25% of beneficiaries accounting for 85% of programmatic costs), about 30% had four co-occurring chronic illnesses: coronary artery disease, diabetes, congestive heart failure, and chronic obstructive pulmonary disease. It is also possible to observe clusters of concurrent diseases whose association has still to be studied. For instance, diabetes has been found to be more common in concert with asthma, and – of patients with Alzheimer’s disease – 28% also have congestive heart failure, 27% chronic obstructive pulmonary disease, 22% diabetes mellitus, and 20% cancer. It has been proposed that six clusters of conditions – including musculoskeletal diseases, lung diseases, neurological disorders, heart diseases, diabetes, and cancer – should be given priority for future research, because of their prevalence, associated risks for disability and/or death, and associated health care costs and utilization.

42 Pivacat JS, van den Bos GAM. The contribution of six chronic conditions to the total burden of mobility disability in the Dutch population. Am J Public Health 1997;87: 1680-2.
C.6 Comorbidity and Function

The functional consequences of multiple chronic conditions are still poorly understood, but it is known that persons with MCC are at greater risk of disability and activity limitations. Overall, specific chronic conditions have a stronger relationship with functional impairment than others, and persons with more chronic conditions become more functionally impaired sooner than persons with fewer chronic conditions.

The picture, however, appears to be more complex. One of the most revealing studies to date found that, after controlling for the presence of individual conditions, specific MCC were associated with disability far greater than expected based on the disability observed for each disease in isolation. The authors suggested that some diseases may be associated with disability only in the presence of other specific diseases, and that "a new, potentially effective strategy for prevention or amelioration of disability would be to decrease targeted disease-disease interactions". Fultz et al also found synergistic interactions between some pairings of mental and physical conditions, but not others. For example, persons with stroke and cognitive impairment had a higher level of impairment in activities of daily living than predicted by the presence of stroke and cognitive impairment alone. Other combinations, such as stroke and depression, did not have the same synergistic effect on activities of daily living impairments. A recent analysis of near-elderly veterans found that in general the risk of 5-year mortality increased with the number of co-occurring chronic conditions; however, osteoarthritis in combination with any other chronic condition actually lowered the risk of 5-year mortality.

D From Comorbidity to Geriatric Syndromes

D.1 Complexity

We have seen as the common disease management model is directed toward individuals with a single disease that dominates their health care utilization and why this model is less able to address older adults. The approach to comorbidity represents a step forward for a better understanding of MCC patients and their peculiarities and is a milestone in the definition of new models of chronic care; research should help illuminate why certain clusters of comorbid illness may be more prone to quality lapses or be associated with significant but unexpected clinical outcomes and lead to the development of targeted strategies, including tailored MCC-specific clinical guidelines, to improve the management of patients with key MCC.

We also know that the health care use of elderly patients is not only related to single or multiple diseases but as well to conditions and disabilities that affect one another. Overall, 76% of UK care home residents require assistance with their mobility or are immobile; 78% have at least one form of mental impairment and 71% are incontinent; but 27% of the population are simultaneously immobile, confused and incontinent.

There are unexplained findings – such as clusters of chronic diseases causing unexpectedly high repercussion on functional outcomes – that could be better interpreted and faced with the introduction of the concept of geriatric syndromes.

There has been a growing awareness that optimum clinical care cannot be based entirely on a biological framework. According to Mary E. Tinetti, the changed spectrum of health conditions, the complex interplay of biological and nonbiological factors, the aging population, and the interindividual variability in health priorities render medical care that is centered primarily on the diagnosis and treatment of individual diseases at best out of date and at worst harmful. A primary focus on disease, given the changed health needs of patients, inadvertently leads to undertreatment, overtreatment, or mistreatment. The emphasis on diagnosing and treating individual diseases has led to a plethora of disease management guidelines. For example, for a patient with the not uncommon combination of diabetes, heart failure, myocardial infarction, hypertension, and osteoporosis to comply with existing guidelines, a physician must prescribe up to 15 medications. The “obvious solution” is to better align medical care with health needs
by integrating existing knowledge and effective strategies; the integration and coordination of such strategies should constitute the standard of care for all patients. "Clinical decision making should be predicated on the attainment of patient goals and on the identification and treatment of modifiable biological and nonbiological factors, rather than on the diagnosis, treatment, or prevention of individual diseases."

