

University of Groningen

Healthy Ageing

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Published in:
Older People

DOI:
[10.1007/978-3-319-97610-5](https://doi.org/10.1007/978-3-319-97610-5)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2019

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Stallinga, H. A., Roodbol, P., & Buskens, E. (2019). Healthy Ageing: Focus on the European Core Competences Framework outcomes. In *Older People: Improving health and social care* (1 ed., Vol. 1, pp. 75-101). Springer International Publishing. <https://doi.org/10.1007/978-3-319-97610-5>

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4.1 Definitions of Health

What is health? When are people healthy? There are a number of approaches to define health. These are oriented on different perspectives or health norms. For example, health can be understood as the absence of complaints or symptoms or the

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capability to cope with stress and strain; for some health is a synonym for well-being and happiness. The particular visions have a significant influence on which means are considered appropriate to improve and promote health. This is essential, since these specifications determine how healthcare will be organized. The current and formal definition of health is stated by the World Health Organization (WHO): ‘Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’ [1]. This definition is criticized in the last decades, for several reasons. The first one is the state of ‘complete physical, mental and social wellbeing’. No one can achieve this state, and therefore it labels a lot of people unhealthy for most of the time [2, 3]. Second, this definition assumed a kind of objective state. To classify people as unhealthy, [3, 4] standards or norms have to be determined by established characteristics in a reference group. Deviations from these norms are labelled as negative, and a person will be classified as ill, or not healthy, when complaints and symptoms related to a disease are present. Setting norms and standards are set for a large extent in the bodily part of the definition such as, for example, blood pressure and body temperature. But, how to deal with the other dimensions in the definition? Standards and norms cannot be set in that way for the social part. That is why this definition is labelled as biomedical, representing a pathogenic orientation of health, focused on curing body functions and looking after causes of disease [5].

Available evidence supports that health has to be viewed as a dynamic, complex, adaptive, positive and personal balanced state. It has to be considered as a multidimensional concept, including bodily items, sociological items, abilities, meaningfulness and performance [3, 6–8]. The most recent proposed conceptualization of health will illustrate this new vision on health: ‘health is the ability to adapt and self-manage in the face of emotional, physical and social challenges’ [2].

This widespread and most cited new concept of health emphasizes ability, adaptation and self-management in a biopsychosocial context. In line with its origin from the salutogenic approach [9], this is called ‘positive health’ as counterpart to ‘ill health’. It is acknowledged that in modern healthcare systems, the biomedical pathogenic ill health approach is limiting and even counterproductive [2, 4]. Both, the salutogenic and the biopsychosocial perspective, point to the need to adopt, teach and systematically implement into the health system as a whole and its professionals individually in their interaction with patients [3, 10, 11]. This will support the experience of ‘being healthy’, even though biological or physical abilities have become markedly reduced [12].

4.1.1 Salutogenesis and the Biopsychosocial Model

Salutogenesis [9, 13] is an approach focused on discovering the causes and precursors of health. It is complementary to the pathogenic orientation focusing on the causes and precursors of disease [14–16]. Relevant practical constructs in this approach are the sense of coherence (SOC) and the generalized resistance resources (GRR).

- Sense of coherence (SOC) is an instrument which measures how comprehensible, manageable and meaningful a person views his own life. A strong SOC is associated with better health reflecting a person's capacity to deal with stressors and also enable them to have the capacity to qualify and find the ways to manage their life [11].
- General resistance resources (GRR) is an overview of biological (e.g. genes, intelligence, immune system), material (e.g. money, home) and psychosocial (e.g. knowledge, experience, social networking) resources which will reinforce a person's SOC. This means that persons with a strong SOC are likely to identify a greater variety of GRRs at their disposal [11].

The biopsychosocial model [17, 18] emerged from dissatisfaction with the biomedical model of illness. The model broadened the scope of health by incorporating the psychological and sociological dimension to the biological dimension. The model is considered as a complex, adaptive, personal and experiential system model. This means that the system can fail even if all subparts are normal [19]. The person him/herself can determine when the various components are in balance [3, 19].

In 2001, the WHO published its International Classification of Functioning, Disability and Health (ICF) [20], which is explicitly related to the biopsychosocial model. Comparable to the operationalizing of disease, as central theme in the pathogenic-biomedical perspective, by the International Classification of Diseases (ICD) [21], functioning is proposed as the central theme to operationalize the salutogenic-biopsychosocial perspective by the ICF.

4.1.2 Functioning and the International Classification of Functioning, Disability and Health (ICF)

The ICF is published as a common language and framework to describe health and health-related states. The framework is described as the conceptual model of health (Fig. 4.1). Functioning, as central theme in the ICF, is described as the result of a dynamic interaction between health conditions (i.e. diseases or disorders) and contextual factors (i.e. environmental and personal factors) [20]. Functioning pertains to how people function in everyday life, in the performance of activities and in the areas of life in which they participate [22].

Functioning is presented as a tripartite construct (Fig. 4.1) including the components of body functions and structures (what people have, e.g. sensory functions; eyes), activities (what people do, e.g. reading) and participation (the type of relationships in which people are involved, e.g. family, work) [22]. The environmental factors include all aspects of the physical, social and attitudinal world (e.g. devices, family, political opinions). Personal factors include age, gender, race, education, profession and so forth. Personal factors are not classified yet in the ICF; they are currently under construction [23].

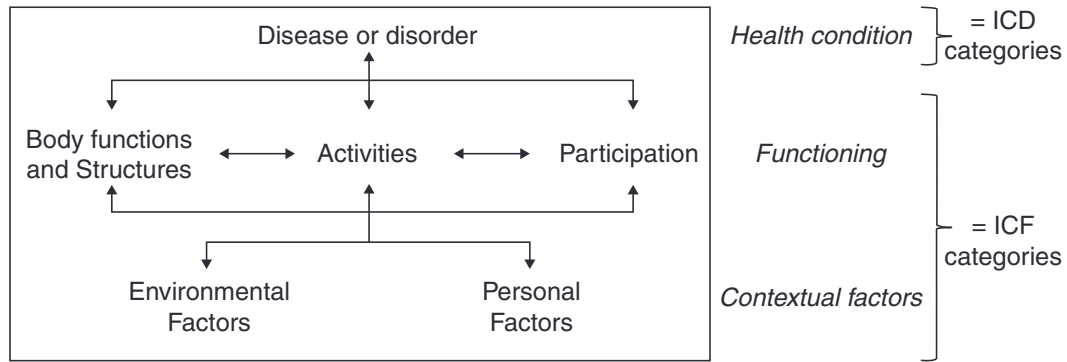


Fig. 4.1 WHO's conceptual model of health representing the interactions between the components (disease, body functions and structures, activities, participation, environmental and personal factors) of the health status [20]. *ICD* International Classification of Diseases; *ICF* International Classification of Functioning, Disability and Health

In the conceptual model of health, the ICF and the ICD are complementary; both classifications have to be used to describe an individual's health status [20].

This model facilitates the process of clinical decision-making by the members of the (multidisciplinary) team and acknowledges that characteristics and status of functioning of patients with the same health condition may differ more than those between patients with different health conditions [24].

4.1.3 Application of ICF

The first step in healthcare provision is to identify the patient's problems and needs [25]. The model can be applied to describe the patient's problems, capacities, resources and targets to get a complete picture of the patient's health status, which is relevant to determining multidisciplinary healthcare provision. The model represents what affects the patient and addresses those (i.e. the target mediators and abilities) with the most potential for improving the patient's health [20, 24, 26–28]. Almost 1500 categories of ICF offer a differentiated language to describe a patient's health state in his/her specific environment. Each ICF category has a discrete meaning and unique code.

The concept of functioning has to be understood as a continuum ranging from completely able (non-problematic) to completely disabled (problematic), which can be expressed by qualifiers ranging from 0 (no problem) to 4 (complete problem). For example, the ICF code d450.1 describes a person's (dis)ability to walk as a mild problem. The environmental factors can act as complete barrier (decreasing ability or producing disability) or as complete facilitator (improving ability or eliminating disability). For example, the ICF code e310.2 means that the 'immediate family' acts as a moderate barrier, and e310 + 2 means that the 'immediate family' acts as a moderate facilitator (facilitators are denoted in the code with a plus sign instead of a period).

