

DISABILITY IN OLD AGE

Final Report

Conclusions and Recommendations

Burden of Disease Network Project

The Finnish Centre for Interdisciplinary Gerontology

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Preface

The Burden of Disease in Old Age (BURDIS) network project was set up with financial support from the European Commission in March 2001. The project has brought together recognised expertise in ageing research with the main aim of better exploiting existing data resources and exploring gaps in the understanding of the disablement process.

The network has addressed these issues from four different perspectives, viz. the physiological and psychological changes associated with increased vulnerability to disability, hereditary vs. environmental factors in the disablement process, gender differences in the disablement process and the life-span perspective on disablement, focusing on early modifiable predictors and mortality.

Several working methods were used to address these issues. The project steering committee met regularly twice a year to manage and guide project work and to discuss the relevant scientific issues. Annual meetings were held to bring together scientists both within the project and outside it working in the four domains to discuss the most recent developments in disability research. In the first phase of the project, areas in which knowledge was sparse or lacking were identified, following which studies were conducted and the results written up in articles for publication in scientific journals. These studies also included researcher exchanges which facilitated the making of cross-centre comparative studies. This report presents the results of this project work and makes recommendations for good practice. It also includes an evaluation of the need for a new cross-national study. Project work has been coordinated from the Finnish Centre for Interdisciplinary Gerontology in Jyväskylä, Finland. Professor Eino Heikkinen has led the project work as the principal coordinator with Mr. Timo Törmäkangas working as the coordinator assistant.

In the writing of this document both existing recent knowledge and results from new studies carried out within the BURDIS network have been used. Experts in multiple areas of disability research have participated in preparing this report, which has primarily

been written by Professor Eino Heikkinen, Professor Shah Ebrahim, Dr. Luigi Ferrucci, Dr. Jack M. Guralnik, Dr. Taina Rantanen and Professor Marianne Schroll. The drafts of the different sections of this report have been reviewed by various participating researchers within the network. In addition, Professor Stig Berg, Associate Professor Kirsten Avlund, Associate Professor Bo Malmberg and Dr. David Melzer have offered comments and advice in the preparation of this report. Technical editing of the report was done by Mr. Timo Törmäkangas. The project has also heard the reactions and comments of stakeholder organisations, including Age (The European Older People's Platform, Stockholm, Sweden), AgeConcern (Britain), the Jyväskylä City Health Centre (Finland), the Ministry of Social Affairs and Health (Finland) and STAKES (National Research and Development Centre for Welfare and Health, Finland). We are thankful for their helpful comments and suggestions. We also thank the WHO, Ageing and Life Course, for their cooperation in making this report. Finally, we thank Mr. Michael Freeman for checking the language of the report.

The participants in this project hope that this report will be seen as a valuable source of recommendations and suggestions for use in the formulation of research and practical policies regarding disability in old age. The recommendations may be of interest to governmental and voluntary health organisations, and to policy-makers as well as elderly individuals.

For further information visit the project website at:

<http://www.jyu.fi/BURDIS>

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Summary

DISABILITY IN OLD AGE

Scope and purpose

The increase in the number of old people is presumably also increasing the number of old people with disabilities, as any possible compression of morbidity would be too small to offset the effect of the rising numbers of older people in European populations. Disability increases the risk for need of home help, hospitalization, nursing home admission and premature death. In addition the economic burden presented to society by disability is great. There is, therefore, an urgent need for effective intervention programmes for disability prevention, which has become an important public health concern.

The Burden of Disease in Old Age (BURDIS) network project was set up with financial support from the European Commission in 2001 for a three-year period. The project brought together recognized expertise in ageing research with the aims of better exploiting existing data resources to study the risk factors for disability in old age, exploring information gaps in the understanding of the disablement process, and presenting recommendations and policy options regarding the development and implementation of research and programmes in order to prevent and manage disability in old age. Because of the multifaceted and complex nature of the issue and the great number of approaches and interventions aimed at preventing disability in old age, it was necessary to limit the scope and purpose of the work to cover mainly questions which were dealt with in the participating research centres.

The framework and concepts

The development of disability in old age is regarded as a dynamic social phenomenon that relates to individual physiological, psychological and medical conditions as well as socio-economic position, cultural norms and environment. There are many theories about disability with differing definitions of the concept and pathways leading to disability. Within the BURDIS network *the disablement model* was used as the starting framework. The main pathway in the disablement process proceeds from the acquisition of pathology (diseases, injuries) to impairments (anatomical, physiological or mental abnormalities) which generate functional limitations in basic physical and mental actions, ultimately leading to disability (cessation or restriction in carrying out activities of daily living and other social roles). The disablement process is modified by factors related to life style, availability and use of services, ageing processes, and characteristics of the social and physical environment. The most commonly used measures of disability are self-reports of *basic activities of daily living* (such as mobility and self-care) and *instrumental activities of daily living* (such as preparing meals, shopping, telephoning, managing money, taking

medication). More recently *performance-based measures of functioning* have been applied to the assessment of functional limitation and consequent disability.

Most studies applying the disablement model have focused on chronic somatic conditions as causes of impairments and functional decline, and the effects of environmental factors have largely been neglected in previous research. In this report attempts are made to also explore the role of the psychological and mental health factors together with environmental factors as predictors of old age disability.

Predictors of function and disability in old age

The factors underlying functional decline in old age are multiple and vary between individuals and populations. Furthermore, it is obvious that disability is also socially constructed and that it is the existence of a disabling environment which transforms impairments and functional limitations to disabilities. The health and behavioural factors which at an individual level contribute to disability in old age include inappropriately treated diseases, depression, cognitive, sensory and physiological impairment, smoking, sedentary life-style, unhealthy dietary habits, deviance from optimal body weight, high or no alcohol use compared to moderate use, and insufficient social support. Recent evidence suggests that the accumulation of deficits across multiple domains may better explain the development of functional limitation than decline in a single domain. Physical activity, for example, may counteract the effects of some risk factors. Knowledge about the role of genetic factors predisposing older people to functional limitations and disability is still insufficient but the available data suggest that genes play a role in the disablement process

Disability can be defined as a gap between a person's abilities and environmental requirements. Identical physical and mental conditions may result in different patterns of disability depending, for example, on the occupation, housing conditions or family structure of a person. On the other hand, a similar type of disability may arise from different types of health conditions. There are also significant gender differences in disability. Women have a longer duration of life lived with disability and it has been suggested that they may suffer from "multiple jeopardy" i.e. have combinations of social disadvantages. Many studies of socio-economic position and disability in old age have shown that the relationship between measures of material wealth and functional decline is strong with those equipped with more material resources being protected against unfavourable trajectories of change.

Also, cultural factors may produce disability. Prejudice and discrimination in different arenas of life may disable and restrict people's activities even more than impairments and functional limitations do.

Disability prevention interventions and research

The development of interventions that may effectively reduce the burden of disability in the older population is a major concern for the social and health care systems of all European and non European countries. In spite of abundance of observational data, evidence that age-associated disability can be prevented or delayed is scarce and limited

to small studies that are generally underpowered. The BURDIS network is therefore presenting recommendations concerning the conduct of both clinical trials and large-scale trials of interventions aimed at preventing or delaying disability in older persons:

- Trials aimed at prevention of disability in old age should be considered a priority in the allocation of resources for health and social care research
- Standard criteria should be developed and validated for the identification of older persons at high risk of disability, and a standard operational definition of frailty should be developed
- Given the multifactorial origin of disability, multi-component interventions need to be developed and tested
- Disability-related measures should be systematically introduced among the primary outcomes of intervention trials that target the kinds of diseases and health events that are highly prevalent among the older population
- Research aimed at improving reliability, ecological validity and comparability of tools to measure physical and cognitive function in elderly people should be encouraged
- Research into the roles of environmental factors, including social, physical, economic, cultural and political domains, should be strengthened
- Because in significant part the predictors of old age disability stem from earlier phases of life, it is important to examine the predictors and risk factors also from the life-course perspective and not only rely on the relation to prevailing living conditions and behavioural factors.

