

Health, Demographic Change and Wellbeing

**Study for European Commission
Directorate General For Research & Innovation**

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13 June 2012

Final Draft

1. Introduction

Europe 2020 Strategy “Promoting smart, sustainable and inclusive growth” places research and innovation at its core.¹ The Strategy aims to promote smart, sustainable and inclusive growth. The Strategy, which proposes increased spending on R&D to 3% of total European GDP by 2020, is positioned as a key tool in implementing the Innovation Union² -- a flagship initiative which provides a comprehensive set of actions for improved research and innovation performance through a seamless approach.

Horizon 2020 – the Framework Programme for Research and Innovation³ is a key tool in implementing EU Innovation Flagship. Horizon 2020 brings together key funding streams for research within the European Union with a Budget of €90.4 billion (current prices) to establish a single specific programme for implementation with a single set of Rules for Participation and Dissemination.

Horizon 2020 emphasises the links between research and innovation, proposing to fund activities throughout the innovation cycle. As such, Horizon 2020 will foster public-private partnerships, emphasise involvement of SMEs throughout the R&D and innovation activities, make available risk finance for early stage projects and commercialisation of new technologies, and provide for improved intellectual property management within EU.

Horizon 2020 has identified three major focal areas for funding, namely, “Excellent Science”, “Industrial Leadership” and Actions to address “Societal Challenges”. Section Two of this paper briefly describes these three focal areas with more detailed description of the proposed activities within “Health, Demographic Change and Wellbeing” theme within the Societal Challenges area. The paper then discusses in Section Three the key contextual challenges face by the European member states, followed in Section Four by a brief overview of EU health system responses to these challenges, with gaps that need addressing. Section Five of this paper proposes a number of areas for consideration for funding within Horizon 2020 activities, and briefly compares these with the priority actions identified within Health, Demographic Change and Wellbeing theme. A sub set of the proposed areas is identified as early candidates for funding, with a brief rationale for the proposition.

2. Horizon 2020 – the Framework Programme for Research and Innovation

Horizon 2020 integrates all existing EU research and innovation funding, namely (i) the Framework Programme for Research; (ii) innovation related activities of the Competitiveness and Innovation Framework Programme, and; (iii) the European Institute of Innovation and Technology. The Horizon 2020 Framework Programme for Research and Innovation brings together the activities of the European Research Council, European Institute of Technology and Marie Curie Actions. It proposes to strengthen the joint R&D programmes developed within European Research Area and international collaborations.

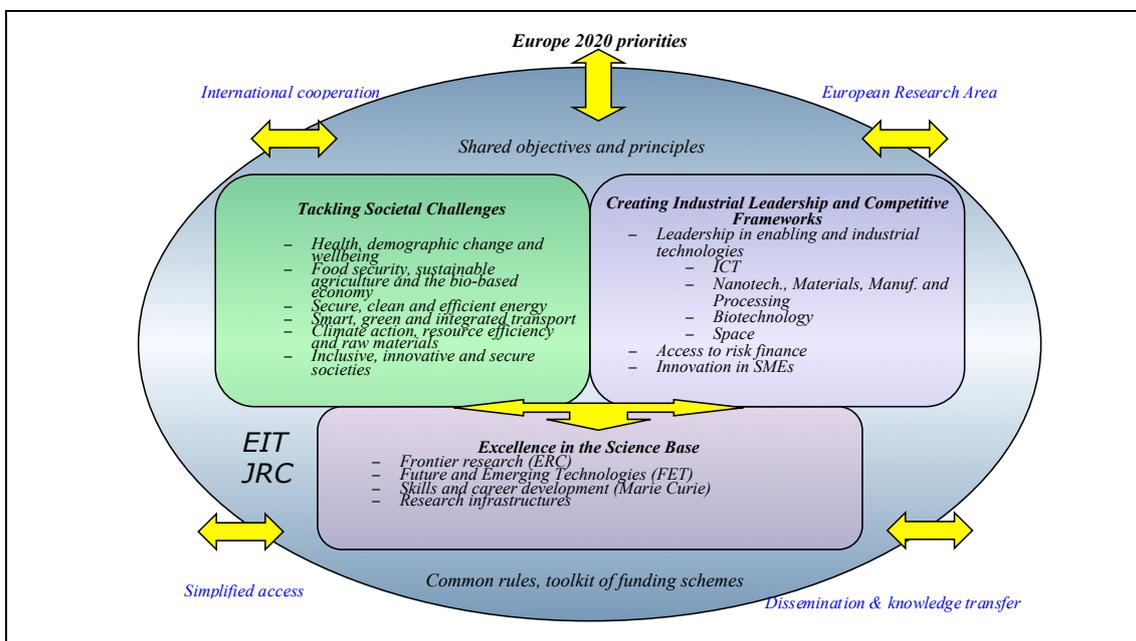
¹ Europe 2020. A strategy for smart, sustainable and inclusive growth. COM(2010) 2020