Fig. 4.2 Example of an ICF spider chart of body functions of a patient

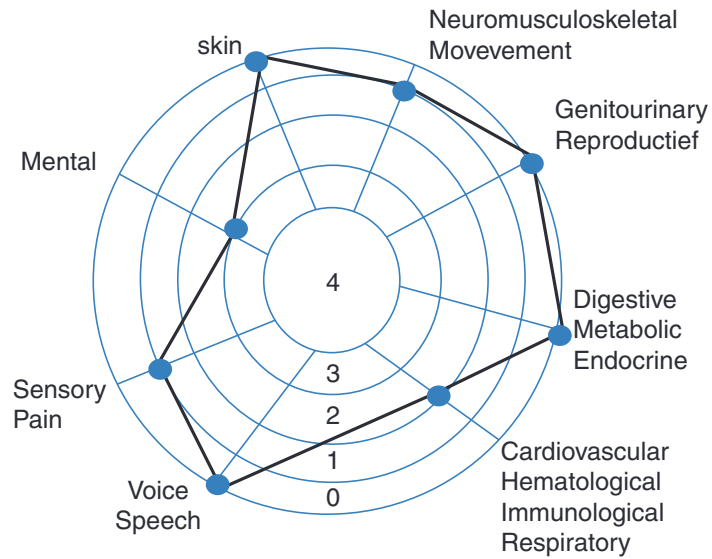
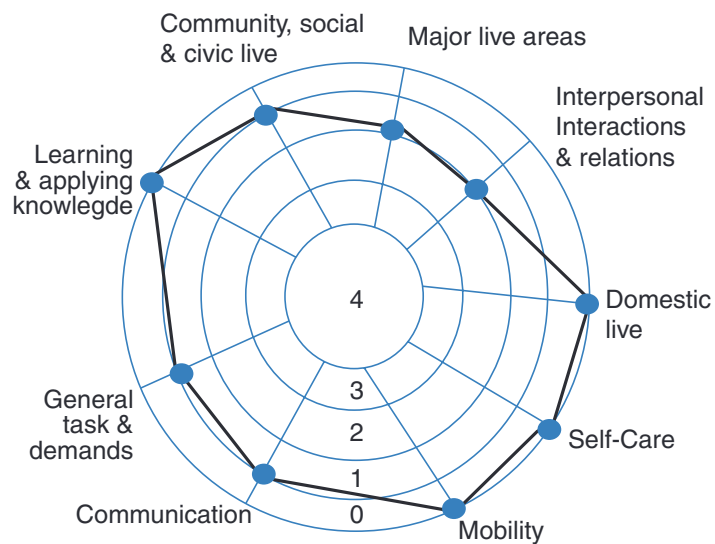


Fig. 4.3 Example of an ICF spider chart of activities and participation scores of a patient



Core sets, meaning a selected set of ICF categories, related to a specific health condition [22, 29], can serve as a minimal standard for the assessment and reporting of the status of functioning. Visualizing functioning in net diagrams or spider charts (Figs. 4.2 and 4.3) by using ICF categories in an electronic system [30] can help to recognize predispositions over time, as well as making information accessible to professionals and patients [31].

4.2 Older People's Comprehensions of Health

In the previous Sect. 4.1, the concept of health was discussed. Most of older people want to live healthy lives in their own homes. Health is a natural part of ageing, and the understanding of health makes it possible for older people to define and find

strategies to manage everyday activities. For health and social care professionals, awareness of multidimensional approaches to older people's health is an opportunity to recognize the individuality of older people and their resources and thus to find suitable ways to support their health as well as resources and everyday life at home [32].

Comprehension of health for older people is a multifaceted issue, and it has been described and evaluated from different perspectives. Older people's health can be described, for example, from perspective of health expectancy, perceived health, self-care ability and quality of life, and measured by using questionnaires and interviews related to older people's opinions concerning their own health [32].

Health expectancy can be understood as an indicator of population's health that is used to evaluate quantity as well as quality of life dimensions of health. As an indicator, health expectancy produces information about health status such as morbidity, mortality and disability. In addition, it compares changes in social and economic conditions, medical advances and changes of lifestyles, as well as better access to health services. As a calculator, health expectancies can be exploited to estimate differences between socio-economic categories and regions and to analyse the changes that occur. Perspective of older people's health, using health expectancy on the level of health policy, is remarkable because it makes possible to evaluate and foretell needs for care and services in the future [32].

Perceived health is related to the individual's subjective conceptions of their own health. It means not only the lack of chronic disease or invalidity but also well-being in all life sectors, such as social and mental dimensions which make possible to catch up and realize individual dreams and goals. From the view of health evaluation, perceived health is an indicator for predicting mortality in addition to demographic variables and physical health. Therefore, evaluating how physical, mental and social well-being influence on perceived health will help to improve positive conception of one's own health in ageing. Perceived health will vary among older people. In a study [33], older people aged 75 evaluated their health as good or very good; however, at the same time, they mentioned many kinds of health problems. Having positive expectations about one's own health is found to be significant for older people's perceived health [34]. Older people with a positive attitude and conceptions of their health predicted higher degree of life satisfaction than those with negative conceptions [35]. Therefore, older people's own assessment of their health is emphasized to be an important factor to be taken into account in the field of older people's examination and care. When observing older people's health, their own experience of their health is found to be one of the most common elements influencing on their quality of life [36]. Quality of life can be observed both objectively and subjectively. From the outside, as objective approach, it is possible to evaluate health, lifestyle and standards of life. Whereas, life satisfaction and well-being are individual experiences and can be described as subjective approach [37].

Furthermore, quality of life is related to individual's own experience of their abilities as well as disabilities [38]. Especially among older people, different health problems are highly prevalent and may make difficult to manage daily activities. However, older people with a high quality of life adapt to changing health

conditions, and therefore, it is significant to perceive that results of objective and subjective evaluations for quality of life can be contrary [39]. When older people accept their variable health condition, their quality of life will improve [38]. We have to take into consideration that old age does not mean automatically that quality of life will reduce. For example, available resources and other individual elements influence how older people evaluate and deal with their quality of life [40].

When observing older peoples' health, self-care ability is one part of health related to individuals' lifestyle. It can be described as the method of activities that individuals will do to achieve their health and well-being [41]. Self-care ability is linked to older people's activities of daily living (ADL), such as eating, bathing and dressing, and instrumental activities of daily living (IADL), such as managing money, shopping, using the telephone, housekeeping and preparing meals [42] as well as otherwise enjoying independent living in their own homes. In older peoples' daily life, satisfactory self-care ability makes possible active participation in improving their own health [43]. Contrary to normal self-care ability, reduced self-care ability will weaken life satisfaction among older people and therefore, reduce their abilities to manage everyday activities. When older people need help to manage everyday activities, it is remarkable to take into account and support their self-care routines, in order to support their ability to function to guarantee the continuity and independence in their lives [41].

In sum, older people's health can be approached from different perspectives. Health is a natural part of life and also go together with ageing. In contrast to reducing health, older peoples' understanding of meaningful health in their own life enables them to have the capacity to qualify and find the ways to manage daily activities by adapting to disabilities and diseases [44]. Understanding of multidimensional views to older people's health makes possible to recognize the individuality of older persons and therefore to find appropriate ways to support their health and everyday life.

4.3 Physical Activity to Enhance a Healthy Lifestyle in Older Adults

Physical activity is one of the building blocks of a healthy lifestyle in older adults. The benefits of regular physical activity in older adults are well documented. Numerous studies show an increase of health-related physical fitness, the prevention of chronic diseases, an improvement in psychosocial health and a decline in all-cause mortality. Still, a substantial number of older adults in Europe do not meet the guidelines of regular physical activity.

4.3.1 Guidelines for Physical Activity of Older Adults

A general consensus has been reached in recent years on the amount and type of physical activity recommended to improve and maintain health [45, 46]. Most

public health recommendations on physical activity in older adults focus on 2 h and 30 min of moderate-intensity aerobic activity (i.e. brisk walking) every week and muscle-strengthening activities on 2 or more days a week that work all major muscle groups (legs, hips, back, abdomen, chest, shoulders and arms). Aerobic physical activity should be performed in episodes of at least 10 min, preferably spread throughout the week. Those at risk of falling should add exercises that help maintain or improve balance. To support flexibility necessary for regular physical activity in daily life, older adults should perform activities that increase flexibility for at least 10 min on at least 2 days of the week.

For additional health benefits, older adults should engage in 150 min of vigorous-intensity aerobic physical activity per week or an equivalent combination of moderate- and vigorous-intensity activity.

4.3.2 Prevalence of Physical Inactivity in Older Adults

Overall, older adults are less active than younger adults: 19% of the youngest age group does not meet the recommended level of physical activity, compared to 55% of the oldest age group. Overall, the decline in physical activity over 65–84 years is on average 24% [47]. Socio-economic status tends to be directly related to participation in regular physical activity. Poorer people have less free time and less access to leisure facilities or live in environments that do not support physical activity [48].

4.3.3 The Benefits of Physical Activity

Physical activity *is* ‘any force exerted by skeletal muscles that results in energy expenditure above resting level’ [49]. In older adults health-enhancing physical activity focuses on physical activity that benefits health and functional capacity. Regular or habitual physical activity is actually a way of life that integrates physical activity into daily routines. It comprises a variety of physical activities in daily life, such as walking, cycling and gardening, at a moderate intensity, which is about 3–6 metabolic equivalents (METs). The benefits of regular physical activity in health-related fitness, like physical fitness, the prevention of chronic diseases, psychosocial functioning and reduction of mortality in older adults, are widely demonstrated [50].

4.3.3.1 Health-Related Physical Fitness

The impact on health-related fitness shows benefits in cardiovascular fitness, musculoskeletal fitness, the metabolic syndrome, cognitive functioning and functional capacity. In cardiovascular fitness regular physical fitness shows a significant increase in maximal oxygen consumption (VO₂ max) as indicator of aerobic endurance, heart rate, blood pressure, cardiac output and left ventricular function [51]. Effects of regular physical activity on musculoskeletal fitness are found in increased muscle mass and muscle strength and neural adaptation by hypertrophy of type II

muscle fibres, muscle protein synthesis and a significant decline of cytokines like interleukin (IL-6) and tumor necrosis factor- α (TNF- α) in older adults [52, 53]. Regular physical activity significantly affects the metabolic syndrome by lowering high rates of central obesity, increasing low levels of high-density lipoprotein cholesterol (HDL) and lowering hypertriglyceridemia and hypertension [54].

