



World Health Organization

CURRENT AND FUTURE LONG-TERM CARE NEEDS

**An analysis
based on the 1990 WHO study**

The Global Burden of Disease

**and the International Classification
of Functioning, Disability and Health**

**The Cross-Cluster Initiative
on Long-Term Care**

**Noncommunicable Diseases
and Mental Health Cluster
World Health Organization**

Note: Data and forecasts for all countries
can be found on the WHO web site

http://www.who.int/ncd/long_term_care/index.htm

[http://www.who.int/ncd/long_term_care/
long_term_care_publications.htm](http://www.who.int/ncd/long_term_care/long_term_care_publications.htm)

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Most care delivered to disabled people is provided by families or by other ‘informal’ caregivers. Care of disabled people is also an important task for professional caregivers, who are often in short supply and whose payment must be provided by national economies.

Changes in fertility and life expectancy over the next fifty years, combined with changes in the patterns of diseases affecting populations, will lead to a large increase in the number of people with severe chronic conditions and/or disabilities in most parts of the world. At the same time, the number of adults who are economically active or available to fulfil caregiving roles will change, and in some countries will decrease.

We have used data from the WHO Global Burden of Disease study (1990) to calculate the prevalence of severe levels of disability. From this, we have made estimates of the numbers of people in the world who require daily care by another person for their health, personal, or domestic needs, beyond that expected for an able-bodied person. We have used population projections to forecast these estimates over the next fifty years.

The biggest increases in prevalence of dependency –up to five- or sixfold in some cases –will occur in the countries of sub-Saharan Africa, Latin America, the Middle Eastern Crescent, and ‘Other Asia and Islands’ (Asia excluding China and India). However, these increases will occur in the context of generally increasing populations, and the increases in the ‘dependency ratio’ (number of dependent people as a proportion of the working population) will be fairly modest.

Large increases in prevalence will also be seen in China and India, but the ‘dependency ratio’ will increase greatly –up to 14% for China. The Established Market Economies, especially Europe and Japan, with mature population structures, will experience only modest increases in both prevalence of dependency and ‘dependency ratio’. The Former Socialist Economies of Europe have declining fertility, relatively short life expectancy, and recently, extensive emigration. They will have static or declining numbers of dependent people, but large increases in ‘dependency ratio’.

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These data are subject to a number of approximating assumptions. Limited empirical data are available, but generally support the validity of the estimates. It must be stressed, however, that the figures presented are estimates which are subject to error. The projections into the future are determined only by how the size and structure of the population is expected to change, and not by any possible changes in disease prevalence (which might be influenced by prevention, cure, or rehabilitation).

The figures serve to highlight the potential magnitude of this issue. It is clear that many countries will be profoundly affected by the increasing number of people with severe chronic conditions, and will need to identify human and financial resources to support them. Improved collection of data on disability and caregiver needs would guide future provision of health and long-term care (LTC), and inform labour and macroeconomic planning.



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Abbreviations

AIHW	Australian Institute of Health and Welfare
ADL	Activities of daily living
CFAS	Cognitive Function and Ageing Study (of MRC, see below)
ICF	International Classification of Functioning, Disability and Health
GBD	The Global Burden of Disease, a comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020.
HIV	Human Immunodeficiency Virus
MRC	Medical Research Council (United Kingdom)
WHO	World Health Organization



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1

Introduction

1.1 The increasing importance of chronic disease

Over the past century, the economically more developed countries of the world have gone through considerable change in their population structure and the types of diseases which afflict them – the so-called demographic and epidemiological transitions. ‘Developing’ and ‘middle-income’ countries are experiencing these transitions currently, or will do so in coming decades.

‘Demographic transition’ involves a country or society passing from a state of high fertility and high mortality, to one of low fertility and low mortality. This transition is characterized by increasing life expectancy, and population ageing’ – in which the population structure changes from one in which there is a predominance of children and young adults, to one in which all age groups are represented more or less equally, up to the age of 70-80 years.

‘Epidemiological transition’ involves progressing from a time when infectious disease predominates, with high maternal and child mortality, to a state where premature mortality is low and chronic diseases predominate. These diseases include ischaemic heart disease, cancer, stroke, arthritis, chronic obstructive pulmonary disease, dementia, and depression. The prevalence of these diseases typically increases with age. Those who suffer from them often have multiple, co-morbid, pathologies.

There is also considerable disability associated with trauma and infectious diseases – such as HIV/AIDS, tuberculosis, malaria, filariasis, and poliomyelitis – prevalent in less developed countries. As well as contributing to increased mortality, these diseases cause disability, often at much younger ages than would be expected in economically more developed countries.

1.2 The language of functional limitation

The common feature of these chronic diseases is their propensity to cause limitation in functional abilities. The recently-published *International Classification of Functioning, Disability and Health* (ICF) (WHO, 2001) introduced standardized definitions for terms relating to these limitations.

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‘Disability’ is used as an overarching term covering the experience of functional limitation at the level of the body or organ system, person, and society. Disability is the outcome of the interaction between a person’s health condition and the context in which he or she finds him- or herself. Context is made up of personal factors (e.g. age, sex, race, education) and (external) environmental factors (e.g. attitudes, physical environment and assistive technology, policies, services, natural environment, personal support).

Disability is described from three perspectives or levels:

- **Body:** *body functions and structures*, where an experience of disability is called impairment (e.g. lack of muscle tone, lack of speech, incontinence, intellectual impairment);
- **Person:** *activities* where an experience of disability is called an activity limitation (e.g. inability to walk, to communicate, to self care);
- **Societal (or person within society):** *participation* where an experience of disability is called a participation restriction (e.g. not working because of inaccessible environment, not communicating because people do not engage in conversations). A person may have no ability and still be able to participate given the right environmental facilitators. For example, a person may be unable to walk but can get around in a wheelchair, or have the ability to do something but be prevented from doing it because of environmental barriers (such as ability to communicate with others but not given the opportunity to do so because of negative attitudes towards disability).

What ICF calls ‘disability’ was previously called ‘disablement’. ‘Activity limitation’ was previously called ‘disability’ (WHO, 1980). Common clinical usage (in English) of the word ‘disability’ refers to something close to activity limitation, but also includes elements of participation restriction.

In the Global Burden of Disease publications, ‘disability’ was used broadly and loosely, and was largely based on consideration of impairment. In this analysis, disability should be taken to mean the overarching term in accordance with ICF, except where explicitly qualified.

1.3 Disability, dependency, and caregivers

The prevalence of chronic disability (activity limitation) has been documented in several national surveys (e.g. Australian Institute of Health and Welfare 1999 and 2001; Martin et al., 1988). Inability to perform some key activities –for example, preparing food or feeding, maintaining personal hygiene, and safety awareness –brings a requirement for human help that would not customarily be needed for a healthy adult.

This is called ‘dependency’. Such care may include personal, domestic, or health needs. The person providing care may be a family member, a friend, or a neighbour (so-called ‘informal carers’); or may be a health or social care professional, working in the patient’s home or in an institution such as a hospital or nursing home.

‘Caregivers’ is the North American term for ‘carers’ in Britain and Australia, and ‘caretakers’ in India and some other countries. One definition is “a family member or friend helping someone on a regular (usually daily) basis with tasks necessary for independent living” (Brodaty & Green, 2000).

The large number of ‘informal’ family and other caregivers has been well documented (Brody, 1990; Jones, 1990; Brodaty & Green, 2000). These caregivers are important for a number of reasons. They provide a high volume of care that is important for the quality of life of the dependent person. If they did not provide this care, government or other care services would probably neither be able to provide equivalent care, nor afford to do so.

Furthermore, the caregiving role has an important impact on the caregivers themselves. Their mental and physical health may be adversely affected, and their social life and employment opportunities are often severely curtailed. Skilled labour may be lost to the national economy, and pension and social security entitlement for the caregiver may be restricted.

Care work has been invisible in the global statistical picture of social and economic reality. Today the International Labour Office makes a strong argument that care work must be dealt with as ‘decent work’ (e.g. economic security, recognition, and respect), whether it is provided by families, friends and neighbours, or by the formal sector (Daly, 2001).

Numerically, the largest number of caregivers comprise family members. Studies have shown that this is not a resource to be exploited without thought. Caregivers must be supported and nurtured, to enable them to maximize the care they can deliver, to avoid the considerable stress that can accompany caregiving, and to be able to sustain a caregiving role over a long period of time, often many years.

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In this way, premature and unnecessary placement in institutional care (hospitals and nursing homes) can be avoided. In addition, many nurses, doctors, therapists, and social care workers are engaged in supporting disabled people, either in their own homes or in institutions.

In summary, the negative side of care work exists and should not be minimized. However, to give care is also a valuable part of the human condition, just as the need for care is part of it. Therefore, this requires a serious debate in civil society –not only on the right to receive care, but also on the obligation to provide and give care, and how such obligations should be shared between men and women, and among families, communities and the State.

1.4 Current estimates and future projection of need for care

WHO Member States need to know how many of their citizens have disabling conditions requiring ongoing care. They also need to know how the numbers needing this care might change in the future, to predict the likely call on the health care system, social infrastructure, labour market, and economy.

The majority of people who will require these services over the next 50 years are already alive. If we choose, we can plan for future changes, and in some cases intervene (for example, prioritizing prevention and rehabilitation services). This may help avoid crises, for example in hospital bed availability and occupancy, and in the recruitment of health professionals.

Some potential health and social policies take many years to implement. These include developing caregiver support structures, building up insurance funds to pay for long-term care, or training health professionals. The need for these must therefore be anticipated years or decades in advance (WHO, 2002).

We have used data from the WHO Global Burden of Disease study (1990, described in Murray & Lopez, 1996a) and United Nations population projections, to estimate the number of people with daily care needs, and to project these forward to 2050.