² Europe 2020 Flagship Initiative: Innovation Union. SEC (2010) 1161. COM(2010) 546

³ Communication from the Commission to the European Parliament, the Council, the European Economic And Social Committee and the Committee of the Regions. European Commission. Brussels, 30.11.2011 COM(2011) 808 final

The three key objectives within Horizon 2020 and their key elements are depicted in Figure 1.

Figure 1. Horizon 2020 Framework Programme for Research and Innovation



The first objective of Horizon 2020 will support the development of an 'Excellent Science' base in Europe. A budget of €24.6 billion is allocated to further strengthen science and innovation within the EU, thereby enabling the Union to maintain its position as a world leader in science. The budget of €24.6 billion will include: €13.2 billion for the European Research Council (ERC) that funds successful and emerging researchers working in Europe; €3.1 billion in future and emerging technologies (FET) to establish new research domain; €5.75 billion for the Marie Curie Actions for training and career development of researchers and to enhance mobility across Europe, and; €2.4 billion to establish appropriate research infrastructures and networks across Europe with improved access to these.

The second objective, 'Industrial leadership', will help position Europe as an attractive location for investment in science, business and innovation. A budget of €17.9 billion, will investments in key industrial technologies such as Information and Communication Technologies (ICT), nanotechnologies, biotechnology and space (total of €13.7 billion). It will facilitate access to risk finance, which has a high leverage on private investment and has been shown to be a very valuable tool in fighting the lack of risk capital following the financial crisis (Dedicated budget of €3.5 billion). It will also provide EU-wide support for innovation in SMEs with high growth potential.

The third objective, 'Societal challenges' has a budget of €31.7 billion and focuses on six major issues that affect the lives of European citizens, including:

- i. Health, demographic change and wellbeing;
- ii. Food security, sustainable agriculture, marine and maritime research and the bio-based economy;
- iii. Secure, clean and efficient energy;
- iv. Smart, green and integrated transport;
- v. Climate action, resource efficiency and raw materials, and;

vi. Inclusive, innovative and secure societies

A funding envelope of €9.077 billion has been earmarked for the first societal challenge “Health, demographic change and wellbeing”, the largest amount for the six societal challenges. This challenge is further discussed below.

2.1. Health, Demographic Change and Wellbeing

2.1.1. Health and Wellbeing

Health is the complete of status of physical, mental and social wellbeing and not only the absence of disease or infirmity as defined by the World Health Organization.

Interventions to improve health and wellbeing need to be multisectoral and holistic in nature to address the determinants in the broad context and within health and social care systems. This can only be achieved through investment in innovations aimed at addressing these challenges and by creating an enabling environment to ensure timely adoption of these innovations.

There are multiple and interacting determinants of health and wellbeing. These include, inter alia: hereditary factors; the context of people’s lives – especially social, economic and physical environments; the person’s individual characteristics and behaviours, especially risk perception and risk behaviour; timely access to social and health care, and; access to novel diagnostics, health technologies and medicines.

Genetics, hereditary factors and gender substantially influence health, chances of developing certain illnesses and life expectancy. There is strong evidence to suggest **in-utero experiences** influence life chances and longevity, which are also influenced at later stages of the life cycle by **income and social status**. Higher income and social status are linked to better health, with a clear gradient from higher to lower income. **Education** is a key determinant of health and wellbeing. People with lower education levels have poorer health and wellbeing.