Walking, running, swimming and bicycling significantly increase the synthesis and expression of BDNF (brain-derived neurotrophic factor) which is related to beneficial epigenetic changes, hippocampal neurogenesis, synaptic plasticity, working memory and reaction time performance and the modulation of brain glucose metabolism [55–57]. Moderate to higher levels of activity of regular physical activity confer a reduced risk of functional limitations and disability as well as loss of independence in older age [58].

4.3.3.2 The Prevention of Chronic Diseases

Regular physical activity supports the prevention of chronic conditions like cardiovascular diseases, diabetes mellitus (type II DM), cancer (especially colon and breast cancer) and bone and joint diseases (osteoporosis and osteoarthritis) [59]. In cardiovascular diseases, including coronary heart disease, stroke and peripheral vascular disease, an inverse association is found between the level of regular physical activity, cardiovascular fitness and mortality [60]. Review studies have concluded physically active people have a substantially lower overall risk for major coronary events [61]. An inverse association between reported level of physical activity and stroke, in both ischemic stroke and haemorrhagic stroke, is found in review studies [62].

There is evidence that the incidence and progression of type II DM can be reduced with physical activity in older adults with impaired glucose tolerance (IGT) [63]. Physical activity improves blood glucose control in type II DM due to improved insulin sensitivity and halves the risk of developing diabetes [64, 65]. Either aerobic or resistance training improves glycaemic control (HbA1c) in type II DM, but the improvements are greatest combined with aerobic and resistance training [66].

Physical activity is linked to lower risk of cancers [67]. Regular physical activity is associated with a decreased risk of colon adenomas (polyps) that may develop into colon cancer [68]. Data on leisure-time physical activity from prospective cohort studies reported a risk reduction of 16% in colon cancer. In addition, the incidence of both distal and proximal colon cancers is lower in people who are more physically active [69].

Studies in physically active women show a lower risk of breast cancer in both premenopausal and postmenopausal women. A meta-analysis found the average breast cancer risk reduction associated with physical activity was 12% [70]. Women who increase their physical activity after menopause may also have a lower risk of breast cancer [71]. Studies that examined the relationship between physical activity and the risk of endometrial cancer found a risk reduction of 20% [72]. There is evidence that this risk reduction may reflect the effect of physical activity on obesity, a risk factor for endometrial cancer. For a number of other cancers, like liver cancer, gastric cardia cancer (a type of stomach cancer), kidney cancer, myeloid leukaemia,

myeloma, and cancers of the [head and neck](#), [rectum](#), and [bladder](#) there is more limited evidence of a relationship with leisure-time physical activity.

Physical activity is essential for maintaining the health of joints and bone density and appears to be beneficial to prevent the onset of osteoarthritis and helps to control symptoms among people with osteoarthritis [73]. Aerobic, weight-bearing and resistance exercise training have been shown to have a positive effect on the bone mineral density (BMD). Moderate physical activity also reduces pain and increases function in patients with osteoarthritis [74].

4.3.3.3 Psychosocial Health

The incidence and progression of a variety of age-related psychological and social health problems, such as loneliness, anxiety, depression and cognitive decline, are related to a lack of regular physical activity. Physical activity is inversely related to depression. A meta-analysis and a Cochrane review showed that regular physical activity has similar efficacy to cognitive behavioural therapy in treating depression [75, 76].

Loneliness increases with ageing. About 40% in the age group 65–74 experience loneliness. It rises to an average of 59% for those over 85 [77]. In older adults loneliness is an independent risk factor for physical inactivity in the short and longer term [78]. There is evidence that physical activity has an impact on the quantity and quality of social relations in older adults [79].

Generalized anxiety is the most common form of anxiety in older adults. In generalized anxiety, there is a constant concern about daily events. Although review studies indicate that ageing has a negative impact on generalized anxiety, the impact of physical activity on anxiety is hardly examined. Physical activity shows limited anxiolytic effects [80, 81]. The explanation for the effect of regular physical activity is based on the endorphin hypothesis which assumes that physical activity promotes the secretion of β -endorphin [82].

Cognitive limitations due to ageing, also referred to as mild cognitive impairment (MCI), are reflected in the deterioration of various cognitive functions such as memory, the speed of information processing, executive tasks and spatial orientation. Studies have shown that physical activity enhances the blood flow and vascular functions of the brain. Moreover, it promotes the production of BDNF, which makes older people less likely to have cognitive and motor problems [83, 84]. Older adults with low socio-economic status have twice as much psychosocial problems as older adults with a higher socio-economic status [85].

4.3.3.4 All-Cause Mortality

Being physically active reduces the risk of all-cause mortality. The largest benefit was found from moving from no activity to low levels of activity, but even at high levels of activity, benefits occur from additional activity. Physical inactivity is estimated to account for nearly 600,000 deaths per year in the WHO European Region [48]. Review studies indicate that at least two to two and a half hours per week of moderate-intensity physical activity is needed to significantly decrease all-cause mortality rates. It appears that walking for at least 2 h per week is also associated

with significantly lower all-cause mortality rates. There is evidence that it may be the overall volume of energy expended—regardless of which activities produce this energy expenditure—that is important to lower the risk of mortality. The inverse relation between physical activity and all-cause mortality appears independent of obesity.

4.3.3.5 Summary

There is a general consensus on the amount and type of physical activity recommended to improve and maintain health. Still, a substantial number of older adults in Europe do not meet the guidelines of regular physical activity. The benefits of regular physical activity in older adults show an increase of health-related fitness like cardiovascular and musculoskeletal fitness, reduced prevalence of metabolic syndrome, increase in cognitive functioning and functional capacity, and the prevention of chronic diseases such as cardiovascular disease, cancer, type II DM and osteoporosis and osteoarthritis. Meeting the physical activity guidelines studies shows improvement in psychosocial health (loneliness, generalized anxiety disorder, mild cognitive impairment and depression) and a decline in all-cause mortality.

4.4 A Healthy Diet for Older Adults

A healthy diet is known to contribute to a healthy lifestyle in all ages. But what exactly is considered a healthy diet? And what topics with respect to food intake are most relevant for older adults?

Briefly, food intake can be described as a combination of what people eat (the foods that are consumed over the day or week) and how and with whom they eat. Foods provide the body with energy and nutrients that are needed to think, breath, move and perform all bodily reactions. A good supply of energy and nutrients is thus of great importance for health. Besides, also the social environment is of great importance to food choices. With age, the social environment tends to change rapidly, which also leads to possible adverse effects in food intake. The topics that are of biggest relevance for the ageing population will be touched upon in this chapter; where applicable concrete recommendations valid for the European population are provided. Please note that dietary and food guidelines may vary between countries and that collecting data on food intake is prone to a lot of difficulties.

4.4.1 Changes in Food Intake with Ageing

Due to a set of physiological aspects, older adults' smell starts to decrease. The smell of a food, whether it is encouraging or warning, is of big importance in the amount of food that is taken. Moreover, also taste diminished over time. This combination leads to a decreased food intake, resulting in a lower energy intake [86]. Due to physiological changes, also production of saliva starts to decrease, making it

more difficult to chew and swallow. On the other side, dysfunction in chewing is suggested to be an epidemiologic risk factor for dementia, and mastication is said to play an important role in preserving the hippocampus-dependent cognitive function [87]. Besides that, also non-optimal intake of vitamin B12 seems to be associated with cognitive decline; although it is not clear whether this is a causal effect [86].

Since a decrease in energy intake is observed in most older adults, it is important to make sure that all nutrients are still sufficiently provided. Therefore, emphasis should be paid to nutrient density of the diet. This is the level of nutritious nutrients per unit of energy. Most unprocessed foods such as meat, potatoes, vegetables, bread and butter will provide a lot of nutrients, whereas processed food such as soft drinks, alcoholic beverages, sweets and cakes will supply a lot of energy and less nutrients.

4.4.1.1 Nutrient Intake in Older Adults over Europe

Until recently, the adequacy of the dietary intake was studied by examining nutrient intakes; only in the last couple of years, the quality and sufficiency of diets are studied by looking at food intakes and preferences. The following micronutrients were shown to have higher risk of inadequate intakes in older adults in Europe: folic acid, selenium, iodine and vitamin C [88]. From another study that was carried out in community-dwelling Western older adults only, also vitamin D, thiamine (vitamin B1), riboflavin (vitamin B2), calcium and magnesium were shown to be inadequate [89].

Due to the heterogeneity in food consumption patterns, it is difficult to provide an overview of differences in food intakes. However, to illustrate the importance of studying food patterns, an example of the Dutch National Food Consumption Survey in community-dwelling older adults (70 years and over) is provided. They consume less wholemeal products, fruit and fish than recommended. Besides that this survey showed a clearly inadequate vitamin D intake, even though about 25% of the women and 20% of the men used dietary supplements containing vitamin D [90].

4.4.1.2 Changes in Body Composition

In an intertwined set of changes going on in the ageing body, also changes in body composition can appear. This is mostly seen as a decline in muscle mass (fat free mass), which is linked to difficulties in activities of the daily living (ADL). Lesser physical activity over the day will lead to lesser weight-bearing activities, contributing—especially when vitamin D and calcium levels are not optimal—to bone loss and increasing the risk for osteoporosis. The latter increases the risk of fractures in falls.