2

Methods

2.1 The Global Burden of Disease study

The Global Burden of Disease (GBD) project is run jointly between WHO in Geneva, and the Harvard University School of Public Health. Age- and sex-specific prevalences of 483 diagnoses, or disease-sequela pairings, have been determined for eight ‘demographic regions’ (or country groupings) in the world (Murray & Lopez, 1996b).

Using these data, the prevalence of seven levels of disability was estimated. A disability scoring system was used. The scores were derived from a preference-weighting exercise, in which utility-type severity weights were established for 22 sample ‘indicator conditions’, and then applied to the whole list of diagnoses.

These conditions were described in terms of the impairments typically associated with them. Severity weights were determined by a panel of professional judges. An iterative ‘person trade-off’ approach was used. The policy consequences of ratings at each round were fed back to inform changes made in the next round, a process called ‘deliberation’.

Indicator conditions were classified into a disability level, according to the preference weight assigned to each. Other diagnoses or disease-sequela pairs were then mapped to disability levels by comparison with the indicator conditions (by a multinational expert panel –see Murray, 1996: page 41). From this, prevalences of the seven levels of disability were calculated by summing the prevalences of conditions at each level of disability.

Prevalences were calculated by age band, sex, and each of eight country groupings. These were based on World Bank groups which were reasonably homogeneous demographically and economically (see Box 1, following page). Published prevalences are not cumulative, and were calculated without regard for multiple pathologies or co-morbidities (that is, it is possible for a given individual to fall within more than one disability level if they have more than one diagnosis).

**Box 1. Global Burden of Disease (1990)
country groupings (Murray & Lopez, 1996a)**

1. Established Market Economies
2. Former Socialist Economies of Europe
3. Sub-Saharan Africa
4. Latin America and Caribbean
5. Middle Eastern Crescent
6. China
7. India
8. Other Asia and Islands

The Global Burden of Disease study is being updated and improved for the year 2000 estimates, as follows:

- The country groupings have been changed (to reflect WHO rather than World Bank regions).
- The list of disease-sequela pairs has been revised.
- A 'disability' classification with six domains is being introduced –moving around, self care, work/household activities, pain/discomfort, distress/sadness/worry, and memory and concentration (note that these include items in both 'activity limitation' and 'impairment' domains of the *International Classification of Functioning, Disability and Health*).
- More information on severity of disability, and concentration on the *distribution* of disabilities associated with each diagnosis or sequela.
- The range of age groups has been extended.
- The issue of co-morbidity is being addressed.
- The disability scoring methods are being refined.
- The work is being linked to population-based surveys of health states.

2.2 Relationship between disability level and care needs

The GBD 1990 disability prevalences are based on disability scores or ‘preference-weights’ –that is an estimate of the value or worth of each level of disability (Murray, 1996; Murray & Lopez, 1997). These quantify societal preferences for health states in relation to the societal ‘ideal’ of optimal health. We have assumed, for the purpose of our estimates, that there would be an approximate relationship between these levels and the need for care.

The description of each indicator condition used in the disability scoring exercise was examined, and a judgement made as to the level of care required. The disability scores associated with these conditions were then mapped back to the classification of disability levels, to determine which level they represented.

To verify this assumption, we have surveyed a group of 20 health professionals from around the world, working in a British National Health Service hospital. A questionnaire was prepared, listing the 22 indicator conditions used to derive the disability preference weights.

Participants were asked to decide whether an adult patient with the condition described would require human help for personal, domestic, or health needs, beyond that which would be expected for a healthy adult. They were asked to indicate whether such help would be needed daily, more than once a week but less than daily, or less than once a week, or not at all. Two experts in learning disabilities (mental handicap), a senior doctor and a senior nurse, were also consulted about the two indicator conditions describing learning disabilities.

2.3 Statistical methods

We regrouped United Nations population data to match the age ranges used in the GBD disability prevalence estimates for the year 2000. In addition, we used medium-fertility population projections for the years 2010, 2020, 2030, 2040, and 2050.

We have assumed stable disability prevalences, and that disability prevalences calculated for each country group apply uniformly to each country within that group. Using these, we have calculated prevalences for the two disability levels needing daily care (levels 6 and 7) combined. Box 2, on the following page, gives a full list of assumptions. The validity and limits of these assumptions are discussed in Part 4, pages 17–30.

Box 2. List of assumptions made in calculating current and future need for care

- Age-, sex-, and country group-specific disability prevalences calculated by the GBD study are valid.
- Disabling conditions occur together in a given individual no more often than would occur by chance.
- Need for daily care can be predicted from disability level.
- Need for daily care at a given level of disability is the same between cultures and countries.
- Age- and sex-specific disability prevalences calculated in the GBD study for each country group apply uniformly to each country within that group.
- Age- and sex-specific disability prevalences will be constant over the next 50 years.
- UN medium-fertility population projections are accurate.

The prevalences of the two levels were combined on the basis of simple probability. The published prevalence was taken as the probability that a given individual would fall into that group. We excluded those who would, by chance, have fallen into both of the levels needing daily care.

Therefore, the probability of being in either disability level 6 or level 7 is the probability of level 6 plus the probability of level 7 minus the probability of both. We have included severely disabled children.

We have performed a sensitivity analysis, which can be taken as representing a 'worst case scenario'. In this analysis, we have estimated and projected the numbers of people with disability levels 5, 6 and 7. These were combined in the same way as for levels 6 and 7 together.

Results have been calculated by country and country grouping. They are presented as:

- absolute numbers;
- proportion of the total population;
- proportion of the population aged 15-59 years (broadly the 'working age' population) –this represents a modified 'dependency ratio'.

In demography, the 'dependency ratio' is the sum of children and elderly people divided by the working-age population. Many caregivers will be over the age of 60 (for example spouses of dependent elderly people, or parents of learning disabled adults), or in some cases will be children.

This demographic index, however, gives a standardized measure of the call of the dependent population on the available labour force, for both informal and professional care. As such, changes in this figure may better reflect the wider social impact of increasing dependency, than the crude proportion of the population who are dependent.

3

Findings

3.1 Relationship between need for care and disability level

Median responses to the survey of health professionals are reported in Appendix 1. All the indicator conditions in disability classes 6 or 7 were considered to require care more often than daily. Two of the three disability class 5 indicator conditions were also rated as requiring daily care.

For our main analyses, we have restricted consideration to disability classes 6 and 7 but have included class 5 in addition as a sensitivity analysis.

3.2 Prevalence of disabling conditions requiring daily care

Estimates of numbers requiring daily care by country group, age, and year are given in Appendix 2. Corresponding prevalences in the sensitivity analysis, incorporating the more liberal criterion for requiring daily care (disability severity category 5, 6 or 7), are given in Appendix 3. Estimates for individual countries are available on the World Health Organization web site at http://www.who.int/ncd/long_term_care/index.htm. http://www.who.int/ncd/long_term_care/long_term_care_publications.htm.

The baseline position in 2000 is of a dependent population (on the more restrictive definition, disability levels 6 and 7), which comprises 4-5% of the total population, or 7-8% of the working adult population ('dependency ratio'). These results are remarkably consistent across country groupings. The exception is sub-Saharan Africa, where the baseline 'dependency ratio' is 10%.

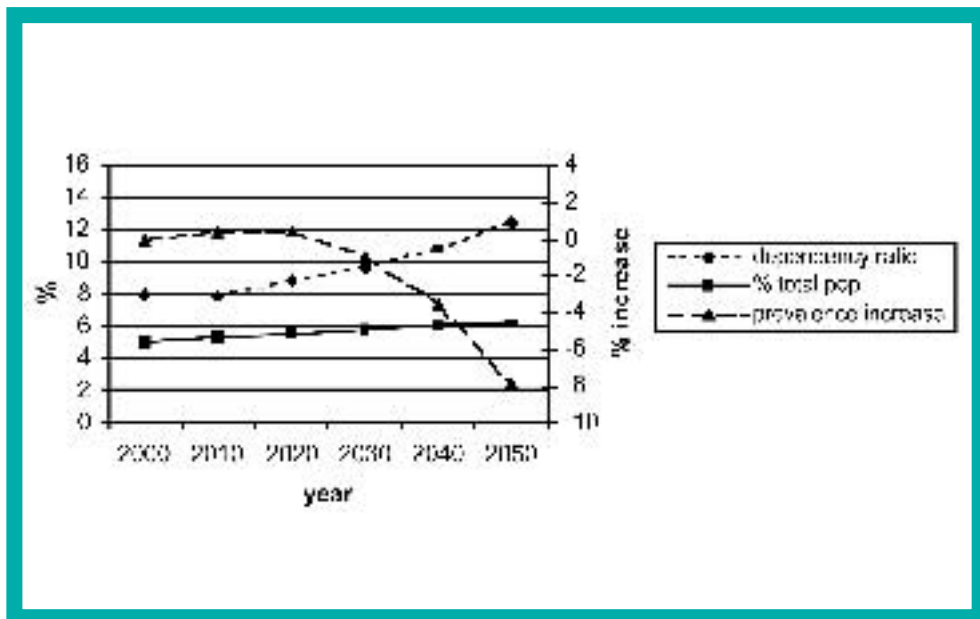
Figures 1-8. Illustration by region of changes in prevalence of people requiring daily care (compared with year 2000), proportion of the total population requiring care, and dependency ratio. Dependency ratio is the number of dependent people divided by the total population aged 15-59 years. Dependency ratio and proportion of total population refer to the left hand scale. Change in prevalence of people requiring daily care refers to the right hand scale.

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There are four main patterns of change predicted over the next 50 years. The first group comprises the Former Socialist Economies of Europe. In these countries a mature population structure, with low and still declining fertility, combined with poor survival into old age, will give rise to a decline in the numbers of dependent people. This reduction is as much as 36% (Estonia), 32% (Bulgaria) and 25% (Ukraine) by 2050.