A range of additional factors also influence health and wellbeing, including:
Physical environment – particularly gradual changes and extreme conditions induced by climate change, air pollution, toxins, sanitary hygiene, crowding, urban design, and transport systems;
Employment and working conditions, the workplace environment (and safety);
Risk perception and risk behaviour – which in turn influence dietary habits, active or sedentary lifestyles, alcohol intake, smoking, substance use and sexual practices;
Coping skills, in relation to life stressors;
Community, family and social support networks to manage – greater support from families, friends and communities is linked to better health;
Health and social care systems – access to affordable systems for prevention, diagnosis and treatment influences health outcomes, and;
New health technologies, diagnostics, medicines, also substantially impact on health outcomes and wellbeing if these technologies are accessed in a timely manner.

Given the multiple and interacting factors which influence health and wellbeing within the context of rapid globalisation, R&D investments to address these factors should foster multisectoral, multidisciplinary and holistic research approaches that bring together environment, health and socio-economic and basic research. Rapid globalisation, increased migration, expansion of travel, wide uptake of

communication technologies across the world, and increased connectivity means more requires cross border collaborations to address evolving epidemics. Hence, R&D investments within Horizon 2020 should emphasise regional and global solutions that extend beyond the EU. There are good examples of multi-country collaborations such as the European and Developing Countries Clinical Trials Partnership (EDCCTP) that provide excellent platforms to build on and to expand.

A holistic view of the innovation cycle is critical to timely development and deployment of novel solutions. Holistic development across the innovation cycle requires R&D investments for “delivery of innovation and innovation of delivery”. Hence, R&D funding in the area of “Health, Demographic Change and Wellbeing” should foster technological innovations along with institutional innovations in health and social care systems to expand access to these novel technologies. In particular, structural changes, new financing methods and incentives are needed in health and social care systems to accelerate uptake of new innovations.

2.2. Priority Activities for Health, Demographic Change and Wellbeing

Horizon 2020 has identified 16 priority activities in “Health, Demographic Change and Wellbeing” element of the Social Challenges objective. These priority activities are shown below, with a more detailed breakdown appended in Annex 1.

- i. Understanding the determinants of health (including environmental and climate related factors), improving health promotion and disease prevention;
- ii. Developing effective screening programmes and improving the assessment of disease susceptibility;
- iii. Improving surveillance and preparedness;
- iv. Understanding disease;
- v. Developing better preventive vaccines;
- vi. Improving diagnosis;
- vii. Using in-silico medicine for improving disease management and prediction;
- viii. Treating disease;
- ix. Transferring knowledge to clinical practice and scalable innovation actions;
- x. Better use of health data;
- xi. Improving scientific tools and methods to support policy making and regulatory needs;
- xii. Active ageing, independent and assisted living;
- xiii. Individual empowerment for self-management of health;
- xiv. Promoting integrated care;
- xv. Optimising the efficiency and effectiveness of healthcare systems and reducing inequalities through evidence based decision-making and dissemination of best practice, and innovative technologies and approaches.
- xvi. Specific implementation aspects

The proposed activities in the Horizon 2020 are extensive. These range from basic scientific research to applied research to understand the basis and determinants of disease and to develop new diagnostics, vaccines, and medicines.

The proposed activities are not disease specific and include new approaches to improve efficiency of clinical trials, the establishment of integrated data management platforms and improved scientific methods for analysis of large data sets to ascertain safety, efficacy, and quality of new health technologies.

Applied research is proposed for improving health service delivery, developing solutions for assisted living, improving self-management of chronic illnesses and for introduction and scale up of novel service delivery solutions for long-term care. Research activities also include new approaches to optimise efficiency and effectiveness of health systems, and for disease surveillance.

We briefly examine below key contextual changes in Europe affecting health, demography and wellbeing. This analysis is used to identify a number of additional and complimentary activities currently not presented in the Health, Demographic Change and Wellbeing element of the Societal Challenges objective and should be considered for funding.