While emphasizing the importance and need of new research it is necessary to use the existing knowledge and continue the developmental work which is ongoing in service systems. However, when addressing such a complex problem as disability in old age, it may not be possible to solve all the problems involved through a scientific research and evidence-based approach. Some recommendations may well be based on personal and clinical experience, experiences from other countries, observational studies, common sense and available resources.

Development of health and social services

Disability in old age should be a focus of all public health policy and programs and cover the whole continuum of services aimed at both preventing disability and restoring functional capacity through rehabilitative measures. In implementing these policies and programs inter-sectoral collaboration is required to be able to meet the challenges of the complex multifaceted nature of the disablement process. This report gives recommendations for the development of health and social services which have gained at least some support from scientific research or are based on some other evidence concerning the disablement process. These services include the following activities, which may to some extent vary between different countries and local contexts:

- Comprehensive geriatric assessment
- Preventive home visits

- Screening
- Home care
- Management of chronic diseases
- Geriatric evaluation and management units
- Medication
- Counselling
- Creating accessible environments

In addition to the abovementioned activities this report describes a great number of both individual and environmental predictors of old age disability which could become targets of interventions within the health and social care services.

Policy options

Giving recommendations about research policy, the development of services and implementation of policies regarding old age disability prevention was set as the final aim of the network project. The recommendations given are based on the knowledge of the member scientists, consultation with other experts and stakeholders, and a review of the relevant scientific literature.

Research policy options. There is a continued need for the development of theories and models of disability and ageing that, together with empirical research, underscore the broader environmental contexts in which the disablement takes place and explore the roles of medical, psychological and social predictors of disability with the aim of developing effective interventions. There is need for high-quality trans-national studies on disability at older ages for purposes of examining variation and trends in life expectancy free of disability and for trials aiming at prevention. Such studies present special challenges to investigators and without substantial EU investment their implementation is unlikely to be feasible. The BURDIS network has identified several important gaps in research that need filling and prioritized six of them as summarized below:

Determinants of old age disabilities

- The life course study of ageing: expanding existing birth cohorts
- Genetic determinants of ageing: establishing ageing modules in new genetic studies
- Establishing of a European core set of functional performance measures

Interventions for preventing old age disabilities

- Interventions targeted at healthy individuals: improving physical activity
- Evaluation of public health interventions: protecting older people's health
- Interventions targeted at vulnerable individuals: screening tools to identify those at risk

Practice policy options. Given the multifaceted nature and genesis of ageing-associated disabilities, the vision of the required policies and programmes also have to be based on inter-sectoral collaboration amongst multiprofessional teams. Examples of actions aimed

at improving health, health and social services and support for the prevention of disabilities in old age can be summarized as follows:

Improving the health of and health services for older people

- Promoting physical activity through inter-sectoral collaboration
- Comprehensive geriatric services: increasing clinical skills in geriatric medicine
- Screening for frail elderly people in the community

Improving social support for older people

- Providing adequate housing and pensions for older people
- Preventing prejudice and discrimination

Implementing policies. An important framework for analysis and action is the independent living movement which underscores active participation, possibilities for choice and prevention and minimization of the uncomfortable consequences associated with the onset of disability. The BURDIS network wishes to emphasize the need for promoting education in gerontology, allocating funds to ageing research at both the international and national levels and developing services to maintain and improve the quality of life of older people in the decades ahead.

Introduction

The purpose of this report is to examine, on the basis of the existing scientific literature, the analyses carried out in the data bases of the BURDIS network, and other available evidence, the current situation regarding knowledge of the risk factors of disability in old age and the gaps in our knowledge, and the need and directions of further research. These questions were addressed from different perspectives, i.e. physiological and psychological changes with increased vulnerability to disability, genetic factors leading to functional limitations, gender differences in the disablement process, behavioural predictors of functional limitations and disability, and environmental and social factors in the disablement process. Attention was also paid to issues regarding the application of current knowledge and assessment methods in service systems. Finally, recommendations and policy options are presented for different stakeholders on how to promote the prevention and management of old age disability on both the individual and population levels.

The concepts and scope of the report

The development of disability in old age is regarded as a dynamic social phenomenon that relates to individual physiological and psychological conditions as well as socio-economic position, cultural norms and broader environmental contexts. The main focus of this report remains, however, at the individual level owing to the fact that environmental factors in the disablement process have largely been neglected in earlier research. Furthermore, the relationships between diseases and disabilities were mainly explored in relation to chronic somatic conditions due to their key role in the disablement process. Attention was, however, paid to certain mental health problems, such as major and minor depression, as causes of disability in old age as well as to environmental issues when research evidence was available. It is worth noting that the most common ways of

assessing disabilities in research and the service sector (self-reports of difficulties in mobility, self-care and instrumental activities of daily living) provide very little information about the factors underlying various disabilities or about disabling environments. In a broader context, disability does not solely reside within individuals who have impairments and functional limitations but also in the social, physical, economic and political environment.

Prevalence of disabilities in old age

During the past century the average life expectancy of Europeans has increased by 28 years, from 45 to 73 years. This trend is expected to continue in the future. From the health policy point of view it is of particular significance that the proportion of people aged 80 and over will increase by 40% between 1995 and 2015 in the current European Union countries. It can be assumed that the number of old people with disabilities will also rise, as any possible compression of morbidity would be too small to offset the effect of the rising numbers of older people in these populations.

Several studies in the 1980s and 1990s sought to understand whether lowered mortality is accompanied by improvement or, on the contrary, deterioration of a population's health status (Freedman et al. 2002, Sulander et al. 2003). Several studies found no cohort changes in disability in the *basic activities of daily living*, such as bathing, dressing and managing toilet visits (e.g. Manton et al. 1993, Allaire et al. 1999, Winblad et al. 2001), the most severe types of disability, generally associated with long-term care needs. On the other hand some studies have demonstrated rather clear decreases in the ability to perform *instrumental activities of daily living*, such as household chores, shopping, and medication management (Manton et al. 1993, Crimmins et al. 1997), and also certain basic physical tasks, such as lifting, climbing stairs, and walking (e.g. Allaire et al. 1999).

Approximately 20% of people aged 70 years or older, and 50% of people aged 85 and over, report difficulties in such basic activities of daily living as bathing, dressing, toileting, continence, feeding, and transferring from chair to bed. Difficulties are also common in carrying out instrumental activities of daily living such as using the phone, housekeeping, laundry, public transportation, taking medication, and handling finances.

The prevalence of disabilities is higher among women than men and life-expectancy with disabilities at 65 years of age is also longer in women (e.g. Heikkinen et al. 1997, Salive et al. 1997). Mobility disability is also common (Guralnik et al. 2001, Avlund et al. 2002) and impedes many activities important to independent living.

A significant proportion of older people have even more serious mobility problems. According to the Evergreen project (Heikkinen et al. 1997), about 8% of people aged 75 years were not able to move outdoors without help, and the percentage increased to 28 at the age of 85. The corresponding percentages in relation to the ability to move indoors were about 5 and 14, respectively. Among 75 to 84 -year-olds about one third reported difficulties in hearing during conversation with other persons and about 20% had readability problems with daily papers or books. Speed of behaviour also decreases with advancing age. This is seen, for example, in walking speed (e.g. Rantanen et al. 1999a) and reaction time (Era et al. 1986). Slow walking speed is reported to predict need for help, institutionalization and mortality among old people (Woo et al. 1999, Laukkanen et al. 2000).