However, decreases in the 'working' population (aged 15-59 years) over the same period mean that the 'dependency ratio' will increase from 8% to over 12%. The 'dependency ratio' will reach 17% in Armenia. A similar pattern is seen in some Western European countries with low fertility and high life expectancy, such as Italy and Spain, where dependency prevalence is static, but 'dependency ratios' will reach 13%.

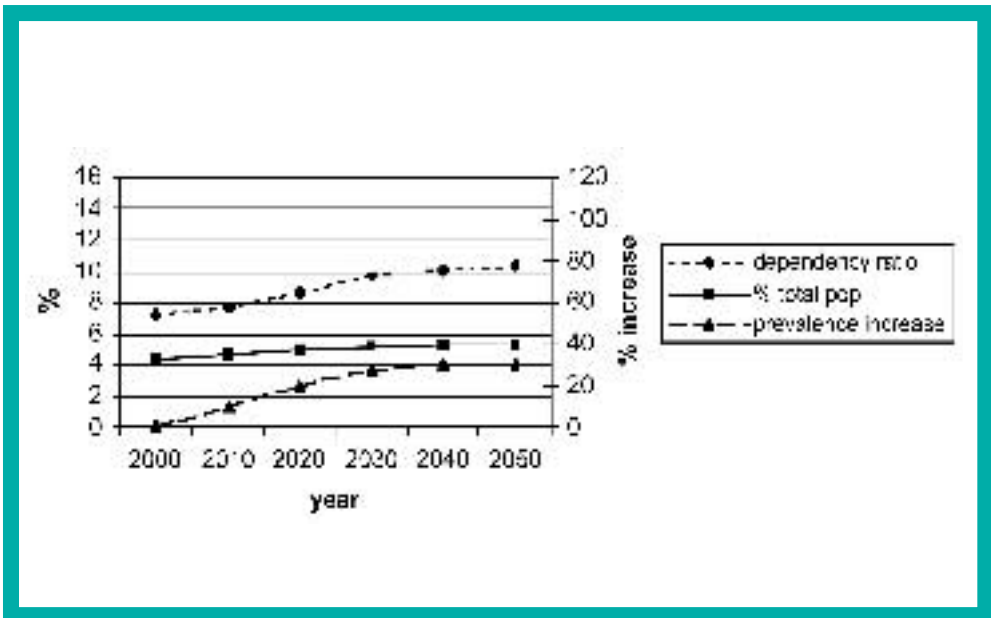
Figure 1: Former Socialist Economies of Europe



The second group is the Established Market Economies. Increasing life expectancy, and the ageing of the 'baby boom' generation born after the Second World War will cause modest increases (on average 31%) in the numbers of dependent people up to 2040, declining thereafter in some countries corresponding to the decrease in fertility in the 1970s and 1980s.

The increases are generally smaller in Europe and Japan (0-20%), and larger in North America and Australasia (about 60%). 'Dependency ratios' will increase from 7% to about 10%, however, and will reach 13% in Japan.

Figure 2: Established Market Economies



The third group is China and India. These countries will experience large increases in the prevalence of dependency to 2050 (70-120%). More striking is the increase in 'dependency ratios' –from 8% to 14% in China (16-17% in Hong Kong and Macau), and from 9% to over 12% in India.

Figure 3: China

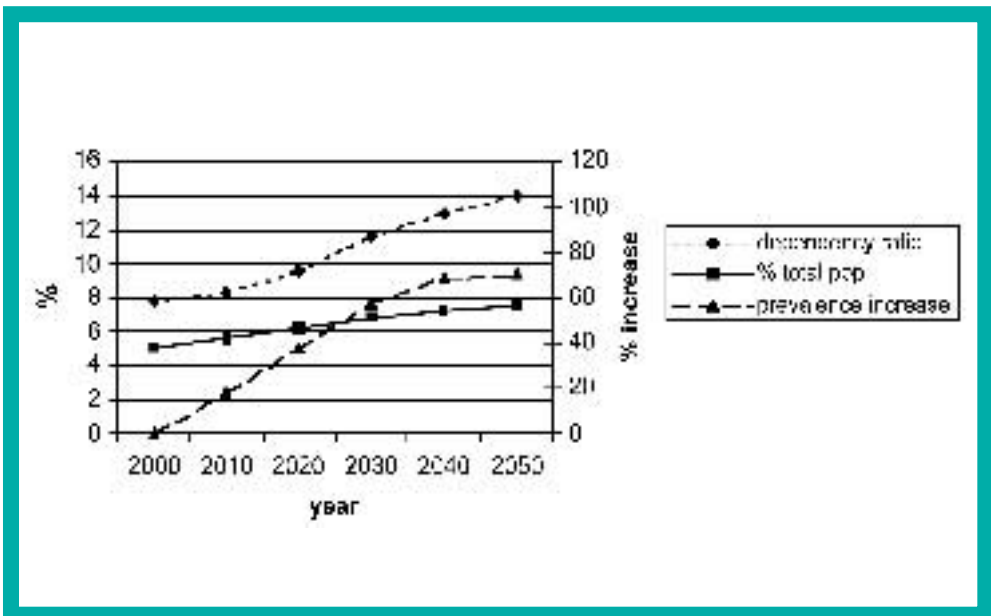
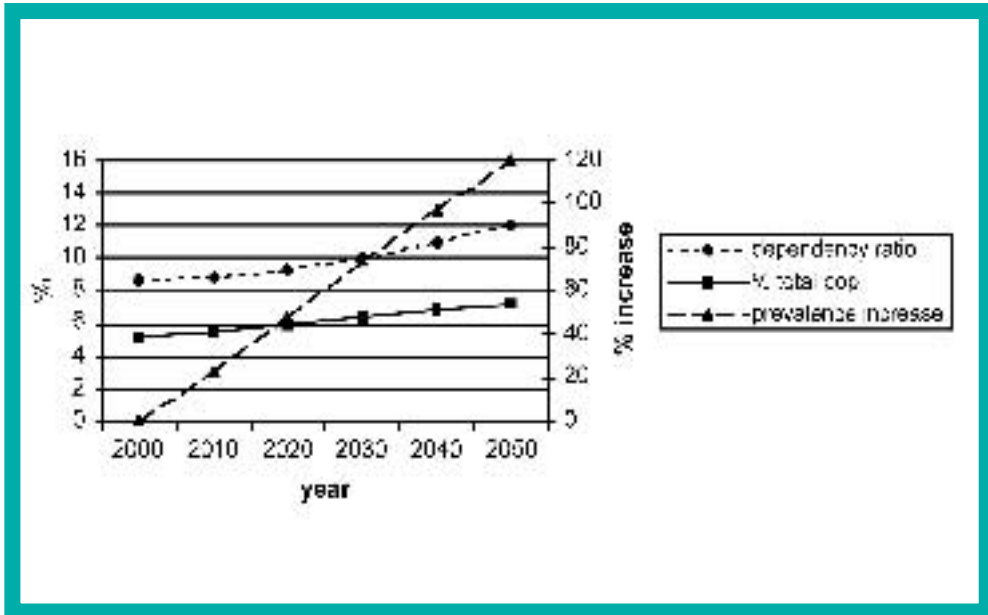


Figure 4: India



The final group is Latin America and the Caribbean, the Middle Eastern Crescent, sub-Saharan Africa, and 'Other Asia and Islands'.