This observation is particularly pertinent to the management of geriatric syndromes, for which it is imperative also to consider relevant social, spiritual, and economic domains. Geriatric conditions, such as incontinence and falling, fall outside the traditional disease model of clinical medicine and thus may be overlooked in the care of older adults\(^8\). Yet, these conditions are a necessary focus for the management of chronic patients. The care management model is currently directed toward patients with single morbidities and there is ongoing research for a model for the care of comorbidity; conditions are not targeted. Geriatric conditions fall outside models that now govern much of healthcare\(^9\). Fairweather et al.\(^8\) and Fried et al.\(^9\) argue that diagnostic procedures in geriatric complex patients should also take into account the time sequence and the interaction of comorbidity. Based on their own data, both authors state that simple, single diagnoses only explain geriatric health problems in less than 50% of the patients. The medical model, with its primary law of parsimony, does not suffice in geriatrics. The concept of geriatric syndromes may bridge this gap between classical medical diagnostics and the highly prevalent interaction of age, comorbidity and risk factors in geriatrics. Therefore, it has been argued\(^10\) that the concept of geriatric syndromes is valuable as a theoretical frame and can substantially improve clinical reasoning both in geriatrics and general internal medicine.

### D.2 Concept of Geriatric Syndromes

The conceptualization of geriatric syndromes has been evolving over time\(^68\). The term “geriatric syndrome” refers to “multifactorial health conditions that occur when the accumulated effects of impairments in multiple systems render [an older] person vulnerable to situational challenges.”\(^69\) Thus, the geriatric usage of the term “syndrome” emphasizes multiple causation of a unified manifestation\(^70\): a defining feature of geriatric syndromes is that multiple risk factors contribute to their etiology. Previous work has suggested that some geriatric syndromes might share underlying risk factors\(^71\); shared risk factors may lead to these syndromes and to the overarching geriatric syndrome of frailty. Although there is not yet a consensus definition, frailty has been defined as impairment in mobility, balance, muscle strength, cognition, nutrition, endurance, and physical activity\(^72\). Multiple underlying factors, involving multiple organ systems, tend to contribute to, and define, geriatric syndromes. The concept of geriatric syndrome is strongly related to symptoms. In frail elderly patients, a large number of diseases present with well-known and highly prevalent atypical symptoms; both in geriatric and internal medicine journals, and in medical textbooks such aggregates of symptoms are labelled as geriatric syndromes. While classically the term syndrome is used for grouping together multiple symptoms with a single pathogenetic pathway, geriatric syndrome primarily refers to one symptom or a complex of symptoms with high prevalence in geriatrics, resulting from multiple diseases and multiple risk factors.

Although heterogeneous, geriatric syndromes share many common features. They are highly prevalent in older adults, especially frail older people, and their effect on quality of life and disability is substantial. The Health and Retirement Study\(^72\) demonstrated that having one or more geriatric conditions is strongly associated with ADL dependency, independent of prevalent diseases (the following chronic diseases were considered: heart disease, chronic lung disease, diabetes, cancer, musculoskeletal conditions, stroke, and psychiatric problems). The numbers of conditions increased markedly with advancing age and – after adjustment for demographic characteristics and chronic diseases – the association of geriatric conditions with ADL dependency remained strong. The interaction between geriatric condition and disability is complex. Conditions may lead to ADL dependency (for example, cognitive impairment contributing to dependency in bathing and dressing), and ADL dependency may lead to geriatric conditions (for example, dependency in transferring contributing to injurious falls and functional urinary incontinence). To confuse matters further, disability itself has been called a geriatric syndrome\(^73\).
One obstacle in approaching syndromes parallel to (or instead of) diseases is the lack of consensus on a single definition of geriatric condition or geriatric syndrome. It has also been confirmed that the use of the term geriatric condition, to indicate a collection of symptoms and signs common in older adults not necessarily related to a specific disease, avoids the ambiguity associated with the term syndrome.

Citing an early edition of the Geriatrics Review Syllabus and drawing on other sources, Flacker noted that geriatric syndromes are understood to have the following features: they occur in older, especially vulnerable, adults; are multifactorial in cause; are precipitated by a variety of acute insults; are typically episodic in nature; and are often followed by functional decline. According to Olde Rikkert et al:\(^{10}\), a geriatric syndrome refers to highly prevalent, mostly single symptom states; in geriatric syndromes the leading symptom is linked to a number of aetiological factors or diseases in other organs; in geriatric syndromes there is a large overlap between the aetiological factors of different geriatric syndromes; a geriatric patient often suffers from more than one geriatric syndrome.