Risk factors of disability in old age

Much research has been dedicated to identifying risk factors for the onset of disability by applying *the disablement model* originally developed by Nagi (1976). The main pathway of the model consists of four components: pathology, functional impairments, functional limitations, and disability. In old age, pathology causes impairments (e.g. decreased muscle strength, poor balance, low oxygen consumption). Impairments predispose people to functional limitations (e.g. slow walking speed, inability to grasp with hands) which lead to disabilities (e.g. difficulties in mobility and self-care). Research on disability in old age has identified several factors that contribute to shaping the dimensions and severity of disability. These factors include both *non-modifiable risk factors*, such as age, gender and genetics, and *modifiable risk factors*, which include both *individual factors* such as age-related diseases, impairments, functional imitations, poor coping strategies, sedentary lifestyles and other unhealthy behaviours, as well as the definition of the situation by others, and their reactions and expectations, and *characteristics of the environment* and the degree to which it is free from, or encumbered with physical and

sociocultural barriers (e.g. Nagi 1991, Verbrugge et al. 1994, Finkel et al. 1995, Lawrence et al. 1996, Stuck et al. 1999). The amount and quality of *social support* (social networks, contacts, support and services) also significantly modify the development and effects of disability (e.g. Mendes de Leon et al. 1999, Everard et al. 2000, Koukouli et al. 2002). Some of the modifiable risk factors stem from earlier phases of life (e.g. Vita et al. 1998). It is therefore important to examine the risk factors for disability in old age also from life course perspective and not only in relation to prevalent living conditions.

It has also been observed that older people in less advantaged *socioeconomic positions* report more disabilities than do their more advantaged age-peers (e.g. Guralnik et al. 1993, Parker et al. 1994, Rahkonen et al. 1998, Grundy et al. 2000, Melzer et al. 2000, Melzer et al. 2001, Rautio et al. 2001, Seeman et al. 2001). This disparity seems to persist, though to a decreasing extent, up to the age of 85-90 years.

Consequences of disability in old age

Disability increases the risk of need for home help (Linden et al. 1997, Avlund et al. 2001), hospitalization (Wolinsky et al. 1994, Avlund et al. 2001), nursing home admission (Sonn et al. 1996, Laukkanen et al. 2000) and premature death (Jagger et al. 1993, Sonn et al. 1996, Avlund et al. 1998). Older people with difficulties in carrying out daily activities are in a danger of losing independence when placement in a nursing home becomes a realistic alternative (Laukkanen et al. 2000). Such individuals need help to be able to remain community-dwelling. According to self-reports by elderly people, disabilities feature among the most important determinants of diminution in quality of life.

Almost all the indicators of physical and cognitive functioning seem to be related to life-expectancy, showing that older individuals with lowered functional capacity have a significantly shorter life expectancy compared to those with good functional capacity. In addition the economic burden imposed on society by disability is great. It has been estimated that the use of social and health services increases in parallel with the increase in various disabilities (Rice et al. 1992, Salive et al. 1997, Tsuji et al. 1999).

Prevention of disability in old age

There is an urgent need for effective intervention programmes for disability prevention, which has become an important public health concern (Ebrahim 2002). The issues related to disability in old age cannot effectively be approached only through narrowly conceived interventions but rather by following the advice of Rudolf Virchow, “Mass problems require mass solutions”. A comprehensive approach to disability prevention would focus on modifiable individual and environmental risk factors. There are, however, both conflicting findings and gaps in our knowledge concerning the importance of various risk factors and the effectiveness of different kinds of interventions aimed at preventing and managing disability in old age. Further research work focusing on different aspects of disability in old age is therefore necessary for the formulation of successful policies and programmes (Heikkinen 2003).

Predictors of function and disability in old age

Research on risk factors for disability in old age has mainly focussed on the main line of the individual disablement process. In the health sciences, at least, environmental factors have been studied to a lesser extent. Research on psychological factors, such as negative and positive emotions, personality, cognitive functioning and adjustment have only recently been established as factors affecting the disablement process. Pathological cognitive decline in the form of dementing illnesses, especially, will for many elderly people lead to loss of autonomy.

Diseases and depressiveness as predictors of disability

According to the disablement model, diseases are the main cause of impairments and functional decline which ultimately may lead to disability. People aged 70 years and over usually have 2-3 chronic conditions, which accounts for around two thirds of total national health care expenditure (Lorig et al. 1999, Nilsson et al. 2002). About 90 % of all 75-year-olds have some clinical diagnosis. Interventions should, therefore, aim at the prevention and effective management of chronic illness (e.g. Grimley Evans 2000). Also, sensory disorders and particularly vision and hearing impairments are important causes of problems in carrying out daily activities (e.g. West et al. 2002).

The prevalence of clinically important depressive symptoms among community-dwelling older adults ranges from approximately 8% to 16% (Blazer 2003). For example in the UK depression affects 10-15% of people over 65 living at home (Anderson 2002). Even higher figures have been reported (Heikkinen et al. 2002). Depressive symptoms are more frequent among the oldest old, but the higher frequency is explained by factors associated with ageing, such as a higher proportion of women, more physical disability, co-morbidity, more cognitive impairment, and lower economic status. Many underlying causes of depressive mood have a social, economic or environmental background (e.g. emotional and social loneliness, poverty, poor living conditions and negative life events

including losses of various kinds). It seems that depressive symptoms and disorders can result from functional limitations as well as cause them (Wells et al.1989, Penninx et al. 1998, Heikkinen et al. 2004). When depressive symptoms are associated with sufficient disruption in everyday function, they tend to have a demonstrable public health impact (Johnsson et al. 1992, Judd et al. 1996). Despite a favourable response to treatment, late-life depression remains largely undetected and untreated. (Anderson 2002, Blazer 2003).

Functional limitations

Recently, it has been suggested that measuring function at the level of the whole organism or person may provide a more uniform approach for research on functional aspects of health, particularly in cross-cultural settings. Functional limitations are measures independent of environmental influences, and may thus clarify the causes of changes in functional aspects of health. For example, within each category of disability, functional limitation values show considerable spread. This may, at least partly, be due to possible changes in population disability levels arising out of environmental modifications, increased use of assistive devices and changing cultural norms. Measures of functional limitation, however, provide more powerful evidence of functions per se improving or deteriorating. Examples of functional limitations include walking a given distance, lifting and carrying a given weight and climbing stairs.

For the assessment of functional limitations, both self- and proxy report as well as performance based measures may be used. However, there remain several aspects of assessment that still need to be developed further. These include standardization of the measurement of functional limitations in terms of which are the most important functions to measure, measurement procedures, clinically relevant cut-off or threshold values and criteria for a meaningful change over time.

Physiologic predictors of functional limitations

Impairment refers to the consequences of disease or injury to an organ system. Examples of impairment include muscle strength, vision, hearing or tactile sensitivity. Extensive information is available about various impairments as predictors of functional limitation

and disability. The International Classification of Functioning, Disability and Health provides an exhaustive listing of these (WHO, 2001). However, focusing on individual impairments has not proved to be sufficient in understanding disablement. A consideration of co-impairments appears to hold more promise. As most studies have focused on the independent effects of various impairments, little information is available on risk for disability that results from the combined effects of multiple impairments, or as they are termed here, co-impairments. Functional limitations may be better explained by the accumulation of deficits across multiple domains rather than by any single specific impairment (Duncan et al.1993). Tinetti et al. (1995) found that when the number of impairments (lower and upper extremity, sensory and affective impairments) increased from zero to one, two, and three or more, the proportion of participants experiencing functional dependence doubled from 7% to 14% to 28% to 60%, respectively. The impact of co-impairments on functional limitation and disability may be greater than the sum of those impairments singly. Cross-sectionally, the odds of severe walking limitation was ten times greater among those who had both strength and balance impairments compared to those who had only one or the other (Rantanen et al. 1999b). Among those who did not have a severe walking limitation at baseline, during the three succeeding years the relative risk of onset of severe walking limitation adjusted for age, height, weight and race was more than five times greater in the group with the poorest balance and strength compared to the group with the best balance and strength. Among those who had good balance, strength was not associated with the risk for developing walking limitation, whereas among those with balance impairment good muscle strength decreased the risk for future walking limitation.