4.4.1.3 Changes in Body Weight

During an adult lifespan, a lot of attention is being paid to body weight, especially with regard to overweight and obesity. With ageing the reduction in fat-free mass is most predominant, though the fat mass also decreased but to a lesser extent. Classifications for weight are globally done by applying the body mass index (kg/m^2) [91].

However, the shrinkage of older adults is due to the fact that their spine is collapsing (kyphosis); thus BMI is no longer a valid measure and needs to be interpreted cautiously. When malnutrition might also be at stake and (unintentional) weight loss might appear, cut-off points for underweight of 20 kg/m² (<70 year) or 22 kg/m² (≥70 jaar) are suggested instead of 18.5 kg/m² for the general adult population [86, 92].

Deficiencies in both vitamins and minerals and also in energy and protein might occur in older age. This situation occurs independent of the body weight. Therefore, malnutrition has been defined as ‘a subacute or chronic state of nutrition in which a combination of varying degrees of over- or undernutrition and inflammatory activity has led to a change in body composition and diminished function’ [93]. From this definition it is also apparent that malnutrition can occur in people that are obese (body mass index of 20 kg/m² or more). Diminished functions refer to cognitive function and immune function.

Assessment of malnutrition varies slightly between countries and is still under discussion. However, the European Society for Clinical Nutrition and Metabolism (ESPEN) indicates malnutrition as having:

1. BMI <18.5 kg/m²
2. OR weight loss (unintentional) >10% indefinite of time or >5% over the last 3 months combined with BMI <20 kg/m² if <70 years of age or <22 kg/m² if ≥70 years of age
3. OR weight loss (unintentional) >10% indefinite of time or >5% over the last 3 months combined with FFMI <15 and 17 kg/m² in women and men, respectively [92]

where FFMI = fat free mass index = FFM (kg)/body height² (m) relating the FFM to the body height, as such taking into account muscle mass. FFM should be measured separately, e.g. skinfold measurement, underwater weighing, air displacement plethysmography, bio-impedance or alike.

Note that before diagnosis of malnutrition is considered, it is mandatory to fulfil criteria for being ‘at risk’ of malnutrition by any validated risk screening tool [92]. Several validated screening tools for malnutrition are available, for different settings. In Table 4.1 a few examples are depicted.

Table 4.1 Examples of screening tools for malnutrition

Screening tool	Description	Website
PG-SGA	The Scored Patient-Generated Subjective Global Assessment (PG-SGA©) sets the standard of nutritional assessment	http://pt-global.org
MUST	Malnutrition Universal screening tool	www.bapen.org.uk
MNA	Mini Nutritional Assessment, specifically designed for use in elderly	www.mna-elderly.com

4.4.2 Achieving a Healthy Diet: Role of Health and Social Care Professionals

As described before, a whole set of interlinked changes in nutrition (status) and body composition occurs in older age that to a certain extent can be prevented. Several kinds of health and social care professionals can play a role in this. In Table 4.2 the link between the most important nutrients and health are presented in order to give an overview of what to monitor with respect to nutrition from different (professional) points of view. Sometimes a quick fix can be done by any health and

Table 4.2 Overview of link between foods, nutrients and the body and how this can be monitored by several health and social care professionals

Main nutrient	Food	Link to body	Effect	Focus/point of action	Reference intake [94]
Protein	Meat (replacers), dairy, grains, legumes, egg, fish	Decrease in muscle tone	Decrease in ADL	Improve protein intake; perhaps use fortified/enriched foods Improve flavour and palatability	0.83 g/kg BW/d ^a
		Decrease in muscle mass	Malnutrition; Decrease in energy requirement		
Calcium	Dairy products, (milk, cheese, yoghurt)	Bone formation, turnover	Bone loss, osteoporosis, falls/fractures	When low levels, perhaps a calcium supplement is needed	950 (mg/d) ^a
Vitamin D, alpha-tocopherol ^b	Fatty fish	Lower bone turnover and bone loss with sufficient amount		In some countries additional supplementation recommendation or fortification is valid	13 mg/d ^c
Vitamin B12, cobalamin	Animal products (dairy, egg, meat, fish)	Cognition			4.0 µg/d ^c
Fluid intake	Water, drinks, dairy, yoghurt	Hydration; renal function, thirst	Risk of dehydration; vulnerable at high temperatures and with fever, diarrhoea, vomiting, etc.	Active offering by caretaker, since thirst diminished with age Avoid alcoholic beverages	M 2.5 L/d ^c F 2.0 L/d ^c

Partly based on [86]

^aPopulation reference intake (PRI)—the level of intake that is sufficient for virtually all people in the population group [94]

^bUnder conditions of assumed minimal cutaneous vitamin D synthesis. In the presence of endogenous cutaneous vitamin D synthesis, the requirement for dietary vitamin D is lower or may be even zero [94]

^cAverage intake (AI)—the level that is estimated when the PRI cannot be established [94]

social care professional, and sometimes a referral to a dietitian is needed. All recommendations presented are valid for a healthy population; in case of illness and disease occurs, other requirements might be more appropriate.

4.4.2.1 Drug Interactions

Most older adults use one or more types of medication, ranging from antihypertensives, diuretics, sleeping pills and psychotropics (with a specific action on mental activity). These types of medication will affect food intake via, i.e. decrease in smell or taste, nausea or obstipation. Besides that medications can also affect the requirements for nutrients, which needs to be taken into account [86].

4.5 Spiritual, Existential Dimension of Healthy Ageing

As explained in previous paragraphs in this chapter, the classic definition of health is changing. Health means more than the absence of diseases, also mental, emotional and social aspects are important. Huber [95] who launched a new definition of health in 2011 describes six dimensions of health derived from interviews with patients, professionals and researchers: physical functioning, mental functions and experiences, spiritual-existential dimension, quality of life, social functioning and participation and daily functioning. In these interviews they found a large variation between the different groups on the spiritual dimension. When it comes to the dimension of spirituality, they found that patients themselves rated this as being significant and more important than did healthcare providers and researchers.

However, spirituality and religion, their impact on health and also the competences of healthcare and social workers in this field have all pretty much been neglected. A study of professionals' views on competences needed for working with older people also revealed that most professionals believed that they did not have sufficient knowledge on how to meet spiritual needs; according to these professionals, questions about faith could be awkward [96]. On the other hand, research suggests that spirituality is important to a large percentage of the older adult population and serves as a promoter of healthy ageing [97, 98]. This gives a reason to explore here the concept of spirituality and its relation to resilience, distress and health.

There is no single shared definition of 'spirituality' and 'spiritual care' [99]; it is differently described by different cultures and religious communities. Spirituality is dealing with existential questions or how to give meaning to life. Historically, spirituality was not distinguished from religiousness until the rise of secularism in the twentieth century. People who do not participate in any formal religion also have a drive to find meaning of their life. Especially when people face their end of life, like older people do, questions of the value or meaning of their life raise. Religion is based on a set of standards of beliefs and practices. A spiritual person believes in a higher power in a more general way and with an eclectic mix of beliefs and practices based on enhancing spiritual awareness.

‘Spirituality is a dynamic and intrinsic aspect of humanity through which persons seek ultimate meaning, purpose and transcendence, and experience relationship to self, family, others, community, society, nature, and the significant or sacred. Spirituality is expressed through beliefs, values, traditions, and practices’ [99].

Spirituality relates to all kinds of beliefs and worldviews. Therefore the number of definitions is high. Spirituality means goal seeking and benefit finding. Religion and spirituality are seen by older people as positive forces that help them face life with more resilience and hope, improve social and familial relationships and cope with life stresses such as financial or health concerns. Another great benefit to older people who belong to a religion or spiritual group is a sense of community. They avoid social isolation; they do volunteer activities that keep them connected with others; they have people who inquire as to their health and well-being with whom they can exchange ideas and information [100]. A spiritual attitude may have positive effects on adaptation of stressful events, on getting older and facing the death. There are positive associations between spirituality and risk for depression and quality of life. Moreover, family caregivers of older people with a spiritual background are less vulnerable for a caregiving burden.

4.5.1 Spirituality and Resilience

When it comes to ageing, spiritual coping has been seen as a resilience resource when navigating the hardships in later life [101]. Resilience in older age is the ability to stand up to adversity and to ‘bounce back’ or return to a state of equilibrium following individual adverse episodes. For continuing adversity it may be a matter of having the ability, or learning how, to cope with or manage that adversity in the longer term. This has to do with the positive meaning-making framework that spirituality can offer [102]. Factors associated with resilience include hope, morality, self-control and forgiveness [103]. These characteristics are often linked to the spiritual-religious domain.

The concept of resilience is closely related to health. According to the salutogenic theory, stressors will cause harm if they violate an individual’s ‘sense of coherence’. That sense of coherence is made up of three components:

1. *Comprehensibility*: a belief that things happen in an orderly and predictable fashion and a sense that you can understand events in your life and reasonably predict what will happen in the future
2. *Manageability*: a belief that you have the skills or ability, the support, the help or the resources necessary to take care of things and that things are manageable and within your control
3. *Meaningfulness*: a belief that things in life are interesting and a source of satisfaction that things are really worthwhile and that there is good reason or purpose to care about what happens

Religious meaning-making in highly stressful or traumatic circumstances is common, and research suggests that it is often particularly helpful in dealing with these situations.