Although empirical research on geriatric conditions has tended to study them individually, there are ongoing efforts to link the conditions theoretically. Some have postulated an etiologic link through aging processes, through multiple physiologic disruptions, or through impairments in several domains that lead to a common pathway resulting in geriatric conditions. Inflammatory, endocrine, or metabolic dysregulation in multiple systems could lead to falls, weight loss, and dementia. Such hypotheses are related to current research in frailty, often considered a geriatric condition itself.

D.3 Which are the Geriatric Syndromes?

The term geriatric syndrome is used to capture those clinical conditions in older persons that do not fit into discrete disease categories. Nevertheless, the lack of consensus on the definitions leads to variation in what is considered a geriatric condition or geriatric syndrome.

Many of the most common conditions that geriatricians treat, including delirium, falls, frailty, dizziness, syncope and urinary incontinence, are classified as geriatric syndromes.\(^{11}\) There is consensus that cognitive impairment, falls, incontinence, and delirium are geriatric syndromes, but less agreement that malnutrition and neglect and abuse also qualify.\(^{12}\) Olde Rikkert et al\(^{10}\) define geriatric syndromes immobility, instability, impaired cognition and incontinence.

The Education Committee of the American Geriatrics Society Writing Group (ECWG) of the American Geriatrics Society recommends that undergraduate students should be trained profoundly in the 13 common geriatric syndromes which are dementia, inappropriate prescribing of medications, incontinence, depression, delirium, iatrogenic problems, falls, osteoporosis, sensory alterations including hearing and visual impairment, failure to thrive, immobility and gait disturbances, pressure ulcers, and sleep disorders.\(^{13}\) The Health and Retirement Study\(^{14}\) considered as geriatric conditions cognitive impairment, falls, incontinence, low body mass index, dizziness, vision impairment, and hearing impairment. Functional decline itself is sometimes called a syndrome\(^{15}\) and frailty has been defined an overarching geriatric syndrome.

Loss of mental capacity, predominantly as a consequence of dementia or stroke, remains the single biggest issue. It has been predicted that the number of people with cognitive impairment in institutions will rise by 63% between 1998 and 2031 based on present service usage. This perspective needs consideration in the context of population trends and the aspiration to reduce care home usage through preventative strategies and various forms of community care. A large study\(^{16}\) provides estimates of the prevalence of cognitive impairment in older people in the UK: in common with other studies, the prevalence of cognitive impairment increased with age and was higher in women, with the highest...
prevalence in women aged 90 years and above. The overall prevalence of moderate/severe impairment (3.3%) is consistent with other UK studies and the prevalence of any impairment (18.3%) is slightly higher than many other UK studies, but is dependent on the cut-off used. There was a high prevalence of cognitive impairment in those aged 75 years and over living in the community. Impairment was significantly associated with poor health, sensory impairments, incontinence and falls.

D.4 Facing Geriatric Syndromes

Frequently \(^{97}\), the chief complaint of an elderly complex patient does not represent the specific pathological condition underlying the change in health status. In some cases, the two processes may involve distinct and distant organs, with a disconnection between the site of the underlying physiological insult and the resulting clinical symptom. For example, when an infection involving the urinary tract precipitates delirium, it is the altered neural function in the form of cognitive and behavioural changes that permits the diagnosis of delirium and determines many functional outcomes. These atypical presentations are found in the organ system most affected in homeostatic reserve function (‘the weakest link’), and are precipitated by diseases that are often unrelated to the presenting symptom (e.g. urinary incontinence precipitated by pneumonia). The fact that these syndromes cross organ systems and discipline-based boundaries, along with their multifactorial nature, challenges traditional ways of viewing clinical care and research. \(^{98}\)

Geriatric syndromes present a challenge to the clinician because they are associated with disability but typically lack a single underlying cause that may be cured. Yet, identifying and assessing geriatric syndromes is clinically important because these conditions can be prevented or delayed (vision impairment\(^{99}\)), managed (cognitive impairment\(^{100}\), falls\(^{101}\), incontinence\(^{102}\)), and sometimes treated (dizziness\(^{103}\)), with resulting improvement in symptoms and decrease in disability. Caregivers need to be informed about syndromes so that they can deal with their practicalities (urinary incontinence) and anticipate their long-term consequences (cognitive impairment). In addition, the presence of geriatric syndromes has implications for how accompanying diseases and disability are to be treated or managed.

The diagnostic workup of geriatric syndromes should consist of a search for both (a) possible disease(s) that may have precipitated the symptom(s), and of a multiple risk factor assessment\(^{104}\), and finally a treatment of the aetologically related diseases and a risk factor reduction. Effectiveness and efficiency of this specific geriatric syndrome workup has been demonstrated predominantly for combinations of geriatric syndromes that often serve as targeting criteria for geriatric interventions, and for some specific geriatric syndromes.