Studying co-impairments is particularly appropriate in older people, because with increasing age the proportion of those with impairments in multiple physiological systems increases. To develop prevention and rehabilitation programs aimed at decreasing severe functional limitations, risk factors and their interaction need to be understood.

Genetic factors and functional limitations

Currently some, if limited, knowledge exists on the role of genetic factors predisposing older people to functional limitation and disability. Particularly scarce, however, is information about the underlying mechanisms.

A recent analysis of data from the Finnish Twin Study on Aging (FITSA) examined genetic and environmental effects on maximal isometric strength among 199 pairs of 63 to 76 –year-old female twins. The results showed that handgrip and knee extension strength shared a genetic component explaining 14% of the variation in handgrip and 31% of the variation in knee extension strength. Furthermore, a common non-genetic familial component was observed (Tiainen et al. 2004). According to results from the Swedish Adoption Twin of Aging (SATSA) study, the change in muscle strength over time, on the other hand, seemed to be non-genetic (Finkel et al. 2003). Another analysis of the FITSA study showed a moderate genetic component (34 %) explaining individual differences in balance measured as postural sway (Pajala et al. 2004).

Functional limitations were examined by Carmelli et al. (2000) using a lower extremity performance test. The heritability of the lower extremity test score was 57%. Disability phenotype was studied in large Danish Twin Study using self-reported difficulty in three functional domains. The heritability of the scores varied between 34-47% among women aged 80 years and over, while among younger women (75-79 years) the range was 15-43% (Christensen et al. 2000). These results suggest that genes play a role in the disablement process.

Behavioural predictors of functional limitations and disability

Physical activity. In cross-sectional studies, physically inactive people often obtain poorer results in physiological and sensory-motor tests, such as tests on aerobic capacity, muscle strength, postural balance, psychomotor speed and bone mineral content. Physically active people on the other hand maintain a higher level of physiological function, such as muscle strength, than their sedentary counterparts (Rantanen et al. 1997). Exercisers have been found to maintain good mobility and independence into old

age (LaCroix et al. 1993). Among people surviving until very old age, even the period of disability prior to death has been found to be shorter among those, who were physically active earlier in life. (Leveille et al. 1999).

Dietary habits. Deviance from normal weight has been shown to be a long-term risk factor for disability, with under- and overweight people having higher risks than those in the normal weight range (Guralnik et al. 1989). Overweight may increase the risk of disability through increasing susceptibility to diseases, e.g. diabetes. It also forms an extra load, placing increased demands on the musculoskeletal system and thus encumbering mobility. However, some researchers have suggested that in older people moderate overweight is beneficial as people with more weight and consequently more muscle are better able to tolerate emergency situations, such as trauma or surgery (Andres et al. 1985, Potter et al. 1988). If muscle has been severely depleted by wasting due to inactivity, aging, or low energy intake, the amino acid reserve is low and healing may be compromised; hence underweight is associated with increased risk (Stini 1991). On the other hand, underweight is not consistently associated with increased mortality risk among older people (Harris et al. 1988). Thin people comprise a mix of those who are lean because they are physically active, and those who are at greater mortality risk, because they have lost weight due to a sickness or who are thin because they smoke (Harris et al. 1988, Willett et al. 1997). Healthy, thin, non-smoking people may not be at increased mortality risk (Harris et al. 1988, Willett et al. 1999).

Smoking. Non-smoking women have been found to survive on average 1.6-3.9 years longer than women who smoke (Ferrucci et al. 1999). It was observed that at the age when smokers were disabled and close to death, most non-smokers were still non-disabled. Smoking has been found to be associated with increased risk of diseases, but it also has an effect on physiological function independent of diseases. For example, smokers have been found to have poorer postural balance than non-smokers (Iki et al. 1994). Furthermore, psychomotor speed and performance of integrated movements as well as cognitive tasks was found to be impaired among smokers (Hill 1989, Nelson et al. 1994), whereas muscle strength was not affected by smoking (Nelson et al. 1994).

Psychological predictors of disability

Cognitive dysfunction is one of the most important factors that make it impossible for older people to live independently at home. For example, in Sweden around two thirds of those in sheltered accommodation / old people's homes have symptoms of dementia. Dementia is usually defined as an impairment affecting multiple cognitive domains, especially memory, as well as severe disruption of activities and social functioning in the activities of daily life (American Psychological Association, 1987). The two most common dementia illnesses are Alzheimer's disease and vascular dementia (Gatz et al. 1996). The prevalence of dementia in the population aged 65+ has been estimated in most studies to be around 5%, and increasing with increasing age from 1% at the age of 70 to up to 40 % or more at ages 85 or 90. The extent to which there are gender differences in the dementia illnesses has been discussed, but no clear results yet obtained. Genetic factors are relatively important for the onset of Alzheimer's disease while heritability seems to be less significant for vascular dementia (Gatz et al. 1997, Pedersen et al. 2004). There are also different environmental candidate factors that might increase the risk for or protect against dementia, e.g. head trauma, some medicines, B12 deficiency and other environmental exposures.

Intact cognitive skills are necessary to respond to the demands and needs of the environment. In particular, adaptation and optimization in functioning allowing for continued independence are dependent on the preservation of cognitive skills (Schaie 1990). However, several studies have shown that emotional factors as well as cognitive factors are associated with functional limitations and disability among older adults (e.g. Laukkanen et al. 1993, Smits et al. 1997). It has been suggested that psychological resources can strongly influence the relationship between personal capability and environmental demand by either increasing personal capability, reducing the environmental demand or both (Femia et al. 1997). For example, a recent analysis showed that having high levels of fatalism, low levels of self-confidence, and low levels of intellectual resources predicted greater difficulty in carrying out important life activities 20 years later (Caplan et al. 2003). The effect of positive emotions on health trajectories was studied among women aged 65 years and older living in the community. Emotional vitality was defined as having a high sense of personal mastery, being happy,

and having low depressive symptomatology and anxiety. Among women without the specific disability at baseline, emotional vitality was associated with a significantly decreased risk for incident disability. Emotional vitality was also associated with a lower risk of dying. These results were not caused simply by the absence of depression since protective health effects remained when emotionally vital women were compared with women who were not emotionally vital and not depressed (Penninx et al. 2000).

A study by Mellors et al. (1994) describes hypertensive individuals as having personalities characterized by neuroticism and introversion and / or extroversion and low psychoticism. Personality traits that may lead to emotional conflict or to the suppression or expression of anger leading in turn to immunological and physiological changes, and eventual hypertension. Considering that hypertension is strongly related to cardiovascular disease which in turn, is associated with disability, it is important to recognize personality dispositions on the development of disease and disability.