Figure 5: Latin America and the Caribbean

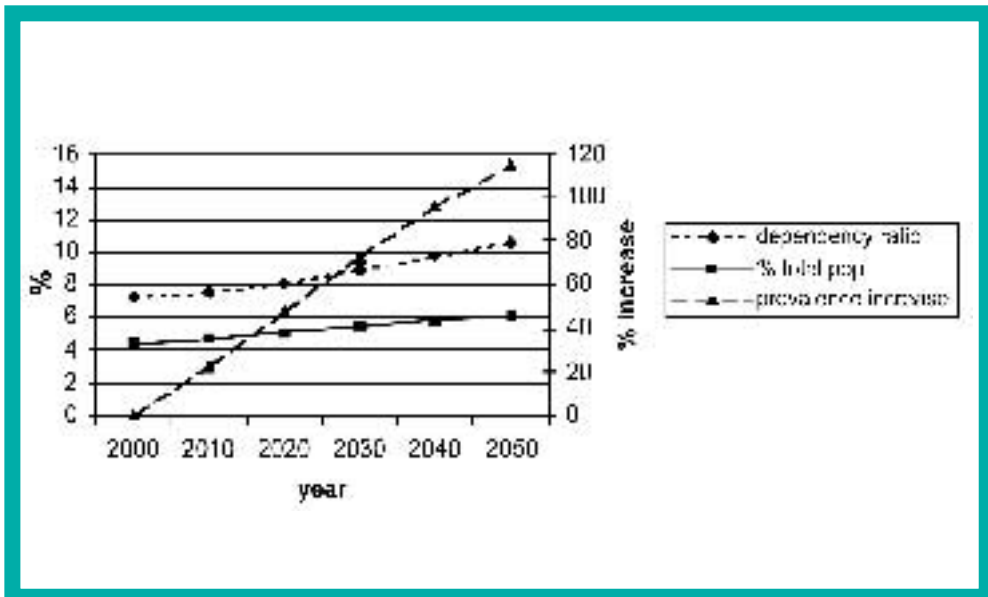


Figure 6: Middle Eastern Crescent

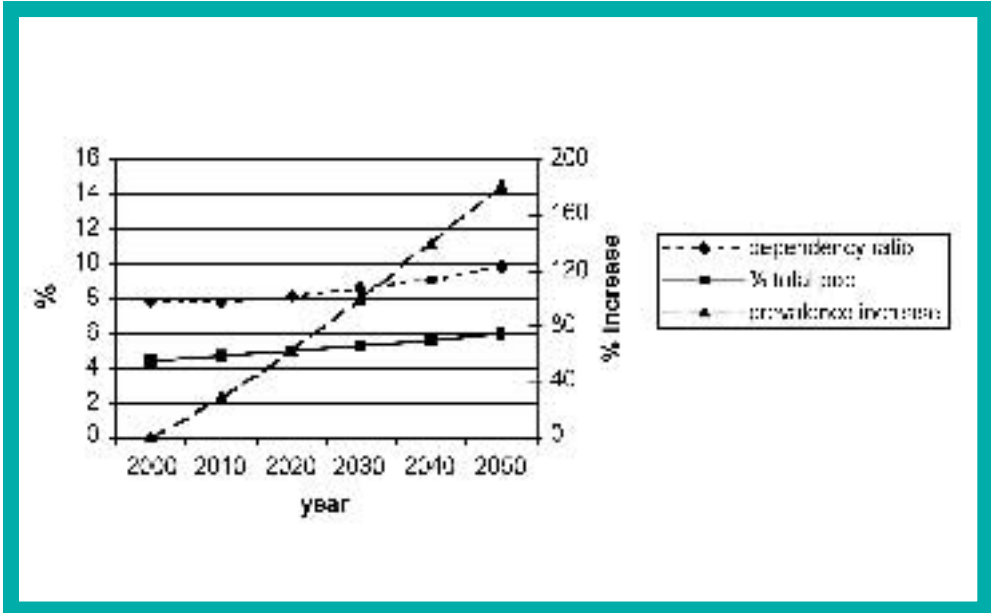


Figure 7: Sub-Saharan Africa

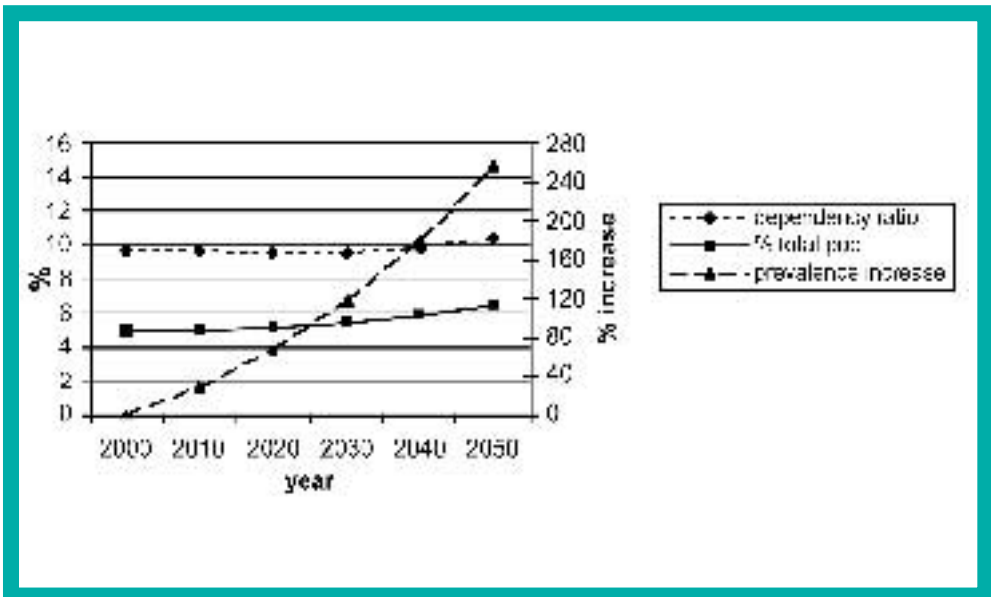
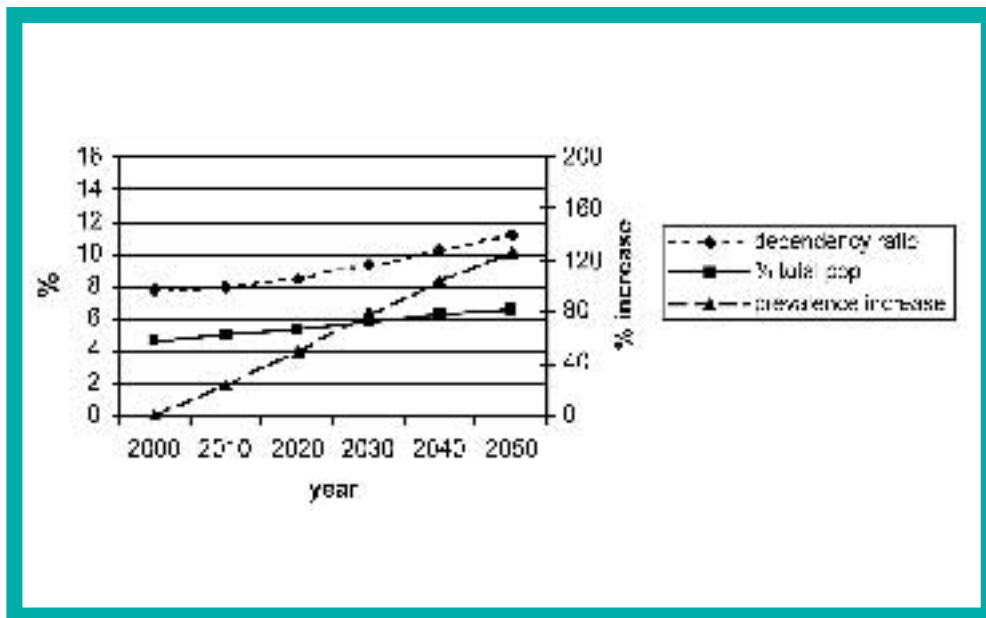


Figure 8: Other Asia and Islands



These countries will experience very large increases in absolute numbers of dependent people (on average 115–257% by country grouping). Somalia, Uganda, Democratic Republic of the Congo, Burkina Faso, Liberia, Niger and Palestinian Occupied Territories will experience increases of over 400% (that is, a fivefold increase). The increase in Yemen will be 581%. However, the whole population in these countries is increasing.

Increases in the ‘dependency ratio’ will be more modest (from 7–10% to 10–11%). The Yemeni ‘dependency ratio’ will remain static at 7.5%. However some countries, such as Cuba and Singapore, will see large increases in ‘dependency ratio’.

The sensitivity analysis, which included all people in disability classes 5, 6, and 7, increases the prevalence estimates and ‘dependency ratios’ by approximately 50%. If these more liberal estimates are correct, then by 2050 in China there will be one person requiring daily help for every five members of the working population.

4

Discussion

4.1 Approximating assumptions

The estimates presented make the following five main assumptions.

4.1.1 Population projections

These are likely to be the most accurate of the data used. Population projection is a well-established discipline. The majority of people who will become disabled over the next 50 years are already born. Projections are driven mainly by expectations of age-specific mortality, which is likely to change relatively slowly compared with fertility rates. The United Nations population projections give high, medium, low, and constant fertility rate estimates, which could be used in further sensitivity analyses if desired.

A potentially greater problem with the population data is the use by GBD of an upper age category of 60+ years. In economically developed countries this group splits into at least three distinct groups. These are the 'young old' (60–70 years), who are generally healthy, the 'middle old', and the 'old old' (>85 years) who often have little physical reserve even when healthy and suffer a high burden of disabling diseases. Stroke, dementia, and hip fracture incidence all increase exponentially with age, and are very common in people over 85 years of age. Consequently, changes in age structure within the '60+' age group (for example, an increasing proportion of the 'old old') could have important effects on overall disability prevalence.

A further source of uncertainty is the future course of the HIV epidemic, which introduces more instability into expectations of mortality than occurs for most diseases. Large scale socioeconomic instability may also increase mortality rates –as seen in the former Soviet Union, where adult mortality increased rapidly after 1984 (Leon et al., 1997).

4.1.2 Validity of disability prevalence rates

The validity of the Global Burden of Disease study disability prevalence rates is open to some question. The GBD project is wide ranging and based on data of varying quality, and is being refined and improved over time.

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The GBD 1990 study catalogues the prevalence, by age group and country, of 483 diagnoses or diagnosis-sequela pairings. The coverage of noncommunicable diseases and their consequences is very variable. For example, five different complications of diabetes mellitus are listed, but there is only one category each for stroke and fractured neck of femur.

Many diseases, such as these, can give rise to disabilities with a wide range of severities, from independence to complete dependency. In the current study we used a single 'average' severity weight, which is both open to error, and probably insensitive to the effects of health care interventions. Furthermore, disabling diseases tend to cluster together, so more than one will often occur in any given person.

Clinically and conceptually it is not usual practice to infer disability from diagnoses (WHO, 1980; WHO, 2001). Disabilities at the person level are limitations or abnormalities in the performance of tasks or actions. They are identified and assessed in their own right –and in some cases may only subsequently be explained in terms of pathology, or may never be adequately explained at all. Such activity limitation depends on a number of factors.

- The type, location, and severity of the pathological process. Examples include extent of amputation in peripheral vascular disease, intensity of inflammation in rheumatoid arthritis, and number and location of lesions in neurological disease.
- Pre-morbid abilities, physiological reserve, and psychological adaptability provide an important substrate on which the effects of disabling diseases are seen. Clearly the impact of a disease on ability will be less in a fit and strong individual, compared with someone weaker and less able.
- Disability depends on the sum of pathological and psychological processes in a given individual, which often do not occur in isolation.
- Cultural, and age- and gender-defined factors contribute to what people can do, or in fact habitually do.
- Rehabilitation, and environmental and social modification, aim at minimizing the effects of the disability on an individual's participation –regardless of whether impairments or activity limitations are remediable.

An almost infinite number of activity limitations can be defined –one for each task or activity that humans undertake. These can be classified into a dozen or more different domains or dimensions such as mobility, reaching and stretching, manual dexterity, continence, personal care, behaviour, vision, hearing, and intellectual tasks (WHO, 2001). There have been many attempts to define global scales of disability severity. Community surveys often report the prevalence of disability levels, defined in various ways, as well as individual disability prevalences.