4.5.2 Spiritual Distress

Older adults, especially who are suffering from functional decline, mental illness and social isolation, are vulnerable to spiritual distress. Spiritual distress is defined as ‘a disruption in the life principle that pervades a person’s entire being and that integrates and transcends one’s biological and psychological nature’ [104]. It is a disturbance in a person’s belief system. Manifestations are expressions of discomfort with God or concerns and negative remarks about the kind of life one has lived. Indicators are pain, alienation, guilt, loss and despair. There is a validated instrument to measure someone’s state of mind concerning spiritual distress which is called ‘Spiritual Well-Being Scale (FACIT-Sp)’ [105].

The desired outcome for the patient is spiritual well-being. Interventions for a person with spiritual distress need a relationship which is built on trust. Respect is needed for the religion and worldview of the older person. Show compassion for his suffering. Active listening is important as well as treating older persons as individuals, as human beings. Provide privacy and opportunities for daily praying. Stimulate talking about belief and religious feelings. Support from of a clergyman can be important, but each health and social support professional needs to recognize spiritual distress and needs to be capable to listen actively to existential questions based on a trustful relationship. A more intensive intervention can be a course mindfulness.

With the raising number of immigrants, health and social care workers will meet more people with a different ethnic, religious and cultural background. It is important to show respect for their values and beliefs. Especially for the older immigrants, our society is hard to understand. When they are hospitalized, there is a need for understanding of the role of the family, the preference of females to be helped by females, appropriate diets, and also the availability of the consultation of a clergyman with their specific religious background.

4.6 Ageing, Longevity and Champions: Blue Zones

When talking about healthy ageing, it is also interesting to have a look at people who are successful in ageing. People who reach 100, centenarians, might be able to teach us how to stay healthy, even in their very advanced life. The interest in lifestyle and health of centenarians for healthy ageing is driven by the desire to identify key factors associated with exceptional longevity in humans. What does it take to make it to 100? And has the road to 100 been blessed with better health compared

with others who died at much younger ages? Interestingly there appear to be several regions of the world where people live much longer than average, the so-called blue zones. Before we have a closer look at what we can learn from these places, let us recall the concept of ageing.

4.6.1 Ageing

What are we talking about? Check the scientific literature, and one encounters thousands and thousands of papers on ageing or relating to the process of ageing. Indeed, this figure is growing exponentially over the last decades to well over 20,000 new titles per year since 2014 (PubMed 2017). Apparently, ageing attracts a lot of attention, also in the scientific domain. This is true in the field of economics and human resource management, where the reality of changing sales markets and labour markets is studied to be able to meet future challenges. Likewise, with increasing proportions of older individuals among the population, social conditions and relations cannot but undergo change. And, clearly also finance, other services, real estate and infrastructures have to prepare for the diverse demands of an ageing population.

When we switch to biology, ageing has yet other connotations. Humans and any other metazoic organism go through a process of constant change. As we observe our fellow organisms, we see that from the moment of birth or hatching, they first grow and start showing characteristics and abilities of the matured being. This appearance lasts for some time during which procreation typically occurs. Then, after an era of optimal function, we again may start observing changes. Muscle mass decreases, speed and reflexes decrease, sight and hearing diminish, hair or feathers discolour and fade and wrinkles appear. These phenomena we observed on the outside, but the ‘inside’ of the organism undergoes similar changes, ultimately leading to progressive loss of function, until remaining functions are no longer compatible with survival. Indeed, we are all conceived with the potential to reach great heights, literally and figuratively. However, things can go wrong as time passes, and eventually will go wrong, and while we are at it we may pass on our genes. Call it destiny. Apart from accidents and other mischief, for some ageing may be accelerated, whereas others seem more fortunate and appear to be blessed with genes for ‘immortality’. The ageing organisms go through a period of frailty and dependency on an environment providing the appropriate circumstances for development to subsequently reach their independence and potential for participation, contribution and reproduction and finally lose these capacities to again become frail and dependent. To conclude, one could state: ageing happens to cells, organs, organisms, populations, communities, society and maybe even the world at large.

4.6.2 Living Well

The current era is one of great prosperity and unique in the history of mankind. Never before have so many been around and able to reach exceptional ages. The world population has grown exponentially over the last two centuries, with growth only more recently flattening [106]. Notably, up until only one and half century ago, average life expectancy has been remarkably stable at around 45 years globally. Currently, however, in developed countries this figure has soared to over 80 for women (and slightly less in men). Over the course of a few decades, this figure is expected to steadily increase to well into 90, with half the female population becoming centenarians. Ergo, of all the young women and man now roaming the streets, many will reach (thus far) exceptionally old ages. Nutrition, prevention in terms of public hygiene and safe fresh water supply, mass vaccination, social changes and more recently the advances of modern medicine have contributed to conditions enabling a very long lifespan [107]. And mankind lived happily ever after, or do they?

So far so good it seems, but where is the catch? There are in fact several. For one, health span has not increased at the same pace. Where previously many common non-communicable disorders used to have a fatal outcome or exhibited a rapidly deteriorating condition not compatible with continued survival, nowadays, many of these disorders have indeed converted to chronic conditions. Individuals afflicted may have become life-long ‘patients’, yet survival is not immediately at stake, nor is quality of life or participation. The successes of modern medicine have broken the typical old age sickness patterns, i.e. a single serious disorder such as cardiovascular disease or cancer, which precludes an imminent death. However, people are becoming older and the risk of multiple diseases with loss of function is increasing. At the same time use of healthcare services will increase. Although this is not necessarily equivalent with non-participation or poor perceived quality of life, it does put a strain on individuals and society. Importantly, the increases in lifespan and particularly health span are unequally distributed across socio-economic subgroups and geographically [108]. Those who ‘have not’ may envy those who ‘have’, and vice versa, those who have might hold those who have not accountable for their own apparent misfortune. In the meantime, medicine and society have really changed the game of reproduction [106, 109]. Fertility rates (births per women) have halved over the last half century to figures below 2 in many places around the world, i.e. below the replacement rate. In the old days with many young and few old (4 or 5 to 1), the latter becoming frail and dependent was resolved without much strain to society. Nowadays, this so-called old age dependency ratio is dropping to ultimately 2 or less to 1 [110], and that now is something completely different.

The challenge is not ageing as such but to do so healthily and thus remain independent and capable of contributing for a much greater part of the lifespan, i.e. for

health span to catch up with lifespan. Apparently, compared to the average person, individuals identified as master athletes do manage to maintain exceptional health spans [111, 112]. Part of the explanation may be the long period of high level physical exercise and subsequent continued habit of healthy nutrition and exercise. Since, it was not accidental that, alternative explanations such as genes coding for athletic mastery may also contain the code for long health span. Also, for all practical purposes, one might question the feasibility of entire populations rather than exceptional individuals becoming master athletes. Nevertheless, the message that health span is not something fixed and predetermined is crucial.

4.6.3 Blue Zones

Interestingly, there appear to be several unique places around the world where populations rather than specific individuals have achieved the combination of both long lifespan and health span. These places have been casually called ‘blue zones’ (BZ), simply because they were initially marked on the map with a blue pen [113]. Although seemingly very interesting from a demographic and epidemiologic perspective, reports on studies on BZs are scanty and difficult to compare to mainstream literature. The concept is, however, hugely popularized by Buettner, who first reported on ‘The Secrets of Long Life’ in the *National Geographic* magazine in 2005.

Blue zone: To be identified as a longevity hotspot, i.e. a location where the number or in fact prevalence of centenarians is extraordinary high, all the administrative data to support alleged claims of extreme longevity have to be scrutinized. Thus far several places with initial claims have been exposed as false, as the records of apparent longevity were based on exaggeration. In the meantime several spots have been documented as places where indeed people appear to live considerably longer than their peers [113, 114]. These BZs (Ogliastra in Sardinia, Okinawa in Japan, the Nicoya peninsula in Costa Rica and the island of Ikaria in Greece) are located around the world in geographically or historically secluded areas, where modern lifestyle and technology had for a long time not or hardly penetrated daily living. Traditional ways of living were either part of local habitat and/or maintained as valued culture. There was no ‘grand design’ or deliberate manipulation of circumstances according to a theory of healthy living. Rather, BZs may be considered late nineteenth- and early twentieth-century ‘natural experiments’ that could have taken place anywhere; yet, the favourable circumstances coinciding for long periods of time make them extremely rare. The cohorts born those days in what are now known as BZs had limited reason or opportunity to move to other in hindsight less favourable places. As a result their living conditions and way of life have remained remarkably stable throughout their entire long lives.

The ‘secret’ emerging, however, seems apparently simple and straightforward. A clear factor is strenuous physical activity maintained at all ages. For the Sardinian men in Ogliastra, this meant walking up and down steep terrain during their generally steadfast agro-pastoral working days. Their peers living in less uneven areas of

Sardinia did not profit from this natural exercise challenge and, correspondingly, reached less exceptional ages. In the other BZs, mechanization of crafts and activities did not occur for this generation, and as a result they too have maintained high levels of manual labour and exertion. Other characteristics the older generations of populations residing in BZs had in common are low levels of stress from social defeat and exclusion, i.e. the type of stress individuals experience due to insubordinate positions and disadvantageous extraneous factors one has no control over. On the contrary, BZs are characterized by inclusive communities where every individual, and his or her contribution, is valued, giving a strong sense of purpose to being. Thus family and community support are omnipresent, the self-determined outlook is positive and stress is low.