Gender differences in disability

There is a marked gender difference in longevity. In European countries women often live about five years longer than men. Years in full health, however, is another matter. In Sweden, for example, men aged 65-84 are expected to have a one-year shorter disability-adjusted life year (DALY) compared to women in these ages, but to live one year longer in full health (Socialstyrelsen 2001). Prevalence is determined by incidence and duration of a condition. Duration is determined by recovery and case fatality rates. Women have a longer duration of life lived with disability than men. The reasons for this are still partly unknown, although a higher prevalence of fatal conditions among men and of non-fatal chronic conditions among women (Gold et al. 2002) has been shown. It may be that constitutional factors, such as lower muscle strength and lower bone density in women, and higher rates of certain negative life-style factors, contribute to this. Several of these factors are modifiable and, if targeted, would likely reduce the burden of disability in the older population (Leveille et al. 2000).

Women tend to report more ADL problems than men (Socialstyrelsen 2000). The concept “multiple jeopardy” has been introduced to describe older women who have combinations of social disadvantages (Hammond 1995), such as lower income, lesser

education, and more often widowhood. Social factors like these could, at least in part, explain the gender differences in care-utilisation among the elderly. It has been suggested that people who live alone need formal help to a much higher extent than people who live with someone (Socialstyrelsen 2004).

Environmental predictors of disability

Disability is often defined as a gap between a person's abilities and environmental requirements. We can speak of a disabling environment. Social and environmental factors play a major role in determining whether functional limitations are expressed as disability or not. In disability assessment, a person is placed in the context of the physical and social environment and its challenges and limitation in the fulfilment of social roles is assessed. The most commonly assessed dimensions of social role fulfilment are basic activities of daily living (such as basic mobility and personal care), instrumental activities of daily living, (doing housework, managing finances or using the telephone), paid and unpaid role activities, (occupation, parenting or being a student), social activities, (attending group activities and socializing), and leisure activities (sport and physical recreation, reading or travel; Jette 2003).

Identical physical and mental conditions may result in different patterns of disability depending, for example, on the occupation, housing conditions or family structure of a person (Jette 2003). On the other hand, similar types of disability may arise from different types of health conditions. For example, stroke may cause decreased muscle strength and impaired balance leading to walking limitation and making grocery shopping difficult. Walking limitation may also result from arthritis when pain predisposes people to decreased muscle strength and poor postural control.

The interaction between mobility limitation and environmental components adds further complexity to the disablement process. Disablement may be expressed, for example, in a pattern of avoiding physical challenges in the environment (Shumway-Cook et al. 2003). People with mobility limitation often try to avoid travelling alone, climbing stairs, going to crowded places or using escalators. While this potentially decreases their autonomy and quality of life, it also has a detrimental effect on the amount individuals move in the community. When people do not regularly encounter

environmental or social challenges, they gradually get out of practice with respect to the activities in question; this in turn is likely to lead to further deterioration in physical status and social interactions. It has been demonstrated that older people who report living in troublesome neighbourhoods (traffic, noise, crime, trash and litter, poor lighting, and inadequate public transportation) have a greater risk of functional deterioration than those in better neighbourhoods (e.g. Balfour et al. 2002).

Social role fulfilment is strongly related to social position, thus underlining the significance of socio-economic factors in the disablement process. Social position is usually described by indicators of educational attainment, occupation and income. In a life-course perspective, level of education usually reflects a characteristic acquired early in life, representing the transition from a social position largely received from parents to an achieved social position as an adult (Lynch et al. 2000, Singh-Manoux et al. 2002). Occupation influences living conditions in adult life and represents the major structural link between education and income. Income relates directly to the material conditions that may influence health, whether or not a person is inside or outside the labour market (Arber et al. 1993). Women are often at a disadvantage in factors such as socio-economic situation (Moen 1996, Vågerö 1997), not least in older cohorts where women have less education and participate less in the work force.

The majority of studies of social position and disability in old age have shown a strong relationship between measures of material wealth and functional decline among those equipped with more material resources and thus protected against unfavourable trajectories of change (e.g. Robert et al. 1996, Mackenbach 2001, Avlund et al. 2003, Avlund et al. in press). There also is growing evidence that social relations (e.g. social networks, close friends, presence of a confidant) importantly affect the ability of older individuals to function normally in their daily life (e.g. Holstein et al. 1997, Mendes de Leon et al. 1999, Michael et al. 1999, Everard et al. 2000, Avlund et al. 2004). More recently, evidence has accumulated to suggest that community differences in what has been referred to as social capital (cooperative network of social relationships, levels of trust, perceived reciprocity, membership in various groups or associations) have significant independent effects on disability and health (e.g. Hyppä et al. 2003).

Disability prevention interventions and research

The development of interventions that may effectively reduce the burden of disability in the older population is a major priority for the national health care systems. In spite of the abundance of observational data, firm evidence that age-associated disability can be prevented or delayed is scarce and limited to small studies that have generally been underpowered (Center for Drug Evaluation and Research 1989, Penninx et al. 2001, McCormack 2002). In fact, while the literature shows some indication of a decline in the age-specific prevalence of disability, the magnitude of that decline is minimal and wholly inadequate to offset the projected massive increment in the prevalence of disability due to population aging, which will cause a disproportionate expansion in the number of persons in the oldest age groups.

Need for trials on disability prevention

Designing and conducting studies aimed at assessing whether disability can be prevented or delayed presents special challenges. In particular, because of the multifactorial origin of disability in the elderly, disability prevention trials are generally very costly, as they are based on complex, multifactorial interventions and require a large number of participants (Di Bari et al. 2001, Gill et al. 2002, Fransen et al. 2003). Additionally, while disability prevention trials provide important information to health care planners, they are unlikely to be a priority for pharmaceutical companies and thus need to be funded out of public resources. Thus, fostering the implementation of these trials should be accomplished by the introduction of special policies in the funding mechanism for health care research.

Beyond fostering the conduct of *clinical trials on disability prevention*, it is important to encourage the incorporation of disability outcomes in studies focussing on diseases that are highly prevalent in the older population. In the last few years, the medical scientific community has become aware that the results of clinical trials

performed in young and adult persons cannot be directly generalized to the elderly (Hutchins et al. 1999, Lee et al. 2001). A number of randomized controlled trials on the effects of pharmacological and non-pharmacological interventions for the prevention of acute medical events (such as myocardial infarction or hip fractures) have been conducted. These trials included design features that improved the generalizability of their findings to the older population (ICH 1993, Rochon et al. 1998). In general, they showed that interventions that are effective in young-adult persons are similarly effective in older patients without substantial disability and/or co-morbidity. In contrast, the effectiveness of many interventions in older persons with co-morbidity and frailty is somewhat questionable. Interestingly, none of the trials aimed at the prevention of specific cardiovascular or non-cardiovascular outcomes was able to demonstrate prevention or delay of onset of disability in the elderly. In fact, the only disability prevention trials that have shown promising results are those based on complex and multidimensional approaches, such as interventions to reduce the effects of multiple risk factors and care plans based on the comprehensive geriatric assessment articulated in multiple settings.

Despite this pressing need, guidelines for *large-scale trials of interventions* aimed at preventing or delaying disability in older persons have not yet been established, especially for complex interventions, those “made up of various interconnecting parts” (Campbell et al. 2000, Stuck et al. 2000). Examples of complex interventions are the introduction of guidelines in multiple settings, promotion of health behaviours using multiple approaches, modular interventions on multiple risk factors, and the implementation of care plans that foster integration between the health and social services. While these complex interventions are the kind more likely to have a stronger effect on the health of the older population, problems often arise in the evaluation of their effectiveness as researchers have not fully defined and developed adequate methodological tools. In particular, the limited research available indicates that one of the key requirements for effectiveness and efficiency is the ability to identify a population of older persons that are still non disabled but are at high risk of disability. In the most recent literature, this condition is defined as the “the frailty syndrome” (Fried et al. 2001, Malmberg et al. 2002, Ferrucci et al. 2004).