Geriatric syndromes pose some special clinical considerations. First, for a given geriatric syndrome, multiple risk factors and multiple organ systems are often involved. Second, diagnostic strategies to identify the underlying causes can sometimes be ineffective, burdensome, dangerous, and costly. Finally, therapeutic management of the clinical manifestations can be helpful even in the absence of a firm diagnosis or clarification of the underlying causes. \(^{105}\)

The best evidence for the meaningful use of geriatric syndromes comes from the large series of randomised trials that evidenced efficacy, effectiveness and efficiency of geriatric inpatient and outpatient services when compared with regular practice on general medical wards. From the early trial by Rubinstein et al. until the more recent study by Cohen et al., mostly patients with problems, currently classified as geriatric syndromes, were enrolled and both the diagnostic and the risk factor assessment and intervention were carried out by the interdisciplinary geriatric intervention team. \(^{106,107}\)

Winograd et al. investigated the possibility of using geriatric syndromes as targeting criteria to select case-mix groups that might benefit from hospitalisation. They used 15 criteria (a mixture of medical diagnoses and geriatric syndromes) as targeting criteria. The authors point out, based on the finding of their large prospective clinical trial in 985 patients, that the persons who benefit most from a geriatric intervention are probably better identified with geriatric syndromes than with diagnoses. \(^{108}\)

Geriatric syndromes are used as nosological entities in clinical guidelines, health services research and teaching – as an educational tool in teaching geriatrics to medical students and trainees. A recent American Geriatrics Society statement includes “expertise in the diagnosis and care” of geriatric conditions among its core attributes and

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\(^{100}\) Bielsk J. Cholinesterase inhibitors for Alzheimer’s disease. Cochrane Database Syst Rev. 2006;CD005593


E Discussion

The need to ascertain and incorporate individual priorities, to address multiple contributing factors simultaneously, and to prescribe and monitor multifaceted interventions will make clinical decision making more iterative, interactive, individualized, and complex. Creative use of information technologies should facilitate the organization, presentation, and integration of this information to arrive at individualized yet systematic clinical decision making predicated on individual patient priorities.112 This statement focuses the attention on two core issues of caring for MCC patients: systematic decision and individualized interventions. A systematic clinical decision has to be made on the basis of available clinical evidence, mainly referring to clinical guidelines. An individualized intervention has to be provided on the basis of the comprehensive functional state of the patient (determined by the interaction of biological and non-biological variables) and finalized at the attainment of a desired goal.

There is great potential in clinical informatics and its ability to help facilitate complex chronic care. Devising the best possible patient-centered care for patients with complex chronic care needs requires substantive mechanisms for continual patient and caregiver input and feedback. Complex patients with multiple chronic conditions require unique management and self-management support, prioritizing multiple demands, acquiring individualized care plans, and using new technologies to optimize self-management. A specific US Veteran Administration workgroup on complexity in chronic care identified key areas that need to be addressed by researchers to best utilize information technology for this purpose. These key areas include: 1) determine how information systems can improve care for complex chronic illness during and between patient visits; 2) design clinical information systems to promote communication and information sharing among clinicians treating patients with complex chronic illness; 3) identify how to use informatics to improve patient self-management; 4) ascertain how to use informatics to encourage patients with complex chronic illness to share information with their providers between visits; 5) determine the type of aggregate information that should be captured by clinical information systems to help improve quality of care at the provider and system levels; and 6) identify what evidence based practices in informatics already exist that systems should begin to implement113.

Similarly, research on more clinically detailed data may be used to develop computerized decision support that incorporates new knowledge regarding the additive clinical impact of specific comorbidities co-occurring within a patient and anticipate the tendency of clinicians to overlook or overprescribe certain elements in the process of care114.

According to these indications, the K4Care project addresses the exchange of information among all the actors of the HC and supports the decision making enclosing knowledge about syndromes, diseases, disability, and environment.

It has been discussed the fact that the needs of most complex patients – as HC patients are – are better managed through the syndrome approach than through the disease approach, and there is awareness of the scarce attention reserved by the current medical management model to the workup and treatment of syndromes; these are usually addressed by geriatricians, but most older adults with geriatric conditions live in the community and are not under the primary care of geriatricians.