Furthermore, moderate calorie intake, traditional diets low on animal protein and saturated fatty acids, while high on locally often self-grown legumes, come with the heritage of BZs. The term Mediterranean diet has gained recognition since the 1960s in the twentieth century, but apparently nutrition wise similarly healthy dietary patterns were common in quite distinct parts of the world now known as BZs [115]. Finally, the lifestyle emerging from the reports on BZs is also clear on alcohol and tobacco. The first is used in moderation, while the latter is alluded to as low. What clearly comes out is the fact that yet exceptional life-long combinations of physical exertion, absence of stress from defeat, social inclusion, a healthy diet and no tobacco seem to do it. Need we say more?

4.6.4 Public Health Implications

BZs came to the attention through an exceptionally high number and/or prevalence of centenarians, who appear to be exceptions to the rule of human longevity. This raises questions about what generalizable principles apply. Also, the course of life of cohort members, the others of their generation, and that of the subsequent generations, the offspring may convey important lessons. In terms of morbidity, members of the same generation, who also remained life-long inhabitants of BZs, appear to have profited from those favourable circumstances as well. Much like the individualistic master athletes mentioned before, they managed to experience long lifespans and health spans with compressed morbidity, albeit not until their 100th birthday [111, 116]. Conversely, those who moved to other areas often did not manage to take along the 'potion', nor did many of the next generations who for education, vocation or other reasons moved away and did not manage to maintain the traditional ways but instead diluted those with modern ways of living. As they blend in, so do their life and health courses, which might be interpreted as ruling out or at least reducing the likelihood of a simple genetic predisposition for longevity. Thus, although the secret is simple, the general and enduring implementation thereof at population level is extremely rare and appears to only have come about unintentionally. Indeed, epidemiologic studies conducted during the last half of the twentieth century have time and again corroborated the beneficial effects that individual lifestyle factors so miraculously concurring in BZs have. Simple policies to achieve

changes in single factors have mostly proven futile in the long run, particularly for those in lower socio-economic subgroups who are most vulnerable [117, 118]. So far, effective population health management policies designed to purposefully accomplish a BZ are lacking. Clearly it would take huge political effort and public engagement to attain the changes required in lifestyle and social and economic circumstances. Interestingly, Iceland having launched an audacious nationwide and apparently successful youth health policy sets a remarkably Blue example [119]. Over a period of 20 years, they have managed to reduce drunkenness, smoking and hashish use by a factor of 8, 10 and 8, respectively, i.e. all to levels well below 5% among 15- and 16-year-old students.

In conclusion, it seems fair to conclude that BZs are fascinating natural experiments that deserve more study, particularly with regard to the ‘natural’ way a healthy constellation of lifestyle and social factors came about and was maintained. Many public health interventions and experiments have started from notions about highly prevalent risk factors, and how to reduce these through individual or population based approaches. The effects on narrowing the gap between lifespan and health span were mixed, particularly for lower socio-economic subgroups. Importantly, a single ‘silver bullet’ has never been identified and most likely never will. The making of a BZ will take long-term commitment and huge multifaceted effort, but everyone can start, and paraphrasing Gandhi ‘we could try to be the change we wish to see in the world’.

References

1. World Health Organization. WHO definition of health. The preamble of the Constitution of the World Health Organization; 1948. <https://doi.org/10.1016/B978-012466044-1/50296-9>.
2. Huber M, Knottnerus JA, Green L, Horst H v d, Jadad AR, Kromhout D, Leonard B, Lorig K, Loureiro MI, van der Meer JWM, Schnabel P, Smith R, Weel C v, Smid H. How should we define health? *Br Med J*. 2011;343:d4163. <https://doi.org/10.1136/bmj.d4163>.
3. Sturmberg JP. The personal nature of health. *J Eval Clin Pract*. 2009;15:766. <https://doi.org/10.1111/j.1365-2753.2009.01225.x>.
4. Bengel J, Strittmatter R, Willmann H. What keeps people healthy? The current state of discussion and the relevance of Antonovsky’s salutogenetic model of health. Cologne: Federal Centre for Health Education—FCHE; 1998.
5. Madden R, Ferreira M, Einfeld S, Emerson E, Manga R, Refshauge K, Llewellyn G. New directions in health care and disability: the need for a shared understanding of human functioning. *Aust N Z J Public Health*. 2012;36:458–61. <https://doi.org/10.1111/j.1753-6405.2012.00889.x>.
6. Stein MA, Stein PJS, Weiss D, Lang R. Health care and the UN disability rights convention. *Lancet*. 2009;374:1796–8.
7. Sturmberg J, Martin C, Moes M. Health at the center of health systems reform: how philosophy can inform policy. *Perspect Biol Med*. 2010;53:341–56.
8. Wade DT, Halligan P. New wine in old bottles: the WHO ICF as an explanatory model of human behaviour. *Clin Rehabil*. 2003;17:349–54. <https://doi.org/10.1191/0269215503cr619ed>.
9. Antonovsky A. Unraveling the mystery of health. How people manage stress and stay well. 1st ed. San Francisco, CA: Jossey-Bass; 1987.

10. Adler RH. Engel's biopsychosocial model is still relevant today. *J Psychosom Res.* 2009;67:607–11. <https://doi.org/10.1016/j.jpsychores.2009.08.008>.
11. Eriksson M, Lindström B. Validity of Antonovsky's sense of coherence scale: a systematic review. *J Epidemiol Community Health.* 2005;59:460–6. <https://doi.org/10.1136/jech.2003.018085>.
12. Tan KK, Chan SWC, Wang W, Vehviläinen-Julkunen K. A salutogenic program to enhance sense of coherence and quality of life for older people in the community: a feasibility randomized controlled trial and process evaluation. *Patient Educ Couns.* 2016;99:108–16. <https://doi.org/10.1016/j.pec.2015.08.003>.
13. Antonovsky A. The salutogenic model as a theory to guide health promotion. *Health Promot Int.* 1996;11:11–8.
14. Becker CM, Glascoff MA, Felts WM. Salutogenesis 30 years later: where do we go from here? Origins of Salutogenesis. *Int Electron J Health Educ.* 2010:25–32.
15. Lezwijn J, Vaandrager L, Naaldenberg J, Wagemakers A, Koelen M, van Woerkum C. Healthy ageing in a salutogenic way: building the HP 2.0 framework. *Health Soc Care Community.* 2011;19:43–51. <https://doi.org/10.1111/j.1365-2524.2010.00947.x>.
16. Zeyer A. Salutogenesis and pathogenesis - a change of paradigm viewed from the standpoint of modern physics. *Sozial-Und Praventivmedizin.* 1997;42:380–4. <https://doi.org/10.1007/Bf01318613>.
17. Engel GL. The clinical application of the biopsychosocial model. *Am J Psychiatry.* 1980;137:535–44.
18. Engel GL. The need for a new medical model: a challenge for biomedicine. *Science.* 1977;196:129–36.
19. Wade DT, Halligan PW. The biopsychosocial model of illness: a model whose time has come. *Clin Rehabil.* 2017;31:995–1004. <https://doi.org/10.1177/0269215517709890>.
20. World Health Organization, editor. International classification of functioning, disability and health: ICF. 1st ed. Geneva: World Health Organization; 2001.
21. World Health Organization. International statistical classification of diseases and related health problems. 10th Revision (ICD-10). Geneva: World Health Organization; 1992.
22. Bickenbach J, Cieza A, Rauch A, Stucki G. ICF Core Sets; manual for clinical practice. 1st ed. Göttingen: Hogrefe; 2012.
23. Muller R, Geyh S. Lessons learned from different approaches towards classifying personal factors. *Disabil Rehabil.* 2015;37:430–8. <https://doi.org/10.3109/09638288.2014.923527>.
24. Lollar DJ, Simeonsson RJ. Diagnosis to function: classification for children and youths. *J Dev Behav Pediatr.* 2005;26:323–30.
25. Steiner WA, Ryser L, Huber E, Uebelhart D, Aeschlimann A, Stucki G. Use of the ICF model as a clinical problem-solving tool in physical therapy and rehabilitation medicine. *Phys Ther.* 2002;82:1098–107.
26. Chen H, Katz PP, Eisner MD, Yelin EH, Blanc PD. Health-related quality of life in adult rhinitis: the role of perceived control of disease. *J Allergy Clin Immunol.* 2004;114:845–50. <https://doi.org/10.1016/j.jaci.2004.07.008>.
27. Sharma L, Cahue S, Song J, Hayes K, Pai YC, Dunlop D. Physical functioning over three years in knee osteoarthritis—role of psychosocial, local mechanical, and neuromuscular factors. *Arthritis Rheum.* 2003;48:3359–70. <https://doi.org/10.1002/art.11420>.
28. Stallinga, H.A. Human functioning in health care. Application of the International Classification of Functioning, Disability and Health (ICF). Groningen: University of Groningen; 2015.
29. Stucki G, Grimby G. Applying the ICF in medicine. *J Rehabil Med.* 2004;36:5–6.
30. Kostanjsek N. Use of the International Classification of Functioning, Disability and Health (ICF) as a conceptual framework and common language for disability statistics and health information systems. *BMC Public Health.* 2011;11(Suppl 4):S3.
31. Spreyermann R, Luethi H, Michel F, Baumberger ME, Wirz M, Maeder M. Long-term follow-up of patients with spinal cord injury with a new ICF-based tool. *Spinal Cord.* 2011;49:230–5. <https://doi.org/10.1038/sc.2010.93>.