Development of trials for disability prevention

Given the complexity of the factors underlying old age disability and special challenges that the conducting of trials aimed at prevention of disability presents to investigators, there is ample room for the selection of targets and research approaches. The participants in the BURDIS network have produced a list of recommendations concerning the development of trials. These are presented below.

Standard criteria should be developed and validated for the identification of older persons at high risk for disability, as these are the ideal candidates for trials of disability prevention. Criteria should be selected that are: 1) simple and feasible in a screening program conducted in the primary care setting, 2) meaningful to professionals within health and social care, health and social care planners and policy makers, and 3) important for guiding health and social care policies. As a first approximation, criteria in the following domains should be considered as these are generally considered components of the frailty syndrome in the literature: mobility, muscle strength, nutritional intake, weight change, balance, endurance, fatigue and physical activity. These domains are easy to assess and are strong, independent predictors of disability. Performance-based measures of lower extremity function capture composite information on strength, balance and mobility, and may be a good, simple approach to the screening of older individuals at high risk for disability.

A standard operational definition of frailty should be developed, validated and introduced in the minimum set of data collected from patients who access any type of health care service. Exclusion criteria should be minimized.

Given the multifactorial origin of disability, complex interventions that require the integration of multiple components are more likely to be effective than simple, unique interventions. However, multi-component interventions are difficult to standardize and reproduce. Therefore, it is important that pilot data on each single component of the intervention is collected and evaluated before the primary trial is designed. Examples of complex, multi-component interventions that need to be tested are:

- a. Interventions for the promotion of supervised and unsupervised physical activity and exercise in the older population;

- b. Implementation of guidelines for access and permanence in in-hospital and community-based rehabilitation programs;
- c. Post-hospital discharge support programs based on comprehensive geriatric assessments;
- d. Screening of frailty in the primary care setting followed by interventions addressing multiple risk factors;
- e. Financial support for families that agree to maintain older disabled individuals in their homes;
- f. Counselling on health behaviours in retirement communities;
- g. Implementation of standard assessment instruments in nursing homes that facilitate the early identification of risk factors for accelerated disability progression.

Disability-related measures should be systematically incorporated in the primary outcomes of pharmacological and non-pharmacological intervention trials that target diseases and health events that are highly prevalent in the older population. This is important, because functional status is by far the most important factor affecting quality of life and health care utilization in old age. Ideally, objective, performance-based and self-reported measures of physical function should be collected in these trials. In fact, performance-based measures of physical function obtained under standardized conditions are highly reliable, have strong predictive validity, and are somewhat sensitive to change, although performance at the time of assessment may not represent the usual performance of the tested individual.

Research aimed at improving the reliability, ecological validity and comparability of tools for the measurement of physical and cognitive functions in the elderly should be encouraged, especially translational research looking at the feasibility of administering these instruments in current clinical practice and in different health and social care settings. The currently available instruments are problematic for several reasons, including:

- a. Given that functional status may fluctuate over short periods, nosological definitions of disability that take into account the time and reversibility

dimensions should be developed. Examples are: any new disability, transient disability (that resolves within a certain time period) or persistent disability (that lasts over a defined time period or more);

- b. The relationship between self-report and objective ability is unclear, either because the instruments used to measure objective ability assess rudimentary skills and the effect of cognitive function, or because those that mimic traditional activities of daily living have been validated mostly in the rehabilitation setting;
- c. Disability is often associated with inability to provide self-reported information. Thus, pre-defined methods of assessing disability through proxy should be developed and extensively validated.

Disability can be reduced by the social networks surrounding the individual. It is possible to increase the strength of the individual's close social network by e.g. respite care, which needs to be developed. Simple interventions against loneliness and grief have been shown to be useful, but need to be further developed. Educational programs aimed at integrating the social structures in the environment such as home-help services, local associations, house owners and care-givers, etc., to reduce the environmental demands, and thus disability, can be further developed.

A sensible strategy in developing a positive culture of ageing would need to be based upon prevention of the development of disability and forestalling the formation of a disabling environment, including the improvement of housing conditions and neighbourhood quality in order to facilitate the engagement of older adults in social and physical activities. In future research on disability in old age the effects of the physical environment should be accorded more attention and instruments developed for standardizing the required assessments.

Development of services

Disability in old age should be a focus of all public health policy and programs and cover the whole continuum of services aimed at both preventing disability and restoring functional capacity through rehabilitative measures. This report gives recommendations for the development of services which are supported at least to some extent by research findings or for which other scientific evidence of their effects on the disablement process has been obtained. It is obvious that further research and development work is required in order to broaden the knowledge basis for appropriate interventions, as argued in the previous chapter.

Geriatric interventions

Today's geriatric interventions draw upon knowledge obtained at all levels within the biological as well as psychological and social research disciplines. This has broadened our knowledge about how it might be possible to maintain or re-establish the loss of functional capacity in the elderly. From a series of clinical controlled studies on the effect of geriatric assessment and rehabilitation we now also know more about how such efforts could be implemented.

Geriatric research aims at increasing the possibilities for older people to maintain their functional capacity and regain it after succumbing to a disease. Interventions in this area are directed at health promotion, disease prevention, treatment and rehabilitation and take the form of socio-cultural activities as well as health and care management in the community and in hospitals.

Comprehensive geriatric assessment

At all stages in “*the treatment chain*” from healthy, elderly people, independent of help to clients in home care or in institutions, it is possible to prevent (further) functional loss by

interdisciplinary geriatric assessment. The tool is “comprehensive geriatric assessment”, defined as a multidisciplinary evaluation in which the multiple problems of older persons are uncovered, described and, if possible, explained and in which the resources and strengths of an individual are catalogued, need for services assessed, and a coordinated care plan developed to focus interventions on his / her problems (Schroll 1989). This leads to early detection of multipathology, reduction of polypharmacy, avoidance of secondary losses of ability, the making of simultaneous efforts, and coordination between hospital and primary sector.

Preventive Home Visits

The effects of home visits to prevent functional decline in elderly persons have, in a recent meta-analysis of 18 trials, been shown to be effective, provided the subsequent interventions are based on a multidimensional geriatric assessment, include multiple follow-up home visits and target persons at lower risk for death (Stuck et al. 2002). The ability to reduce disabilities among elderly people is related to the home visitor’s experience and performance. In those at low risk for functional impairment, especially, the “flexible approach” is feasible. It leaves considerable discretion to visitors on how to meet the needs of each individual’s situation.

Screening

Reviews of the research literature and the guidelines of various professional organizations with a view to presenting summary recommendations for prevention and screening in older adults have concluded that there is evidence supporting periodic screening for many common illnesses and their risk factors in elderly populations (Goldberg et al. 1997, Mehr et al. 2002). There is, however, no standard method for conducting health assessments, and the results therefore vary between studies. Programmes to screen for assessing various modalities of functional capacity amongst elderly populations have also been applied in primary health care, but the results remain inconclusive, and we need to wait for findings from the ongoing evaluation projects before regular preventive check-ups for various functions can be recommended.

Home care

Most elderly people wish to live in their own homes as long as possible, and various forms of home-based care are provided to support this aim. There is, however, no evidence-based model of care available, and social and health care professionals and policy makers continue to find “local” solutions in their daily provision of community services to frail older citizens. Although descriptions of structural, organisational and funding characteristics of health and social care services exist, there are none that are able to define with confidence the target home-care patient, nor the optimal configuration of primary care or specialist doctors, nurses, therapists, care assistants and home helps for particular patient and client groups. The same uncertainty exists about the effectiveness of night and weekend home-care services and the use of guidelines or management tools. There is observational evidence to suggest that the services currently in place do not maintain an appropriate balance between care of existing disabilities and prevention of functional decline.