3. Key Contextual Changes in Europe Affecting Health and Wellbeing

3.1. Demographics

Increased life expectancy, combined with reduced fertility rate below the replacement level means an ageing European population, with rapid increase in the population aged more than 80 years. The demographic changes will lead to a decline in the number of young and economically active population (15-64 year old) and a worsening total economic dependency ratio⁴ to levels that are not sustainable.

3.2. Economic Challenges

Economic crisis means rising unemployment, low GDP growth with lower tax receipts, rising long-term public and private debt, fiscal imbalance – requiring fiscal retrenchment with pressure to reduce publicly funded health and social care. Simultaneously, a crisis in the pensions system means lower pension support to the retired populations.

The crisis has meant increased unemployment, homelessness and reduced access to health services, with a rise in mental illness, risk behaviour, malnutrition, homelessness and overcrowded living conditions – all adversely affecting health and well being.

3.3. Political and socio-cultural changes

In many European cities loss of family and community cohesion and changing social relations – exacerbated by gentrification and high unemployment in disadvantaged populations – have led to isolation of lower socio-economic income groups, single mothers and the elderly. The economic crisis and unemployment has led to a polarisation of electorate in European countries – with the rise in radical right and left – further exacerbating these social divisions.

Increased migration has produced ghettoisation in many settings, with social and geographic isolation of migrant groups and poor access to health and social services.

Sedentary lifestyles and ‘fast-food culture’ have led to a rapid rise in obesity, especially among children.

⁴ The ratio measures the total ‘inactive’ population (total population less persons employed) as a percentage of persons employed to indicate the average number of people each economically active person ‘supports’.

3.4. Epidemiological Changes

Demographic changes have been followed by an epidemiological transition and polarisation – with a large increase in the absolute and relative burden of cardiovascular diseases (hypertension, coronary heart disease and cerebrovascular disease), diabetes mellitus, cancer, mental illness, Alzheimer's, senile dementia and physical disability related to ageing. Confluence of multiple non-communicable diseases (NCDs) has produced a large population group with multiple co-morbidities, placing very high demands on social-care and health systems.

Migration, economic hardship and widening inequalities among socio-economic groups have produced epidemiological polarisation, with increased concentration of communicable diseases (such as tuberculosis and HIV) and NCDs in poorer marginalised groups.

3.5. Ecological and environmental changes

Climate change is leading to gradual change in weather patterns with global warming, and to increased risk of extreme and unusual weather and environmental conditions (such as heat waves, lengthy cold spells, prolonged droughts, and floods) affecting especially the old and vulnerable populations living in crowded cities. Climate change with global warming has also increased the risk of rise in vector borne diseases.

Increased use of genetically modified foods, greater consumption of highly processed foods and animal produce from antibiotic-treated animals, and a rise in exposure to non-ionising radiation and toxins will likely affect health and well being. However, the long-term effects of these environmental stressors are unknown.

4. Health System Preparedness for Contextual Changes

4.1. Impact of Ageing on Health Systems

The pure demographic effect of an ageing population (at constant health) will lead to an increase in health care spending by between 1 and 2% of GDP in most EU Member States – translating to an approximately a 25% increase in spending on health care as a share of GDP. The projected increase in healthcare expenditure can be halved if healthy life expectancy (falling morbidity rates) evolves in line with change in age-specific life expectancy. Hence, healthy ageing and wellbeing are critical for containing excessive healthcare expenditures.

4.2. Health System Governance

Poor intersectoral governance of health and social care systems in Europe limit the effectiveness of the responses to long-term illnesses such as NCDs. Flaws in organisational design and provider payment systems that reward reactive treatment of sickness rather than effective management of health (see sections 4.3 and 4.4) have led to suboptimal responses to emerging challenges.

Low user involvement in decision making – especially of elderly and marginalised groups – limited user choice and lack of mobility in entitlements have hindered efforts to develop user centred services.

4.3. Health System Organisation and Service Delivery

European health systems are characterised by biomedically oriented hospital-centric services, designed largely for reactive management of acute illness and not for management long-term illnesses that account for almost 80% of the disease burden. With the exception of a few countries, primary and community care systems are weak. Service delivery models do not place enough emphasis on mitigating risks of comorbidities in individuals, communities and populations.