The reason for adopting the unusual step of inferring disabilities from diagnoses in the GBD project is that population surveys of disability are limited in availability. Some national surveys have been undertaken (e.g. Australian Institute of Health and Welfare, 1999; Martin et al., 1988), but world coverage is not comprehensive. Furthermore, the definitions of various types of disability usually differ between surveys, making direct comparisons difficult.

Despite this difficulty, information about disability is very important. Often, what individuals can and cannot do in their everyday lives is more important to them than the exact reason for their limited abilities. Disability may bring limitation in educational and employment opportunities, difficulties with domestic, family and social life, and problems in participating fully as a citizen.

Disability may also lead to a need for personal help in basic activities of daily living, for adaptations to the physical environment, and for health services to cure, palliate, or remediate problems and to prevent deterioration, or development of complications. In the fields of health policy and health economics, such measures of health status as disability can be used to assess the outcomes of health care intervention or the performance of a whole health care system.

The GBD 1990 study therefore attempted to estimate the prevalence of disabilities of different severities from the prevalence of diagnoses, on the basis of published work, or –where this was lacking –expert opinion. The intention was that these estimates would be replaced with directly measured prevalences as and when data were available.

Only very limited data were available on co-morbidity, and this was incorporated into the disease-sequela pairings (for example, tuberculosis with or without HIV infection). The published table of disability prevalences is therefore non-cumulative –it is possible for an individual to appear more than once in the table under different levels of severity if they have several different diseases.

A further criticism of the process of determining disability levels is that all the ratings were made by professionals, rather than by including the views of people who themselves had disabilities. It is unclear if this will have affected the final ratings made.

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The GBD 1990 estimates have the virtue of comprehensiveness, and at least some grounding in disease prevalence. However, they are very much approximations, and are subject to very clear limitations in the way they were compiled. We would expect there to be considerable error in any estimates secondarily derived from them.

4.1.3 Homogeneity of country groupings

Disability prevalence rates are assumed to be similar among different countries in the eight country groupings. This is not the case. For example, stroke incidence varies at least threefold among European countries, and hip fracture rates vary at least twofold (Ebrahim & Kalache, 1996).

However, the assumption is probably reasonable for the purposes of making broad estimates for most of the groups, such as Established Market Economies, Former Socialist Countries of Europe, sub-Saharan Africa, and Latin America. The main exception, in which there is likely to be considerable heterogeneity, is the 'Other Asia and Islands' group, which ranges from relatively well-developed economies and health systems, such as Hong Kong and Singapore, to much less developed countries such as Mongolia, Bangladesh, and Viet Nam.

4.1.4 Stability of disability prevalence rates

The disability prevalence rates are assumed to be stable over the next fifty years. This approach has also been used by others in making future projections of disability prevalence and the need for care services (Australian Institute of Health and Welfare, 2001: page 203).

The great hope for 'successful ageing' is that there will be increasing 'compression of morbidity' as time goes by (Fries, 1980). It is hoped that through disease prevention programmes, healthier lifestyles, improving social and economic conditions, and better health care and rehabilitation, the period between the onset of disability and death will be shortened or 'compressed'.

There are good reasons to believe that many disabling diseases can be prevented or deferred. There are large differences in disease occurrence among different countries; among regions within countries; with time (secular trends); and within populations according to personal risk factors, including socioeconomic status. Studies of migrants show that they acquire the same risk as the indigenous population for some diseases, often within one generation (Ebrahim & Kalache, 1996).

Finally, some intervention studies have reduced the incidence of disabling disease in 'experimental' situations. These include lowering of blood pressure to prevent stroke (Collins et al., 1990), calcium and vitamin D supplementation to prevent hip fracture (Chapuy et al., 1992), cholesterol reduction to prevent ischaemic heart disease (Shepherd et al., 1995), and organized stroke rehabilitation to prevent disability and institutionalization (Stroke Unit Trialists' Collaboration, 1997).

Already, in many parts of the world, the disabling consequences of poliomyelitis and neurological sequelae of measles have been prevented by vaccination. Secular trends for ischaemic heart disease, stroke, and some cancers have been downward over past decades.

However, age-specific incidence of hip fracture is increasing in Europe. Smoking-related diseases are likely to decrease in countries where the prevalence of smoking has decreased. However, the prevalence of smoking has risen in many developing countries, and they can expect a rapid increase in such diseases (chronic obstructive pulmonary disease, lung cancer, and ischaemic heart disease).

HIV infection is producing a major burden of disability in countries where it is very prevalent, as well as killing many adults who would have taken on care giving roles. Age-specific prevalence of dementia and schizophrenia shows no sign of significant change, and since our understanding of the etiology of these diseases is poor, there are currently poor prospects for prevention. This is also true for other common age-related conditions such as osteoarthritis, cataract, and macular degeneration.

The evidence of whether compression of morbidity is actually occurring in economically developed societies is mixed, but still hopeful. In the United States National Long Term Care surveys, age-standardized proportions of people over 65 unable to perform at least one basic activity of daily living (ADL) declined 3.6% over 12 years. Decreases were seen in each age stratum examined, and for each severity level of disability (Manton et al., 1997).

Other studies have failed to confirm this, however (Australian Institute of Health and Welfare, 1999 and 2001; Crimmins et al., 1997). Extending any compression of morbidity to the rest of the world community will be a major challenge in the light of social, economic, and health care inequalities. Modelling such changes using currently available data would be extremely difficult or impossible – to attempt this, the collection of prospective, longitudinal disability data over the next few decades is required.

4.1.5 Translation between disability level and need for care

Most healthy adults have the capability to live lives which are independent of direct human help – in the short term at least – should the need arise. In the face of disability, however, they may become unable to undertake tasks which are necessary for biological or social survival. These include obtaining, preparing, and consuming food and drink; remaining safe from falls and other injuries, fire, and attack; keeping clean, warm, and dressed; and maintaining a clean and safe dwelling.

If a person is unable to undertake these tasks, we may reasonably consider that he or she needs help beyond that which would normally be expected. Moreover, there should be reasonable correspondence between tasks which must be undertaken in various societies and countries.

‘Need for caregiving’ defines ‘dependency’. Quantifying dependency is complicated. There is little agreement over exactly which tasks should be considered as ‘necessary’ –especially when considering social and leisure activities, other volitional activities, and complex tasks like shopping and managing money. Such tasks may vary among countries and societies.

One method of quantifying the intensity of need for help is to define the length of time during which a person can manage without human assistance –the so-called ‘interval of need’ (Isaacs & Neville, 1979). ‘Long interval’ needs are those which must be provided less than once a day (e.g. shopping, or money management). ‘Short interval’ needs are those required daily (e.g. preparing meals). ‘Critical interval’ needs are those required unpredictably throughout the day (such as the need for help going to the toilet). People who need help all the time (such as supervision of someone with dementia who falls or wanders) are sometimes included in an additional category of ‘intensive care needs’.

There is a normative element to assessments of dependency. We are all dependent (or interdependent) to some extent. In complex societies, many of the necessities of daily life (food, electricity, water) are available only through the work and actions of others. We also need others to provide for social and emotional support. We may not routinely undertake some domestic activities (if there is division of tasks within families or paid help).

It is not easy to define in absolute terms what constitutes ‘normal’ and ‘abnormal’ dependency (Wilkin, 1987). The importance of this distinction is illustrated by the American Longitudinal Study on Aging. ‘Disability’ was defined by “needing or getting personal assistance” with a basic ADL task. Including respondents who said they received assistance but had the capacity to perform the task themselves, increased prevalence estimates by 83% (Crimmins et al., 1997).

Some studies have examined the relationship between disability (activity limitation) and need for care. One, from New Zealand, compared observed weekly hours of care (from all sources) required, with scores on the Functional Independence Measure, and the Edinburgh Rehabilitation Status Scale. The association overall was only moderately strong (correlation coefficient about 0.4). This was weakened by cases in which supervision was required because of blindness or cognitive problems. If these were excluded, a strong relationship emerged for the remaining cases (Disler et al., 1993).

The 1998 Australian Bureau of Statistics survey ascertained care received in relation to disability level. Of 961 600 people with a 'profound or severe core activity restriction' living at home, the vast majority (958 000) required assistance. At least 60% of these would have required daily care (judged by the type of restrictions described) (Australian Institute of Health and Welfare, 2001: Table 7.2). In addition, 210 000 Australians in institutional care can all be assumed to require daily care.

The United Kingdom Medical Research Council Cognitive Function and Ageing Study (MRC CFAS) is a cohort study of 10 377 people aged over 65 years in four English towns. Disability (activity limitation) was measured using the Townsend activities of daily living scale. Care received was ascertained by interview. Of the 'severely disabled' group, 3% were independent, 14% needed help less often than daily, 62% needed help at least daily, and 21% needed continuous supervision. In this study, therefore, the great majority of very disabled people received daily care. Professional caregivers were the sole source of help in 25% of cases, supplemented with informal care in a further 10%, leaving 65% of care provided by informal caregivers alone (MRC CFAS, 1999).

A study of 5000 people over the age of 65 from Scotland also compared dependency and disability (activity limitation) levels (measured using the Townsend activities of daily living scale). There was reasonable correspondence. None of the independent participants was in the Townsend 'severe incapacity' group, most of whom had short or critical interval dependency. However, the sensitivity of the Townsend score for detecting dependency was compromised where mental health problems gave rise to need for help. Over half of this group had low Townsend scores. Even among those with critical interval needs for non-physical reasons, 20% were in the minor or no incapacity groups –suggesting that estimates of need for care based on ADL criteria alone would be too low (Bond & Carstairs, 1982).

In the GBD 1990 study, disabilities were grouped based on preference-weight scores (or 'utilities' –a measure of the value, worth, or desirability of a health state). Ideally, need for care should be determined by direct ascertainment. In the absence of such data, we can make estimates based on disability (activity limitation).