These considerations guided the choice of introducing syndromes in the K4CARE platform. Such approach provides the knowledge and an ICT instrument that allows the management of emblematic states such as – for instance – those of people who are simultaneously immobile, confused and incontinent115. Among the plethora of conditions labelled as

“geriatric syndromes” it has been decided to introduce great “syndromes” that are incontestably as such and that encompass a huge functional domain. The key functional areas that are mostly affected by chronic diseases and that have highly significant impact on self-dependency in the activities of daily living are undoubtedly cognition and mobility.

As regards cognition, it has been shown that cognitive impairment – predominantly as a consequence of dementia or stroke – is the single biggest issue\textsuperscript{116} with an overall prevalence of 18.3\% (UK data) in those aged 75 years and over living in the community; cognitive impairment is significantly associated with poor health, sensory impairments, incontinence and falls.

As regards mobility, it has been reported\textsuperscript{117} that restricted activity (defined as staying in bed for at least half a day and/or cutting down on one’s usual activities because of an illness, injury, or other problem) is common among community living older persons and is usually attributable to several concurrent health-related problems; over a median follow-up of 15 months, for example, about 3 of every 4 persons reported restricted activity during at least 1 month, and nearly 40\% reported restricted activity during 2 consecutive months. Restricted activity has face validity as a measure of health and functional status: for most older persons, restricted activity is an important predictor of functional decline and not just a benign feature of old age\textsuperscript{118}. Furthermore, in the definition of “frailty”, five out of seven descriptive characteristics (impaired mobility, balance, muscle strength, endurance, and physical activity\textsuperscript{119}) are related with severely impaired mobility.

So, it is possible to individuate main components of a more global functional impairment and restrict the panel of possible clinical and functional entities to be supported. It seems sensitive and realistic to focus on the two main components of both cognition and mobility, and from that derive the necessary structure aimed at the management of complex patients.

The syndromes that have been selected are Cognitive Impairment and Immobility, taking into account the fact that they encompass most of the functional impairments of the HC patients, are mutually related influencing each other, are strictly related to the most prevalent symptoms to be managed in HC, influence and are influenced by the most prevalent chronic diseases, have to be considered in the definition of efficient intervention plans.

F Conclusions

The K4CARE platform, in addition to the possibility of exchanging information related to HC, provides tools to be used as support in the clinical decision making process. The main support is provided through the definition of the Formal Intervention Plans (FIPs), which reassume, synthesize, and propose in a machine-readable format the knowledge contained inside a series of clinical guidelines.

Specific FIPs have been defined for the two main geriatric syndromes introduced in the model, Cognitive Impairment and Immobility. Those specific FIPs – expressly realized for the K4CARE project – allow the possibility of moving from symptoms to diseases and provide a “guided” workup of the conditions. Those FIPs provide decision paths that link symptoms, diseases, interventions, assessment, and other FIPs.

Inside the K4CARE platform, the HC patient’s needs are not only managed through the Cognitive Impairment and Immobility FIPs. Chronic diseases and conditions are addressed at three different levels: geriatric syndromes, comorbidity, individual diseases. All the elements are enclosed and systematized inside the Case Profile Ontology, together with the relationships with the other elements of the model (symptoms, treatments, FIPs) defining the whole set of diseases and conditions supported by the K4CARE platform.

A set of chronic diseases is recognized to be related to two main geriatric syndromes (Cognitive Impairment and Immobility) and to have a high prevalence in chronic HC patients. Each of these chronic diseases is related – at different degrees – with both geriatric syndromes. For those individual diseases, specific FIPs are provided to guide clinical decision making according to the knowledge and the guidelines used in their definition. The “supported” diseases are:

1. Anemia
2. Arthritis
3. Cerebrovascular diseases
4. Chronic ischaemic heart disease
5. Chronic Obstructive Pulmonary Disease
6. Decubitus ulcer
7. Delirium
8. Dementia
9. Depression
10. Diabetes
11. Heart failure
12. Hypertension
13. Iatrogenic cognitive impairment
14. Parkinson disease

The opportunity of having distinct FIPs for individual chronic diseases provides the different options of managing the individual disease as occurring alone (in the rare but existing cases), or linking a disease-related FIP to a more general syndrome(s)-related FIP(s), or to another disease-related FIP (management of comorbidity).

According to the discussion presented above about MCC, particularly with regard to the difficult application of different guidelines to an individual MCC patient, the K4CARE platform provides the possibility of merging and personalizing FIPs to the peculiar needs of the patients.

Thanks to these various possibilities of approaching the multifaceted needs of the HC patient, K4CARE is a modern ICT healthcare focused system, updated to the lively concepts of ongoing research on comorbidity and long term care.