4.4. Health System Financing

Financing systems reward hospitalisation and management of acute illness rather than prevention. Recent declines in vaccination levels are particularly concerning.

There are limited incentives to adopt innovations (new vaccines, medicines, health technologies, behavioral and marketing innovations) that promote good health, sustain wellbeing and proactively mitigate risks of co-morbidity. The uptake of reverse innovations from global health tends to be poor.

5. Research and Development Activities to Address Emerging Challenges

Drawing on the analysis of contextual changes, and the currently proposed activities within the Health, Demographic Change and Wellbeing Element of the Societal Challenges we propose a set of activities to fill R&D gaps which currently exist in Horizon.

In particular, we propose a set of priority activities for the first call for Horizon 2020 in 2014, targeting non-communicable diseases and key infections affecting Europe; establishment of Global Health research capability (including basic research and clinical trials); and the creation of integrated environment and health observatories that bring together multidisciplinary research groups to assess how climate and environmental changes affect evolution and progression of key diseases. We also propose establishment of new approaches that incorporate bioethics into research and care delivery decisions. The proposed activities are elaborated below.

5.1. Activity 1: Molecular, Metabolic, Genetic and Environmental Basis of Key NCDs and Infections and their progression

Multidisciplinary research networks* to establish longitudinal studies using biobanks, socio-economic and environmental data to understand in different sub-populations;

- how molecular, metabolic and genetic determinants of NCDs (cancers, diabetes, cardiovascular disease, mental illness) and key infections are influenced by nutritional, environmental, socio-economic, educational and behavioural factors along the life cycle;
- emergence of multiple NCD co-morbidities and their progression when confluent;
- hospital acquired drug resistant infections (E. Coli; C. Difficile; MR Staph Aureus).

*Including molecular biology; genomics; proteomics; structural biology; immunology; metabolomics; microbiology; photonics; and systems biology.

5.2. Activity 2: Identify and Address Factors that Influence Risk Behaviours for NCDs and Obesity

Interdisciplinary longitudinal multi-country studies to:

- identify how environmental, socio-economic, educational, family, nutritional, employment, migration, life-experiences, peer-networks, social media, popular media and the interaction of these along the life cycle influence risk behaviour for obesity and key NCDs
- design, implement and evaluate impact of novel interventions at individual, community and population level to modify risk factors and risk behaviour for obesity and NCDs.

5.3. Activity 3: Accelerating Development of New Medicines, Health Technologies and Diagnostics for NCDs

Improve efficiency of discovery to commercialisation value chain to:

- develop targeted treatments for populations with different expression and progression of NCDs – especially cancer and cardiovascular disease – influenced by genotype and phenotype characteristics and environmental exposures;
- design new technologies for near patient testing, remote sensing and monitoring of NCDs.

5.4. Activity 4: Global Health Research

Establish global research networks to:

- expand clinical trials, building on EDCCTP, for neglected diseases, vaccine preventable diseases, HIV, TB, MDR-TB, malaria and NCDs;
- undertake comparative health systems research on innovative delivery approaches prevention, treatment and care;
- understand barriers and enablers to uptake of health innovations;
- quantify how economic crisis impacts nutrition, risk behaviour, health, wellbeing and social protection of European and LMIC citizens;
- evaluate effectiveness and impact of donor-financed health programmes.

5.5. Activity 5: Innovative Health System Design

Multidisciplinary research that uses communication, neuroscience, behavioral science and behavioral economics to design financing and service delivery interventions:

- for promoting health through behavioral change;
- for risk based management of multiple NCD co-morbidities in primary care and home settings, including through remote monitoring and sensing;
- multisectoral interventions at community level – such as safe communities – to improve social cohesion and reduce isolation of elderly and migrant populations;
- to improve uptake of new diagnostics, medicines, vaccines and health service innovations;
- to effectively respond to extreme events, such as terrorist attacks, epidemics, heat waves and floods.