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To estimate the need for care, we need data on *severity* of disability –for example, a measure of the extent of limitation in performance of a task, or of the difficulty of the tasks that can or cannot be performed. This is conceptually different from the *desirability* of being able to perform the task, which includes elements of the value of the activity to the individual, and the stigma or other disadvantage associated with not being able to perform it, as well as disability severity. Utility weighting has its roots in health economics, whereas severity assessment is more clinically orientated. In general terms, it is not unreasonable to assume that there will be a fairly close relationship between severity and desirability, but this assumption does add a further level of approximation to an already approximate process.

For this report, we did not have data on the prevalence of inability to perform specific tasks. Instead, we used the disability levels defined by the GBD study. We therefore had to judge which levels were likely to be associated with need for daily help. To do this, we used the 22 sample ‘indicator conditions’ (which had been used to measure the preference weights that defined the disability levels in the GBD study). For each condition we made a judgement on the likely care needs of an adult with the condition. In many cases, this was uncontentious.

To validate our judgement, we surveyed a small convenience sample of health professionals from around the world, who were all working in one British hospital. This exercise had some clear limitations –the sample was limited, and despite wide geographical origins was working in adult medicine and rehabilitation in one place only. The main problems encountered were lack of precision in defining the conditions (e.g. ‘an average individual with Down syndrome’) and lack of experience with some conditions (including learning disabilities/mental handicap and where the condition was contrived for the sake of the valuation exercise, such as ‘continuous sore throat’). There was some variation in interpretation as to what constituted a daily need (for example, does a person with infertility problems have psychological needs beyond those of a fertile person?).

However, a reasonable consensus was achieved. In our main analysis we considered that people will need daily care with diseases at the severe end of the disability spectrum, including blindness, active psychosis, severe dementia, paraplegia and quadriplegia, severe constant pain, and severe depression. Conditions not included were mild mental retardation, below knee amputation with crutches but without a prosthesis, deafness, or angina on walking 50 metres. Our estimates are therefore likely to be conservative (i.e. low). The sensitivity analysis (which included the top three levels of disability severity as a ‘worst case scenario’) gives estimates which probably include the great majority of people requiring daily help, as well as a few who probably do not.

4.2 Disabled children and young people

In attempting to estimate the number of people requiring daily care, a problem occurs in the consideration of children and young people up to the age of 14. Very young children (0-4 years) routinely require close supervision and considerable help with basic activities of daily living (one might say they have 'intensive care' or 'critical interval' needs). Older children become progressively more independent, but generally require daily help with some aspects of their lives. On this basis one might consider that all children have daily care needs, or that none of them do (since it is 'normal' to need this level of care).

Provision for very disabled children is more complicated however. Such children will often have considerable additional needs above those of healthy children. Providing for these needs will decrease availability of care for other children and dependent adults, and of paid employment. Since all the figures are approximate, and the numbers involved are relatively small compared with those of older adults, for the sake of simplicity we have included disabled children on the same basis as adults.

4.3 Empirical validation of estimates

We have identified a few studies which have compared care needs with measured disability.

The United Kingdom Cognitive Function and Ageing Study (CFAS) measured disability (activity limitation) using the Townsend activities of daily living scale (nine items rated for difficulty in performance). Prevalence of severe disability (based on an arbitrary cut-off point on the scale) was 10.6% for men and 19.2% for women. This corresponded to 1.3 million disabled elderly people in England and Wales. As discussed above, this study also measured care needs directly. The great majority of people in the 'severe disability' category received daily care. For the United Kingdom as a whole, we can estimate about 1.3 million people over the age of 65 require daily care (MRC CFAS, 1999).

The estimates from the GBD study for people over the age of 60 years in Established Market Economies are males 9.8% (disability classes 6 and 7) or 14.8% (disability classes 5, 6 and 7), and females 10.1% (disability classes 6 and 7) or 14.6% (disability classes 5, 6 and 7). Notwithstanding the difference in age range, these estimates are of reasonably similar magnitude, but do not reveal the large difference in prevalence by gender in the observed data. The overall estimate from the GBD data of numbers of people aged over 60 years needing daily care in the United Kingdom for the year 2000 was 1.2 million, a remarkably close approximation to the observed figure in CFAS.

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The 1985 United Kingdom national disability survey defined ten levels of disability (activity limitation). A judgement can be made as to which of these levels might require daily care from typical descriptive scenarios given for each level. People in disability level 7 and above clearly need daily care. Those in level 5 and above do in some cases. The number of people aged over 16 years at level 7 or above in the United Kingdom was 1.46 million, and at level 5 or above 2.7 million. This compares with a total prevalence estimate from the GBD data of 2.6–3.8 million. In this survey the female preponderance was much smaller, except at age 75+, where disability was approximately 50% more prevalent in women (Martin et al., 1988).

A study of 5000 people over 65 from Scotland gave short interval dependency rates of 15% overall; 11.2% men, 17.4% women; 4.6% at age 65–69 rising to 55.3% at 85+ years (Bond & Carstairs, 1982). A smaller and earlier Scottish study of 1035 people over 65, identified short or critical interval needs in 19% of them (Isaacs & Neville, 1979).

A survey of 1273 people over 65 years, 59% female, was undertaken in Leganes, Spain. Dependency in any of seven basic ADLs was 15.5% (bathing, dressing, toileting, transferring, eating, grooming, and walking across a small room –any of which might be expected to give rise to need for daily care) (Béland & Zunzunegui, 1999).

A series of high quality, comprehensive surveys (*Surveys of Disability, Ageing and Carers*) has been undertaken by the Australian Bureau of Statistics, in 1981, 1988, 1993, and 1998. These surveys defined “profound and severe core activity limitation” as “being unable to perform, or always or sometimes needing assistance with the activities”. The activities considered were bathing, showering, dressing, eating, toileting, managing incontinence, transfers, home mobility and using public transport, and communication. Since some of these limitations, in isolation, would not necessarily imply the need for daily care, the prevalence estimates will be an overestimate of people requiring daily care. Prevalence increased from 7.8% (men) and 9.2% (women) at age 65–69 years, to 56% (men) and 69% (women) at age 85+ years. Age-specific prevalence has been more or less stable since 1988, but total prevalence has increased rapidly, 658 000 in 1988, to 795 000 in 1995, to 1 135 900 in 1998. Broad comparability is seen between these empirical figures and the estimates from the GBD dataset (791 000–1.14 million).

Data from three areas of France show similar correspondence to the GBD estimates. Participants from random community samples were classified according to level of confinement, the upper two levels being ‘confined to bed or chair’ and ‘confined to home’. These two levels together comprised 12.4% of the population over 65 –a figure probably comprising most of those requiring daily care, and probably including a few who do not (Leibovici et al., 1995). Again, this compares with estimates of 10–15% for the over 60 year-old population of Established Market Economies from GBD data.

The United States National Long Term Care surveys studied nationally representative samples of the population over 65 years of age. A series of surveys has been conducted in 1982, 1989, and 1994. The last survey showed 17.1% to be disabled in at least one basic ADL, or to be in an institution; 21.3% were disabled in at least one instrumental ADL (e.g. cooking, doing laundry). Inability to perform one ADL rose from 8.4% among those aged 65-74, to 53% in those over 85 (Manton et al., 1997).

Two further United States surveys provide data. However, both exclude the institutional care population –5.2% in 1994 (Manton et al., 1997). The National Health Interview Survey is an all-age repeated cross-sectional sample survey. It includes questions about need for help with personal care (such as “eating, bathing, or getting around the house”). Of those over 70 years, 6.4-8.5% were dependent between 1982 and 1993, with no clear trend over time. The Longitudinal Study on Aging gives a rate of ADL limitation of 9.2% of the non-institutionalized population over 76 years of age (Crimmins et al., 1997).

These results are summarized in Table 1. None is directly comparable with the estimates made in this report:

- The age ranges considered are different in most cases. We would expect our percentage prevalence estimates to be lower than those in the reported studies.
- The structure of the ‘elderly’ population has been changing over the time during which observations have been made, with increases in the proportion of very elderly.
- Different ways of defining disability, and different thresholds for inclusion are used. The empirical evidence suggests that ADL-based data may underestimate need for care because it does not give due weight to cognitive and vision problems.
- Some reports excluded institutional residents.
- Failure in one basic ADL alone may not indicate a need for daily care (e.g. bathing).

The most comparable studies are from England (MRC CFAS, 1999) and Australia (Australian Institute of Health and Welfare, 2001). Importantly, these studies examined the assumption that severe disability requires daily care (but not that lack of severe disability did not require care). The estimates in MRC CFAS were very close.

Table 1. Empirical validation of estimates made from the GBD study

Country, year	Group	Observed prevalence of people needing daily care	Estimate for 2000 from GBD study (disability levels 6 & 7)	Estimate for 2000 from GBD study (disability levels 5,6 & 7)
England, 1995	Baseline of cohort >65y, 'severe disability' in ADL	1 300 000	1 200 000	1 802 000
United Kingdom, 1985	National survey, disability levels 7-10 and 5-10	1.5-2.7 million	2.6 million	3.8 million
Scotland, 1982	Survey >65y, need daily care	15%	10%	14.7%
Scotland, 1979	Survey >65y, need daily care	19%	10%	14.7%

Country, year	Group	Observed prevalence of people needing daily care	Estimate for 2000 from GBD study (disability levels 6 & 7)	Estimate for 2000 from GBD study (disability levels 5,6 & 7)
Australia, 1998	Population survey, 'profound or severe activity limitation'	1 135 900 (>65y: 20%)	791 000 (>60y: 10%)	1 143 700 (>60y: 14.7%)
Spain, 1993	Survey >65y, any of 7 ADLs	15.5%	10% (>60y)	14.7% (>60y)
France, 1982-86	Survey >65y, confined to home or worse	12.4%	10% (>60y)	14.7% (>60y)
USA, 1994	Survey >65y, any of 6 ADLs	17.1%	10% (>60y)	14.7% (>60y)
USA, 1991-93	Survey >70y, dependent in personal care *	11.6-13.7%	10% (>60y)	14.7% (>60y)

* adjusted to include those in institutional care.