Management of chronic diseases

Disease, particularly chronic disease, is the main cause of disability in old age. Patients with chronic diseases account for majority of hospitalizations in European countries. Many are elderly patients with multipathology, functional limitations and related social problems. It is therefore important that interventions are also aimed at the effective management of chronic illness by providing both clients and service providers with adequate information, skills, incentives and resources. Evidence of the value (cost, wellbeing) of comprehensive assessment, optimised medical treatment, disease-specific interventions, patient education, physical exercise, nutritional advice and follow-up have been found in cases of ischemic heart disease, heart failure, diabetes mellitus, stroke and in patients with hip fracture and complex geriatric conditions (Griffin 1998, Anderson et al. 2002, Joliffe et al. 2002, Lloyd-Williams et al. 2002).

The development of new medical technologies, which can successfully be used in the treatment of serious conditions in middle-age (e.g. different coronary events), may in later life lead to an increased need for effective tertiary prevention and chronic disease

management in order to prevent physical and mental decline in these patients. There is also evidence to suggest that a chronic disease self-management program can improve health status while reducing hospitalization (Lorig et al. 1999).

We also know that intervention strategies at the level of both the community and person can improve the quality of life of older people (Blumenthal et al. 1999, Rybarczyk et al. 1999, Blazer 2002). By focusing interventions on well-known risk-factors of depressiveness, adding support when needed, strengthening protective factors and improving coping skills, we can develop effective disability prevention strategies and at the same time promote mental well-being in late life.

Geriatric evaluation and management units

The goals of geriatric rehabilitation are to restore and maintain an optimal level of function despite the disabling effect of diseases and injuries. These goals are achieved by detecting rehabilitation needs early and getting rehabilitation off to an early start to avoid complications, i.e. establishing the rehabilitation process as a continuum from geriatric expertise to social and family support and promotion of active follow-up.

A survey of the literature (Handoll et al. 2003), including 30 scientific studies (9496 patients) in randomized trials containing valid end points, has been able to show significant reduction in mortality, postponement of nursing home placement, and some differences in outcome regarding function and costs.

Specialized geriatric rehabilitation is complicated but effective when properly performed. Interdisciplinary teamwork, targeting of patients, comprehensive assessment and intensive and patient-targeted rehabilitation seem to characterize the most effective programs (Sletvold et al. 1996, Jonsson et al. 2003).

Appropriate medication

There has been a continuous rise in the use of therapeutic drugs, especially in the industrialized world, which has also meant that an increasing number of drugs are being prescribed for elderly people. A study among community-dwelling people aged 65-84 years showed that they used on average 2.2 prescribed drugs per person, and that one

fifth of the subjects had a greater number of drugs in simultaneous use (over 4 drugs) than is generally recommended (Laukkanen et al. 1992). The increased use of psychotropic drugs (sedatives, neuroleptics, antidepressants) also increases unwanted effects such as confusion, accidental falls, memory decline and behavioural changes (Gurnack 1997, Armour et al. 2002). The pharmacokinetics of drugs changes with age (e.g. Sadana et al. 2003), which, given the high prevalence of co-morbidity in old age and the interactions of drugs, complicates the medication situation among this segment of the population. This is an area which merits more careful evaluation and control, also from the vantage point of preventing functional decline and disability.

Counselling

There is an apparent need to develop counselling services for elderly people to assist them to better cope with the multitude of questions related, for example, to ways of counteracting the development of disabilities, managing chronic conditions, developing and maintaining healthy life styles, and being actively involved in social life. It is possible to counsel older people in the course of the various contacts they have with the service system, but specific arrangements for this purpose may also be justified, depending on the infrastructures and services available in different localities.

Exercise. Health care professionals have frequent personal contacts with older people, and are thus a significant resource for the promotion of regular physical activity. In particular, patients with ascertained risk factors or recently diagnosed diseases are candidates for behaviour change. However, only limited amount of evidence exists about the feasibility and effectiveness of exercise promotion in the context of health care organizations. Individualized physiotherapy may not be considered feasible owing to financial constraints. Sustainable forms of exercise include walking for fitness, home-based exercise or supervised exercise groups. Some evidence exists that promoting more effective use of available resources, such as exercise classes provided by the community, is a cost-effective way to increase physical activity levels (Stewart et al. 1997). A recommended strategy for health care professionals in promoting physical activity among older people is to alter the key mediators of physical activity. Self-regulatory skills, social

support, perceived benefits, motivational variables and self-efficacy have been identified as the main determinants of exercise adherence in previous studies (King et al. 1998). Currently, the practices of health care professionals in promoting exercise among older people vary widely between EU member states and even within countries.

Nutrition. Even healthy elderly people may, through dietary modifications, better maintain health, delay the onset of some diseases and prevent functional decline (Bales et al. 2002). Nutrition education and counselling thus seem to be necessary in assisting older people to comprehend new information about healthy nutrition and apply it to their own situations (Sahyoun 2002). Both obesity and underweight are common problems in older people. According to the Cochrane review of Milne et al. (2002), elderly patients produced a small but constant weight gain by nutritional supplementation, resulting in a modest beneficial effect on mortality and decrease in the length of hospital stay. With respect to obesity in older ages only a few prevention programmes have been developed and implemented and success rates have been low. Much work remains to be done to identify which approaches will be of greatest benefit in both healthy older people and in older patients with nutritional frailty.

Self-care. The coming generations of old people will have better education and more material, social and psychological resources to enable their active involvement in self-care tasks, including appropriate medication and other treatments of diseases, healthy diet, sufficient physical activity, maintenance of adequate level of hygiene, and use of modern technology for information and safety purposes.

Creating accessible environments

Ageing is associated with increasing difficulty in getting around on foot both indoors and outdoors. One definition of impaired mobility is the inability to walk a specified distance, to climb stairs without assistance and to cross a street controlled by traffic lights in the time allotted (e.g. Hirvensalo et al. 2000). It is important that in the future, the needs of older people are taken more closely into account in the design of services and the improvements in housing conditions and neighbourhood quality in order to facilitate the

involvement of older adults in social and physical activities in their homes and neighbourhoods.

Policy options

Making recommendations for research policy, the development of services and the implementation of policies aimed at the prevention of disability in old age was set as the final aim of the network project. It is understood that the ongoing increase in life-expectancy, and also healthy life-expectancy, relates to the overall increase in wealth in many societies and consequent improvement in public health. In deciding on what policy options to recommend the aim was not to cover the whole spectrum of issues related to the prevention of disability in old age but rather to focus on a few important items which relate to the evaluations presented in the preceding chapters of this report. The recommendations given are based on the knowledge of the member scientists, consultation with other experts and stakeholders, the analyses carried out using the network data bases and the review of earlier relevant scientific literature.

Research policy options

There is a continuing need for the development of age-related disability theories and models and empirical research that underscore the importance of the environmental contexts in which the disablement process takes place and explore the roles of medical, psychological and social predictors of disability with the aim of developing effective preventive interventions.

The 6th Framework Programme of European Union that provided funding of €17 billion over 5 years for mainly trans-national projects was announced in 2002. Unlike the previous 5th Framework Programme that funded over 100 projects concerned with ageing, there appears to be no direct interest in this area of research. Non-thematic research is supported under the Marie-Curie scheme which will support fellowships, transfer of knowledge, conferences and training courses, and research training networks. However, this scheme does not provide for the direct funding of non-thematic research projects. While the need for high quality trans-national studies on disability at older ages

is clear for purposes of examining variation and trends in life expectancy free of disability, conducting them is extremely difficult. Similarly, conducting trials aimed at the prevention of disability also presents special challenges to investigators. Without substantial EU investment such studies are unlikely to be feasible. It is therefore important that in the 7th Framework Programme research on population ageing, including the prevention of old age disability, is included as one of the priority areas.