32. Jeune B, Bronnum-Hansen H. Trends in health expectancy at age 65 for various health indicators, 1987–2005, Denmark. *Eur J Ageing*. 2008;5:279–85.
33. Sherman H, Forsberg C, Karp A, Tornkvist L. The 75-year-old persons' self-reported health conditions: a knowledge base in the field of preventive home visits. *J Clin Nurs*. 2012;21:3170–82.
34. Kim SH. Older people's expectations regarding ageing, health-promoting behaviour and health status. *J Adv Nurs*. 2009;65:84–1.
35. Kim S-Y, Sok SR. Relationships among the perceived health status, family support and life satisfaction of older Korean adults. *Int J Nurs Pract*. 2012;18:325–31.
36. Wu T-Y, Chie W-C, Kuo K-L, Wong W-K, Liu J-P, Chiu S-T, Cheng Y-H, Netuveli G, Blane D. Quality of life (QOL) among community dwelling older people in Taiwan measured by the CASP-19, an index to capture QOL in old age. *Arch Gerontol Geriatr*. 2013;57:143–50.
37. Netuveli G, Wiggins RD, Hildon Z, Montgomery SM, Blane D. Quality of life at older ages: evidence from the English longitudinal study of aging (wave 1). *J Epidemiol Community Health*. 2006;60:357–63.
38. Hsu HC, Tung HJ. What makes you good and happy? Effects of internal and external resources to adaptation and psychological well-being for the disabled elderly in Taiwan. *Aging Ment Health*. 2010;14:851–60.
39. Sims RV, Ahmed A, Sawyer P, Allman RM. Self-reported health and driving cessation in community-dwelling older drivers. *J Gerontol A Biol Sci Med Sci*. 2007;62:789–93.
40. Rodriguez-Blazquez C, Forjaz MJ, Prieto-Flores M-E, Rojo-Perez F, Fernandez-Mayoralas G, Martinez-Martin P. Health status and well-being of older adults living in the community and in residential care settings: are differences influenced by age? *Aging Ment Health*. 2012;16:884–91.
41. Cohen-Mansfield J, Jensen B. Adequacy of spouses as informants regarding older persons' self-care practices and their perceived importance. *Fam Syst Med*. 2007;25:53–67.
42. Janlov AC, Hallberg I, Petersson K. Care managers' view of family influence on needs assessment of older people. *Scand J Caring Sci*. 2011;25:243–52.
43. Hoy B, Wagner L, Hall EOC. Self-care as health resource of elders: an integrative review of the concept. *Scand J Caring Sci*. 2007;21:456–66.
44. Donahue M, Piazza I, Griffin M, Dykes PC, Fitzpatrick JJ. The relationship between nurses' perceptions of empowerment and patient satisfaction. *Appl Nurs Res*. 2008;21:2–7.
45. American College of Sports Medicine, Chodzko-Zajko WJ, Proctor DN, Fiatarone Singh MA, Minson CT, Nigg CR, et al. American College of Sports Medicine position stand. Exercise and physical activity for older adults. *Med Sci Sports Exerc*. 2009;41(7):1510–30.
46. World Health Organization. Global recommendations on physical activity for health. Geneva: WHO; 2010.
47. Sun F, Norman IJ, While AE. Physical activity in older people: a systematic review. *BMC Public Health*. 2013;13(6):449.
48. Cavill N, Kahlmeier S, Racioppi F. Physical activity and health in Europe: evidence for action. Copenhagen: WHO; 2006.
49. Bouchard C, Shepard RJ. Physical Activity, fitness and health: the model and key concepts. In: Bouchard C, Shepard RJ, Stevens T, editors. *Physical activity, fitness and health: International Proceedings and Consensus Statement*. Champaign, IL: Human Kinetics; 1994.
50. Warburton DE, Nicol CW, Bredin SS. Health benefits of physical activity: the evidence. *CMAJ*. 2006;174:801–9.
51. Theou O, Stathokostas L, Roland KP, Jakobi JM, Patterson C, Vandervoort AA, et al. The effectiveness of exercise interventions for the management of frailty: a systematic review. *J Aging Res* 2011:569194.
52. Mangione KK, Miller AH, Naughton IV. Cochrane review: improving physical function and with progressive resistance strength training in older adults. *Phys Ther*. 2010;90(12):1711–5.
53. Lambert CP, Wright NR, Finck BN, Villareal DT. Exercise but not diet-induced weight loss decreases skeletal muscle inflammatory gene expression in frail obese elderly persons. *J Appl Physiol*. 2008;105(2):473–8.

54. Yamaoka K, Tango T. Effects of lifestyle modification on metabolic syndrome: a systematic review and meta-analysis. *BMC Med.* 2012;10:138.
55. Kramer AF, Hahn S, Cohen NJ, Banich MT, McAuley E, et al. Aging, fitness and neurocognitive function. *Nature.* 1999;400:418–9.
56. Colcombe S, Kramer AF. Fitness effects on the cognitive function of older adults: a meta-analytic study. *Psychol Sci.* 2003;14:125–30.
57. Dougherty RJ, et al. Moderate physical activity is associated with cerebral glucose metabolism in adults at risk for Alzheimer's disease. *J Alzheimers Dis.* 2017;58:1089–97.
58. Paterson DH, Warburton DER. Physical activity and functional limitations in older adults: a systematic review related to Canada's physical activity guidelines. *J Behav Nutr Phys Act.* 2010;7:38.
59. Nunan D, Mahtani KR, Roberts N, Heneghan C. Physical activity for the prevention and treatment of major chronic disease: an overview of systematic reviews. *Syst Rev.* 2013;2:56.
60. Foster C, Hillsdon M, Thorogood M, Kaur A, Wedatilake T. Interventions for promoting physical activity. *Cochrane Database Syst Rev.* 2005;(1):CD003180.
61. Shiroma EJ, Lee IM. Physical activity and cardiovascular health lessons learned from epidemiological studies across age, gender, and race/ethnicity. *Circulation.* 2010;122:743–52.
62. Howard VJ, McDonnell MN. Physical activity in primary stroke prevention, Just Do It! *Stroke.* 2015;46:1735–9.
63. Tuomilehto J, Lindstrom J, Eriksson JG, Valle TT, Hamalainen H, Ilanne-Parikka P, Keinänen-Kiukaanniemi S, Laakso M, Louheranta A, Rastas M, Salminen V, Uusitupa M. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *N Engl J Med.* 2001;344:1343–50.
64. Boule NG, Haddad E, Kenny GP, Wells GA, Sigal RJ. Effects of exercise on glycemic control and body mass in type 2 diabetes mellitus: a meta-analysis of controlled clinical trials. *J Am Med Assoc.* 2001;286(10):1218–27.
65. Gillies CL, Abrams KR, Lamber PC, Coope NJ, Sutton AJ, Hsu RT, Khunti K. Pharmacological and lifestyle interventions to prevent or delay type 2 diabetes in people with impaired glucose tolerance: systematic review and meta-analysis. *BMJ.* 2007;334:299–302.
66. Thomas D, Elliot EJ, Naughton GA. Exercise for type 2 diabetes mellitus. *Cochrane Database Syst Rev.* 2006;(3):CD002968.
67. Moore SC, Lee IM, Weiderpass E, et al. Association of leisure-time physical activity with risk of 26 types of cancer in 144 million adults. *JAMA Intern Med.* 2016;176(6):816–25.
68. Wolin KY, Yan Y, Colditz GA. Physical activity and risk of colon adenoma: a meta-analysis. *Br J Cancer.* 2011;104(5):882–5.
69. Boyle T, Keegel T, Bull F, Heyworth J, Fritschi L. Physical activity and risks of proximal and distal colon cancers: a systematic review and meta-analysis. *J Natl Cancer Inst.* 2012;104(20):1548–61.
70. Wu Y, Zhang D, Kang S. Physical activity and risk of breast cancer: a meta-analysis of prospective studies. *Breast Cancer Res Treat.* 2013;137(3):869–82.
71. Fournier A, Dos Santos G, Guillas G, et al. Recent recreational physical activity and breast cancer risk in postmenopausal women in the E3N cohort. *Cancer Epidemiol Biomark Prev.* 2014;23(9):1893–902.
72. Schmid D, Behrens G, Keimling M, et al. A systematic review and meta-analysis of physical activity and endometrial cancer risk. *Eur J Epidemiol.* 2015;30(5):397–412.
73. Roos EM, Arden NK. Strategies for the prevention of knee osteoarthritis. *Nat Rev Rheumatol.* 2006;12:92–101.
74. Veenhof C, Huisman PA, Barten JA, Takken T, Pisters MF. Factors associated with physical activity in patients with osteoarthritis of the hip or knee: a systematic review. *Osteoarthr Cartil.* 2012;20(1):6–12.
75. Daley A. Exercise and depression: a review of reviews. *J Clin Psychol Med Settings.* 2008;15(2):140–7.
76. Mead GE, Morley W, Campbell P, Greig CA, McMurdo M, Lawlor DA. Exercise for depression. *Cochrane Database Syst Rev.* 2009;(3):CD004366.