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The Australian study suggests that our main estimates (disability levels 6 and 7) are too low, but that those in the sensitivity analysis (levels 5, 6 and 7) are closer. Most of the other studies (confined to elderly populations) suggest that our estimates are about right, especially given the different methods used.

The Australian study has made future projections similar to ours, based on changes in the population structure. However, they had data on age-specific disability prevalence for many more age strata over 60 years of age. Hence, their projections take better account of future changes in the age structure of the elderly population (i.e. the increasing proportion of very elderly people). This should lead to an underestimate in prevalence of disability in future years when using GBD data.

The extent to which this is the case can be seen in Table 2. The Australian category of ‘profound or severe core activity limitation’ is most closely comparable with the lesser degree of disability used in our sensitivity analysis. The estimates for 2000 differ by only 4%. By 2030 the underestimate is 14%.

Table 2
Projections of future prevalence of severe disability in Australia made by the Australian Institute of Health and Welfare (2001) compared with estimates based on GBD data

	Prevalence (thousands) by year			
	2000	2010/11	2020/21	2030/31
AIHW	1189.5	1438.7	1670.9	1983.8
GBD data, main analysis (levels 6 & 7)	791.0	924.8	1060.6	1175.4
GBD data, sensitivity analysis (levels 5, 6 & 7)	1143.7	1338.3	1537.5	1706.1

We have no validation data from outside the Established Market Economies. A United Nations disability data assembly project (DISTAT and DISTAT-2) has very wide coverage, often from national censuses. However, disability definitions are too vague to make these figures useful for our purposes (Chamie, 1989; United Nations, 2001).

5

Recommendations for future work

5.1

It may be possible to circumvent some of the potential criticisms of the methodology used for this report by taking advantage of improvements made in the ongoing updates of the GBD dataset. It may be possible to assign a care need level based on severity of limitation in particular domains of health.

5.2

There are a number of high quality national disability surveys, some of which may have included caregiver needs. We believe that these are too patchy in their availability (mainly, but not exclusively, Established Market Economies), and too diverse in their data collection (definitions etc.) to be of direct use in the current report. However, it would be possible to catalogue and re-examine these, and they may be of use in validating or calibrating the estimates made using GBD data.

5.3

There is a need for systematic collection of population-based information on health status and care needs, which should be repeated over time using comparable methods, to allow modelling of trends and to make predictions for the future. Data from health surveys should include disability questions, using standardized definitions (WHO, 2001). Direct questions should be asked about caregiving needs and care received. The WHO World Health Survey may help meet this need.

6

Conclusions

We have estimated the number of people with severe chronic conditions and disabilities in the world, who are in need of daily caregiving, using disability prevalence data from the GBD study. These dependent people currently represent 4–5% of the total population. It is vital to acknowledge that all human beings are dependent upon others, and need care for their emotional, physical, and social well-being.

However, most healthy adults have the capability of living lives which are independent of direct human help –in the short term at least. In the face of severe disability, people are often unable to undertake tasks which are necessary for their biological, emotional, and social survival. They need caregiving in addition to the care on which we all depend.

Based on projected changes in population over the next 50 years, the absolute number of functionally dependent people, and the number in proportion to the working population, will increase greatly – particularly in developing countries. Changes in the Established Market Economies and Former Socialist Countries of Europe will be smaller than elsewhere, but ‘dependency ratios’ will still increase. Provision for such developments will require wide-ranging social, health system and economic changes, necessitating government policy initiatives in the near future.

It must be stressed that the figures presented are very approximate. The projections into the future are determined only by how the size and structure of the population is expected to change, and not by any possible changes in disease or disability prevalence (which might be influenced by prevention, cure, or rehabilitation). The figures serve to highlight the potential magnitude of the issue, and the need for more comprehensive data on disability and caregiving, as well as the need to act now. All societies must acknowledge care as a priority human need that they have an obligation to support.

8

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appendices

8

Appendices

Appendix 1
Rating of dependency needs of GBD study indicator conditions by health professionals

Indicator condition	Disability class	Short description	Median dependency rating
1	6	Blind	1
2	2	Severe continuous sore throat	2.5
3	7	Active psychosis	1
4	3	Infertile	3
5	6	Paraplegic	1
6	3	Fracture radius	2
7	5	Mild mental retardation	2
8	5	Down syndrome	1
9	7	Dementia	1
10	4	Below knee amputation	2
11	2	Anaemia	2
12	7	Quadriplegia	1
13	6	Depression	1
14	7	Severe continuous migraine	1
15	4	Deaf	2
16	5	Recto-vaginal fistula	2
17	2	Diarrhoea	2
18	1	Severe thinness	2.5
19	3	Rheumatoid arthritis	2
20	1	Vitiligo	3
21	3	Impotence	3
22	3	Angina walking 50m	2

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Appendix 2: Numbers of people requiring daily care, total population, proportion of total population requiring care, and dependency ratio by region, country and year, based on two severest Global Burden of Disease study disability categories (levels 6 and 7). Estimates for individual countries are available on the WHO web site at: http://www.who.int/ncd/long_term_care/index.htm

Region	Year	Prevalence (thousands) by age in years						Total population (thousands)	Prevalence increase %	Proportion total pop. %	Dependency ratio (%)*
		0-4	5-14	15-44	45-59	60+	Total				
People's Republic of China	2000	1 024.6	1 601.5	29 238.4	13 483.9	19 445.9	64 794.2	1 275 132.9	0	5.1	7.8
	2010	968.1	1 344.1	30 328.0	18 297.9	25 256.0	76 194.1	1 366 214.5	18	5.6	8.3
	2020	964.9	1 344.8	27 308.5	23 246.0	36 398.8	89 263.0	1 446 092.0	38	6.2	9.6
	2030	861.4	1 277.7	26 647.5	20 938.8	52 222.6	101 947.9	1 484 619.4	57	6.9	11.6
	2040	865.3	1 176.7	24 691.2	20 996.8	61 431.3	109 161.3	1 490 465.4	68	7.3	13.0
	2050	815.4	1 174.9	23 676.4	18 826.8	65 974.6	110 468.1	1 462 058.2	70	7.6	14.0
Established Market Economies	2000	149.7	323.5	13 181.0	7 229.6	16 920.1	37 803.9	852 563.7	0	4.4	7.2
	2010	138.0	302.6	12 672.1	8 271.7	20,290.3	41 674.7	885 147.3	10	4.7	7.8
	2020	140.0	287.4	12 048.8	8 456.3	24 421.8	45 354.2	909 116.7	20	5.0	8.6
	2030	142.3	292.8	11 624.5	7 822.8	28 384.8	48 267.2	925 218.1	28	5.2	9.7
	2040	143.4	296.4	11 266.3	7 689.3	29 998.2	49 393.5	929 956.5	31	5.3	10.2
	2050	147.3	300.1	11 200.8	7 404.1	30 364.7	49 417.0	927 884.0	31	5.3	10.4
Latin America & Caribbean	2000	452.3	778.9	12 501.1	3 933.2	5 215.0	22 880.4	518 808.8	0	4.4	7.3
	2010	455.2	787.3	14 177.0	5 518.2	7 126.0	28 063.8	594 312.3	23	4.7	7.5
	2020	451.5	792.0	15 192.4	7 020.9	10 275.1	33 731.9	663 686.9	47	5.1	8.1
	2030	445.8	783.3	15 581.7	8 326.6	14 434.3	39 571.6	723 162.8	73	5.5	8.9
	2040	442.7	775.9	15 669.2	9 069.2	18 894.1	44 851.1	770 550.1	96	5.8	9.8
	2050	441.2	772.7	15 645.5	9 346.2	22 905.3	49 110.9	805 560.5	115	6.1	10.6
Sub-Saharan Africa	2000	1 466.2	2 185.4	16 137.8	5 533.3	6 824.2	32 146.9	650 572.8	0	4.9	9.7
	2010	1 790.2	2 739.5	21 104.7	6 999.4	8 915.3	41 549.1	829 250.0	29	5.0	9.6
	2020	2 040.8	3 334.9	27 631.6	8 988.7	11 840.0	53 836.0	1 041 283.1	67	5.2	9.6
	2030	2 206.1	3 801.8	35 323.5	12 702.1	15 998.9	70 032.4	1 278 660.1	118	5.5	9.6
	2040	2 268.1	4 082.4	43 118.4	18 162.0	22 677.4	90 308.4	1 523 203.7	181	5.9	9.8
	2050	2 240.4	4 205.7	49 774.8	24 787.0	33 873.0	114 881.0	1 760 358.5	257	6.5	10.5

* (total number of dependent people) / (population aged 15-59)