Against the current European funding background, our policy options for research need to be carefully considered. The BURDIS project has identified several important gaps in research (see pp. 22-24) that need filling, and prioritized six of them as summarized in the following sections.

Determinants of disabilities in old age

The life course study of ageing: expanding existing birth cohorts. There are too few cohort studies that permit examination of the importance of biological, life-style, social, physical and mental health, and environmental factors in determining functional limitations and disability in old age and the disablement process. A key policy option is to establish such studies by expanding existing birth cohort studies with data modules on functional limitations and disability.

Genetic determinants of ageing: establishing ageing modules in new genetic studies. A fairly high proportion of markers of functional limitations and disability appear to be heritable. Many new initiatives in genetic epidemiology are being established (e.g. UK Biobank) with the aim of studying genetic causes and gene-environment interactions relevant to common diseases. The inclusion of phenotypic data of relevance to the ageing process (e.g. muscle morphology and function, osteopenia, cognitive impairment, functional performance measures) would be a step forward in aiding understanding of the ageing process. Trans-national studies would also be of great value as they provide variation in the amount of genetic admixture and linkage disequilibrium which may help in distinguishing true genetic effects. FP6 funding might be obtainable for such studies.

Establishment of a European core set of functional performance measures. There is an apparent need for the cross-national harmonization and standardization of methods for the assessment of impairment and functional decline in the most essential functions (e.g. the minimum data set-approach) regarding old age disability, which would include both measures of functional limitations and activities of daily living. This approach might include both the use of the already established data bases for the definition of the most critical targets of the assessments and a new prospective study to test the feasibility, reliability and validity of the selected performance-based measures of function. The usefulness and applicability of the international classification of functioning, disability and health (WHO, 2001) could be considered in this connection.

Interventions for preventing old age disabilities

Interventions targeted at healthy individuals: improving physical activity. While there is little doubt that physical activity is of great importance in the maintenance of health in older age, methods of improving activity patterns have been little researched. The nature of intervention in terms of both content and “dose” requires work. Links with interventions aimed at reducing obesity would be strategically useful.

Evaluation of public health interventions: protecting older people’s health. There is very little scientific evidence on the best means of making healthy diets, increased physical activity and greater social engagement the most desired options at older ages. Evaluating the effects of increased financial and social support for older people would also be relevant. Randomised controlled trials ought to be promoted and the use of alternative and robust methods of evaluation should also be more widely applied.

Interventions targeted at vulnerable individuals: screening tools to identify those at risk. It is of considerable importance to be able to identify those older people who are not yet dependent at a point where clinical interventions may make a difference. Declines in specific aspects of functional performance may be useful in this regard, if they can be shown to predict important clinical outcomes when used in primary care.

Practice policy options

Given the multifaceted nature and genesis of ageing-associated disabilities, the vision of the required policies and programs also has to be based on inter-sectoral collaboration amongst multiprofessional teams. Examples are given in the following section on actions that could be taken to improve health, health services and social support aiming at preventing disabilities in old age.

Improving the health of and health services for older people

Promoting physical activity through inter-sectoral collaborations. Single-sector approaches to promoting activity and exercise among older people are not very successful as the barriers to activity are multi-factorial. There is a need to establish inter-sectoral groups to plan activities to promote increased activity levels at all ages.

Comprehensive geriatric services: increasing clinical skills in geriatric medicine. Evidence supports the use of comprehensive geriatric assessment and management of sick elderly people. Increasing older people's access to such services through additional training of all health professionals in both primary and secondary care in assessing and managing older people is needed.

Screening for frail elderly people in the community. Evidence suggests that screening for frailty, or incipient frailty, can successfully identify people who will benefit from comprehensive geriatric services. These services now need to be put in place.

Improving social support for older people

The provision of adequate housing and pensions for older people should not be taken for granted as these are the major means by which elderly people's quality of life is improved. In the poorer countries of the European Union, access to decent housing and pensions is not assured, and hence such policies have top priority. It must be remembered that there are important and widening differences in disability-free years of life between people in different socio-economic positions.

Preventing prejudice and discrimination. Different societies produce disabilities quite apart from those that result from impairments and functional decline. Prejudice and discrimination in different arenas of life (work, transportation, involvement in political and economic activities) may disable and restrict people's activities more than do impairments and functional decline. It is therefore important, also from the disability prevention point of view, to promote a positive culture of ageing through education (not only for experts in the field of social and health care but also bringing in planners, architects, journalists, etc.). An increase in the flexibility of age of retirement, which would allow older people to voluntarily continue working after the official retirement age, is to be recommended as one means of maintaining and improving quality of life in older age groups.

Implementing policies

An important framework for analysis and action is the independent living movement, which underscores active participation, possibilities for choice, and prevention and minimization of the uncomfortable consequences associated with the onset of disability. This framework makes room for both healthy and disabled elderly people by appreciating the diversity and multifaceted nature of the processes of ageing and ageing experience. The BURDIS network want to emphasize the need for promoting education in gerontology, allocating funds to ageing research at both the international and national levels, and developing services to maintain and improve the quality of life among the unprecedented increase in the number of older people in the decades ahead.

Education. The promotion of training in gerontology and geriatric medicine is an important challenge and a necessary prerequisite for implementing effective services for older people. Only a very few European universities have a full Master's program in gerontology and, even then, not all the main fields are covered by these programmes. Gerontological education should be increased in the curricula of all the relevant professional groups, and opportunities for specialization in gerontology and geriatric medicine ought to be enhanced both in the individual EU member states and on the basis of international collaboration (e.g. Socrates programmes, European Master in

Gerontology programme). It is especially important that the professional groups working in primary health care are introduced to the essential issues of ageing and its outcomes with regard to the challenges they pose to the preservation and management of various disabilities. The WHO could play a role in hosting European groups to examine training in health and social care for older people with a view to producing model curricula for the health and social work professions.

Research. The conditions necessary for implementing research policies on ageing are somewhat limited by the current EU funding constraints. In the further development of the European Research Area ageing research should be ranked among the priority areas considered to have important implications regarding many aspects of social life across all the EU countries. Genetic epidemiological projects would be supportable, and in this connection it may be most expedient to “piggy-back” ageing projects on existing genetics projects. Other options that may be worth considering are applications for EU Marie-Curie funds to support some of the required activities through meetings and research fellowships. National research funders should also be approached to consider whether support should be given to country-level research initiatives on ageing that are relevant to future EU collaboration.

Practice. The impending changes in the population age structures of the European Union countries, sometimes known as “apocalyptic demography” will in turn require profound changes in the development of social practice and different kinds of services in order to maintain well-being and a satisfactory quality of life for all age groups. Some of the required actions could be developed by creating a special plan, an Age Policy, formulated and constructed on a national level on the basis of accumulating knowledge about the various challenges posed by population ageing and possibilities to counteract its negative consequences and promote positive ones. Such an Age Policy could then be used as a set of guidelines in developing strategic plans at the community level to improve social and health services for different age groups from a life-course perspective.

Also, non-governmental organisations concerned with ageing have a powerful role both in providing services and in lobbying governments to improve services. They

should be involved in the policies described here. Because independent living is not only doing things by oneself but also being in control of how things are done, the amount and quality of social support (services, networks, close friends, etc.) need to be emphasized in Age Policies.

Finally, the improvement of clinical practice in geriatric medicine may be facilitated in a number of ways. Professional organisations in each country could work together to produce evidence-based clinical guidelines in the same way as, for example, the European cardiology societies, which have produced guidelines on the prevention of coronary heart disease over the last decade, up-dated to take account of new knowledge as it arises.

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