5.6. Activity 6: Integrated Environment and Health Observatories

Establish multidisciplinary* environmental observatories to:

- identify and map environmental determinants of NCDs and key communicable diseases, and their influence on disease progression;
- develop models for predicting extreme environmental events;
- design tools for assess health system preparedness for extreme environmental and climate events.

* Including biology, genetics, biochemistry, physics, bioengineering, epidemiology, computing, mathematics, environmental science and clinical medicine.

5.7. Activity 7: Bioethics

Development of new approaches to incorporate bioethics in:

- resource allocation decisions;
- basic and translational research;
- use of human tissue, personal genetic, behavioural and socio-economic data in health research;
- global health research.

Annex 1

Table 1. Priority Areas for Health, Demographic Change and Wellbeing

Priority	Key activities
1. Understanding the determinants of health (including environmental and climate related factors), improving health promotion and disease prevention;	<ul style="list-style-type: none"> • Understanding and integrating environmental, behavioural, socio-economic and genetic factors. • Long-term study of cohorts with linkage to –omics. • Integrated molecular biological, epidemiological and toxicological approaches to investigate health-environment relationships. • Exposure assessment with novel biomarkers
2. Developing effective screening programmes and improving the assessment of disease susceptibility	<ul style="list-style-type: none"> • Early biomarkers of risk and disease onset • Identifying populations at high-risk disease for personalised, stratified and collective intervention strategies.
3. Improving surveillance and preparedness	<ul style="list-style-type: none"> • Improved surveillance and early warning networks for emerging infections, effects of climate change, drug resistance.
4. Understanding disease	<ul style="list-style-type: none"> • Translational research on pathophysiology of disease. • Reclassification of normal variation and disease using molecular data. • Long term cohort studies with integrated databases and biobanks.
5. Developing better preventive vaccines	<ul style="list-style-type: none"> • Translational research and clinical trials for effective preventive vaccines for an expanded range of disease
6. Improving diagnosis	<ul style="list-style-type: none"> • New and more effective diagnostics – especially to enable more patient adapted treatment
7. Using in-silico medicine for improving disease management and prediction	<ul style="list-style-type: none"> • Systems medicine and physiological modelling to predict susceptibility to disease, disease evolution and likely success of treatments
8. Treating disease	<ul style="list-style-type: none"> • Regenerative medicine, transplantation, gene and cell therapy • Medical and assistive devices and systems • Comprehensive approaches to treat co-morbidities
9. Transferring knowledge to clinical practice and scalable innovation actions	<ul style="list-style-type: none"> • Methods to allow for clinical trials to focus on relevant population groups • Use of electronic health records and databases for clinical trials

10. Better use of health data	<ul style="list-style-type: none"> Integrated infrastructures and information systems. Improved data standardisation, interoperability and sharing for knowledge management, modelling and visualisation
11. Improving scientific tools and methods to support policy making and regulatory needs	<ul style="list-style-type: none"> Tools, methods and statistics for rapid, accurate and predictive assessment of the safety, efficacy and quality of new drugs, biologics, advanced therapies and medical devices. Risk assessment methods, testing approaches and strategies relating to health
12. Active ageing, independent and assisted living	<ul style="list-style-type: none"> Multidisciplinary, advanced and applied research and innovation with behavioural, gerontological digital and other sciences to enhance quality of life and human functionality
13. Individual empowerment for self-management of health	<ul style="list-style-type: none"> Technologies and approaches to improve personalised and self-care, wellbeing and healthy lifestyle
14. Promoting integrated care	<ul style="list-style-type: none"> Management of chronic illnesses outside institutions through novel solutions including tele-health and tele-care services
15. Optimising the efficiency and effectiveness of healthcare systems and reducing inequalities through evidence based decision making and dissemination of best practice, and innovative technologies and approaches	<ul style="list-style-type: none"> Health technology assessment and health economics, gathering evidence and dissemination of best practices and innovative technologies. Comparative analyses of health system reforms. Analysis of future health workforce Actions to reduce inequalities
16. Specific implementation aspects	<ul style="list-style-type: none"> Knowledge and technology transfer to large scale demonstration actions, leading to scalable solutions for Europe

5.8. Heading

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