Appendix 2: Continued

Region	Prevalence (thousands) by age in years							Total population (thousands)	Prevalence increase %	Proportion total pop. %	Dependency ratio (%)*
	Year	0-4	5-14	15-44	45-59	60+	Total				
India	2000	1 461.7	3 266.8	25 243.2	9 875.9	11 785.0	51 632.6	1 008 937.4	0	5.1	8.7
	2010	1 418.8	3 348.9	29 738.2	13 518.4	15 534.3	63 558.6	1 164 019.8	23	5.5	8.8
	2020	1 302.1	3 186.8	33 037.6	17 222.1	21 795.9	76 544.6	1 291 289.9	48	5.9	9.2
	2030	1 351.6	3 066.1	34 408.6	20 614.7	30 256.1	89 697.2	1 408 922.6	74	6.4	10.0
	2040	1 304.3	3 126.9	33 900.4	24 278.9	39 369.7	101 980.2	1 503 345.0	98	6.8	11.0
	2050	1 300.8	3 026.4	33 278.5	25 933.7	49 737.7	113 277.0	1 572 054.6	119	7.2	12.1
Former Socialist Countries of Europe	2000	124.3	202.0	6 811.5	3 525.7	6 260.9	16 924.4	338 021.6	0	5.0	7.9
	2010	115.0	135.0	6 384.3	4 157.6	6 194.3	16 986.3	322 334.9	0	5.3	7.9
	2020	107.5	128.1	5 616.3	3 782.7	7 360.0	16 994.6	307 631.1	0	5.5	8.9
	2030	93.2	116.5	4 595.5	4 055.2	7 894.8	16 755.2	290 266.0	-1	5.8	9.7
	2040	93.5	104.2	3 778.4	3 827.2	8 519.3	16 322.6	271 433.5	-4	6.0	10.8
	2050	91.8	106.0	3 480.4	2 699.4	9 203.9	15 581.6	252 218.0	-8	6.2	12.5
Middle Eastern Crescent	2000	818.7	1 310.9	15 089.9	4 744.6	5 340.1	27 304.3	621 618.7	0	4.4	7.8
	2010	907.7	1 409.6	18 854.3	6 938.3	6 997.4	35 107.3	754 947.4	29	4.7	7.8
	2020	986.7	1 562.3	22 393.8	8 870.4	10 413.2	44 226.3	899 037.0	62	4.9	8.1
	2030	997.4	1 677.0	25 262.7	11 826.4	14 789.2	54 552.7	1 040 297.5	100	5.2	8.5
	2040	993.9	1 680.0	27 539.0	14 922.6	20 390.0	65 525.5	1 167 141.4	140	5.6	9.1
	2050	1 019.8	1 703.0	29 226.3	16 529.6	27 993.1	76 471.9	1 283 090.9	180	6.0	9.8
Other Asia & Islands	2000	962.4	1 555.6	19 783.7	6 844.2	7 945.4	37 091.2	798 104.7	0	4.6	7.7
	2010	960.6	1 569.3	22 757.1	9 969.4	10 595.0	45 851.3	918 113.7	24	5.0	7.9
	2020	967.9	1 576.7	24 632.3	12 975.8	15 522.8	55 675.4	1 031 361.1	50	5.4	8.5
	2030	941.4	1 584.1	25 640.4	15 368.0	22 477.2	66 011.1	1 130 773.3	78	5.8	9.3
	2040	939.7	1 547.7	25 949.7	17 389.5	29 867.1	75 693.7	1 211 630.9	104	6.2	10.2
	2050	940.2	1 549.1	25 921.7	18 207.5	37 062.5	83 681.0	1 273 752.4	126	6.6	11.1

Appendix 3: Sensitivity analysis. Numbers of people requiring daily care, total population, proportion of total population requiring care, and dependency ratio by region, country and year, based on three severest Global Burden of Disease study disability categories (levels 5, 6 and 7). Estimates for individual countries are available on the WHO web site at: http://www.who.int/ncd/long_term_care/index.htm

LONG-TERM CARE

Region	Year	Prevalence (thousands) by age in years					Total population (thousands)	Prevalence increase %	Proportion total pop. %	Dependency ratio (%)*
		0-4	5-14	15-44	45-59	60+				
People's Republic of China	2000	2 096.2	3 196.3	37 821.3	19 431.6	29 808.7	92 354.0	0	7.2	11.1
	2010	1 980.9	2 682.6	39 238.1	26 355.4	38 708.1	108 965.1	18	8.0	11.8
	2020	1 974.7	2 683.7	35 345.3	33 470.0	55 777.2	129 250.9	40	8.9	13.9
	2030	1 762.8	2 549.6	34 494.0	30 157.7	80 007.9	148 972.0	61	10.0	16.9
	2040	1 770.9	2 348.1	31 956.9	30 262.3	94 090.6	160 428.8	74	10.8	19.1
	2050	1 668.7	2 344.5	30 639.1	27 139.6	101 049.5	162 841.5	76	11.1	20.7
Established Market Economies	2000	386.3	794.4	18 357.4	10 313.5	24 820.8	54 672.4	0	6.4	10.4
	2010	356.2	743.2	17 651.3	11 801.9	29 776.4	60 329.0	10	6.8	11.2
	2020	361.1	705.8	16 786.6	12 066.9	35 849.1	65 769.5	20	7.2	12.5
	2030	367.2	719.0	16 197.2	11 164.5	41 672.5	70 120.4	28	7.6	14.1
	2040	369.9	728.0	15 699.2	10 975.4	44 037.7	71 810.1	31	7.7	14.8
	2050	380.1	737.0	15 608.4	10 569.3	44 575.3	71 870.0	31	7.7	15.1
Latin America & Caribbean	2000	1 077.2	1 741.1	17 936.1	5 737.5	7 519.5	34 011.4	0	6.6	10.8
	2010	1 084.3	1 759.8	20 348.8	8 047.2	10 273.3	41 513.4	22	7.0	11.1
	2020	1 075.4	1 770.3	21 815.8	10 239.5	14 811.3	49 712.3	46	7.5	11.9
	2030	1 061.8	1 750.7	22 381.4	12 149.3	20 805.0	58 148.2	71	8.0	13.0
	2040	1 054.6	1 734.4	22 511.2	13 238.3	27 234.1	66 772.5	93	8.5	14.3
	2050	1 050.9	1 727.1	22 480.7	13 645.7	33 018.6	71 922.9	111	8.9	15.5
Sub-Saharan Africa	2000	3 251.6	4 120.3	22 293.6	7 157.2	8 229.1	45 051.7	0	6.9	13.6
	2010	3 970.2	5 165.0	29 164.5	9 055.0	10 749.8	58 104.6	29	7.0	13.5
	2020	4 526.1	6 287.6	38 188.8	11 633.4	14 277.0	74 912.8	66	7.2	13.3
	2030	4 892.6	7 168.0	48 819.0	16 444.5	19 297.3	96 621.4	114	7.6	13.2
	2040	5 030.1	7 697.0	59 590.1	23 513.4	27 362.8	123 193.5	173	8.1	13.4
	2050	4 968.8	7 929.5	68 785.9	32 088.6	40 880.3	154 653.2	243	8.8	14.1

* (total number of dependent people) / (population aged 15-59)

Appendix 3: Continued

Region	Year	Prevalence (thousands) by age in years						Total population (thousands)	Prevalence increase %	Proportion total pop. %	Dependency ratio (%)*
		0-4	5-14	15-44	45-59	60+	Total				
India	2000	3 341.5	6 341.8	34 823.1	13 637.6	15 983.4	74 127.3	1 008 937.4	0	7.3	12.5
	2010	3 243.3	6 501.2	41 017.4	18 675.2	21 062.3	90 499.4	1 164 019.8	22	7.8	12.5
	2020	2 976.4	6 186.8	45 560.1	23 790.7	29 561.6	108 075.6	1 291 289.9	46	8.4	13.0
	2030	2 089.5	5 952.5	47 444.1	28 472.6	41 039.2	125 997.9	1 408 922.6	70	8.9	14.1
	2040	2 981.4	6 070.7	46 737.1	33 529.5	53 394.0	142 712.7	1 503 345.0	93	9.5	15.3
	2050	2 973.2	5 875.4	45 875.0	35 812.1	67 446.4	157 982.1	1 572 054.6	113	10.0	16.8
Former Socialist Countries of Europe	2000	250.1	453.7	9 308.9	5 071.6	9 249.3	24 333.7	338 021.6	0	7.2	11.4
	2010	231.5	303.2	8 726.5	5 980.2	9 151.6	24 393.0	322 334.9	0	7.6	11.3
	2020	216.4	287.8	7 677.3	5 444.7	10 877.9	24 504.2	307 631.1	1	8.0	12.8
	2030	187.5	261.6	6 284.9	5 839.7	11 670.2	24 244.0	290 266.0	0	8.4	14.0
	2040	188.2	234.0	5 169.3	5 513.6	12 596.3	23 701.3	271 433.5	-3	8.7	15.7
	2050	184.8	238.0	4 762.4	3 890.9	13 612.8	22 688.9	252 218.0	-7	9.0	18.2
Middle Eastern Crescent	2000	1 870.4	2 755.5	20 117.1	6 397.0	7 321.5	38 461.6	621 618.7	0	6.2	11.0
	2010	2 073.6	2 962.9	25 130.3	9 353.4	9 596.9	49 117.2	754 947.4	28	6.5	10.9
	2020	2 254.1	3 283.9	29 849.2	11 954.5	14 287.2	61 628.9	899 037.0	60	6.9	11.3
	2030	2 278.5	3 525.1	33 675.3	15 938.6	20 285.5	75 702.9	1 040 297.5	97	7.3	11.9
	2040	2 270.5	3 531.3	36 710.6	20 113.0	27 960.4	90 585.8	1 167 141.4	136	7.8	12.5
	2050	2 329.6	3 579.8	38 959.9	22 280.1	38 384.3	105 533.7	1 283 090.9	174	8.2	13.6
Other Asia & Islands	2000	2 183.9	3 125.8	26 575.7	9 178.5	10 784.8	51 848.8	798 104.7	0	6.5	10.8
	2010	2 179.8	3 153.3	30 570.7	13 371.3	14 378.0	63 653.3	918 113.7	23	6.9	11.0
	2020	2 196.4	3 168.3	33 092.2	17 402.8	21 070.7	76 930.4	1 031 361.1	48	7.5	11.7
	2030	2 136.4	3 183.1	34 448.0	20 614.2	30 511.1	90 892.8	1 130 773.3	75	8.0	12.8
	2040	2 132.4	3 109.9	34 864.1	23 329.7	40 536.7	103 972.8	1 211 630.9	101	8.6	14.0
	2050	2 133.6	3 112.9	34 827.4	24 429.1	50 296.4	114 799.3	1 273 752.4	121	9.0	15.3