77. Pels F, Kleinert J. Loneliness and physical activity: a systematic review. *Int Rev Sport Exerc Psychol.* 2016;9(1):231–60.
78. Hawkey LC, Thisted RA, Cacioppo JT. Loneliness predicts reduced physical activity: cross-sectional & longitudinal analyses. *Health Psychol.* 2009;28(3):354–63.
79. Hagan R, Manktelow R, Taylor BJ, Mallett J. Reducing loneliness amongst older people: a systematic search and narrative review. *Aging Ment Health.* 2014;18:683–93.
80. Stonerock GL, Hoffman BM, Smith PJ, Blumenthal JA. Exercise as treatment for anxiety: systematic review and analysis. *Ann Behav Med.* 2015;49(4):542–56.
81. Vicki S, Conn VS. Anxiety outcomes after physical activity interventions: meta-analysis findings. *Nurs Res.* 2010;59(3):224–31.
82. Bartley CA, Hay M, Bloch MH. Meta-analysis: aerobic exercise for the treatment of anxiety disorders. *Prog Neuro-Psychopharmacol Biol Psychiatry.* 2013;45:34–9.
83. Nagamatsu LS, Handy TC, Hsu CL, Voss M, Liu-Ambrose T. Resistance training promotes cognitive and functional brain plasticity in seniors with probable mild cognitive impairment. *Arch Intern Med.* 2012;172:666.
84. Sleiman SF, Rami Al-Haddad HJ, El Hayek L, Haidar EA, Stringer T, Ulja D, Karuppagounder SS, Holson EB, Ratan RR, Ninan I, Chao MV. Exercise promotes the expression of brain derived neurotrophic factor (BDNF) through the action of the ketone body β -hydroxybutyrate. *Elife.* 2016;5:e15092.
85. Adamson JA, Ebrahim A, Hunt K. The psychosocial versus material hypothesis to observed inequalities in disability among older adults: data from the west of Scotland Twenty-07 study. *J Epidemiol Community Health.* 2006;60:974–80.
86. de Groot LCPGM, Haveman-Nies A, van de Rest O. Voeding. In: *Bijblijven*, vol. 33. Houten: BSL; 2017. p. 379–90. <https://doi.org/10.1007/s12414-017-0239-5-379>.
87. Chen H, Iinuma M, Onozuka M, Kubo K-Y. Chewing maintains hippocampus-dependent cognitive function. *Int J Med Sci.* 2015;12:502–9. <https://doi.org/10.7150/ijms.11911>.
88. Viñas BR, Barba LR, Ngo J, Gurinovic M, Novakovic R, Cavelaars A, de Groot LCPGM, van't Veer P, Matthys C, Majem LS. Projected prevalence of inadequate nutrient intakes in Europe. *Ann Nutr Metab.* 2011;59:84–95. <https://doi.org/10.1159/000332762>.
89. ter BS, Verlaan S, Hemsworth J, Mijnders DM, Schols JMGA, Luiking YC, de Groot LCPGM. Micronutrient intakes and potential inadequacies of community-dwelling older adults: a systematic review. *Br J Nutr.* 2015;113:1195–206. <https://doi.org/10.1017/S0007114515000203>.
90. Ocké MC, Buurma-Rethans EJM, de BEJ, Wilson-van den Hooven C, Etemad-Ghameshloou Z, Drijvers JJMM, Van Rossum CTM. Dutch National Food Consumption Survey Older adults 2010–2012. Bilthoven: RIVM; 2013.
91. Body Mass Index—BMI [document on the Internet]. World Health Organisation; 2018. <http://www.euro.who.int/en/health-topics/disease-prevention/nutrition/a-healthy-lifestyle/body-mass-index-bmi>. Accessed 27 Apr 2018.
92. Cederholm T, Bosaeus I, Barazzoni R, Bauer J, van Gossum A, Klek S, Muscaritoli M, Nyulasi I, Ockenga J, Schneider SM, vander Schueren MAE, Singer P. Diagnostic criteria for malnutrition. An ESPEN Consensus Statement. *Clin Nutr.* 2015;34:335–40. <https://doi.org/10.1016/j.clnu.2015.03.001>.
93. Soeters PB, Reijven PL, van Bokhorst-de van der Schueren MA, Schols JM, Halfens RJ, Meijers JM, van Gemert WG. A rational approach to nutritional assessment. *Clin Nutr.* 2008;27:706–16.
94. Overview of Dietary Reference Values for the EU population as derived by the EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA). Summary of Dietary Reference Values—version 4 (September 2017) [document on the Internet]. European Food Safety Authority; 2017. <http://www.efsa.europa.eu/en/topics/topic/dietary-reference-values-and-dietary-guidelines>. Accessed 27 Apr 2018.
95. Huber M, van Vliet M, Giezenberg M, Winkens B, Heerkens Y, Dagnelie PC, Knottnerus JA. Towards a 'patient-centred' operationalisation of the new dynamic concept of health: a mixed methods study. *BMJ Open.* 2016;6(1):e010091.

96. Manning LK. Navigating hardships in old age: exploring the relationship between spirituality and resilience in later life. *Qual Health Res.* 2013;23(4):568.
97. Wallace M, O'shea E. Perceptions of spirituality and spiritual care among older nursing home residents at the end of life. *Holist Nurs Pract.* 2007;21(6):285–9.
98. Felsmann M, Andruszkiewicz A. The opinions of health and social care professionals on important competences in caring for older people. European later life active network. 2016. www.ellan.savonia.fi.
99. World Health Organization Definition of Palliative Care. <http://www9.who.int>.
100. McSherry W, Ross L, editors. *Spiritual assessment in healthcare practice*. Keswick: M&K Update; 2010.
101. Puchalski CM, Vitillo R, Hull SK, Reller N. Improving the spiritual dimension of whole person care: reaching national and international consensus. *J Palliat Med.* 2014;17(6):642–56.
102. <http://seniorsmatter.com/religion-spirituality-older-people/>.
103. Park CL. Implicit religion and the meaning making model. *Implicit Religion.* 2011;14(4):405–19.
104. Carpenito-Moyet LJ. *Handbook of nursing diagnosis*. 15th ed. Philadelphia: Lippincott Williams and Wilkins; 2016. ISBN: 9781496338396.
105. Peterman AH, Reeve CL, Winford EC, Cotton S, Salsman JM, McQuellon R, Tsevat J, Campbell C. Measuring meaning and peace with the FACIT-spiritual well-being scale: distinction without a difference? *Psychol Assess.* 2014;26(1):127–37. <https://doi.org/10.1037/a0034805>. Epub 2013 Nov 4.
106. <https://ourworldindata.org/world-population-growth/>.
107. Christensen K, Doblhammer G, Rau R, Vaupel JW. Ageing populations: the challenges ahead. *Lancet.* 2009;374(9696):1196–208.
108. Asaria M, Doran T, Cookson R. The costs of inequality: whole-population modelling study of lifetime inpatient hospital costs in the English National Health Service by level of neighbourhood deprivation. *J Epidemiol Community Health.* 2016;70(10):990–6.
109. The World Bank. <https://data.worldbank.org/indicator/SP.DYN.TFRT.IN/?view=map>.
110. Old age dependency ratio (+65/15-64). European Commission. European Union pensions policy. 2014.
111. Lazarus NR, Harridge SDR. Inherent ageing in humans: the case for studying master athletes. *Scand J Med Sci Sports.* 2007;17(5):461–3.
112. Hewit J. How to grow old like an athlete. *World Economic Forum*; 2017.
113. Poulain M, Herm A, Pes G. The blue zones: areas of exceptional longevity around the world. *Vienna Yb Pop Res.* 2013;11:87–108.
114. Poulain M, Pes GM, Grasland C, Carru C, Ferucci L, Baggio G, Franceschi C, Deiana L. Identification of a geographic area characterized by extreme longevity in the Sardinia Island: the AKEA study. *Exp Gerontol.* 2004;39(9):1423–9.
115. Willett WC, Sacks F, Trichopoulos A, Drescher G, Ferro-Luzzi A, Helsing E, Trichopoulos D. Mediterranean diet pyramid: a cultural model for healthy eating. *Am J Clin Nutr.* 1995;61(6):1402S–6S.
116. Pes GM, Tolu F, Poulain M, Errigo A, Masala S, Pietrobelli A, Battistini NC, Maioli M. Lifestyle and nutrition related to male longevity in Sardinia: an ecological study. *Nutr Metab Cardiovasc Dis.* 2013;23(3):212–9.
117. Woodward A, Kawachi I. Why reduce health inequalities? *J Epidemiol Community Health.* 2000;54:923–9.
118. Hillier-Brown FC, Bambra CL, Cairns J-M, Kasim A, Moore HJ, Summerbell CD. A systematic review of the effectiveness of individual, community and societal level interventions at reducing socioeconomic inequalities in obesity amongst children. *BMC Public Health.* 2014;14:834.
119. Sigfusdottir ID, Kristjansson AL, Thorlindsson T, Allegrante JP. Trends in prevalence of substance use among Icelandic adolescents, 1995–2006. *Subst Abuse Treat Prev Policy.* 2008;3:12.