ADVICE FOR 2016/2017 OF THE HORIZON 2020 ADVISORY GROUP FOR SOCIETAL CHALLENGE 1, "HEALTH, DEMOGRAPHIC CHANGE AND WELLBEING"

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7) Sustainable health and care systems

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The group recommends focusing on quality in the design of programmes, calls and the peer review process with the use of "best practice" and an open, transparent methodology.

1. Ageing at large

Understanding ageing and quantitative evaluation:

➢ Investigation of the underlying causes (e.g. molecular, physiological and physiopathological, socio-economic) for the diversity in healthy life years across Europe, employing both subjective and objective indicators of health and wellbeing from longitudinal population studies.

➢ Research into behavioural and biological markers which could provide early signals of risk and/or deterioration and trigger intervention from longitudinal and cohort studies.

Conditions, diseases and co-morbidities in the oldest old:

➢ Analysis of and understanding diseases, especially in the oldest old in their ageing-specific dimensions.

➢ Screening of early manifestations of common geriatric syndromes in the oldest old.

➢ Treatment using personalized medical intervention in the oldest old.

➢ Understanding positive effects of active ageing and social inclusion.

Technological innovation:

➢ Research, development and piloting of tools and technological innovations (e.g. ICT, smart living environments, artificial and emotional intelligence, medical products, physical adaptations/devices, big data) that will enhance independence, social interaction, mobility, function and contribution to society, and quality of service provision.

➢ Investigation of methods to involve older and frailer people in research studies, with special attention to gender issues.

Research on health, social and environmental systems:

➢ Investigation of new systems of long-term sustainable health and care provision (building on e.g. communities, families, social services).

➢ Investigation of alternative economic models for projected need for sustainable health, social and pensions systems to better understand the societal benefits and strain of the ageing demographic. Comparison of best practices across different social and cultural contexts.

➢ Investigation of the barriers to accessing appropriate health and social care services among the older population.

➢ Research and analysis of expectations across Europe of younger generations for their future as older adults.

➢ Research to understand the long-term influence of childhood health on ageing.

2. Personalized medicine, mechanisms, system medicine, biomarkers and diagnostics

Personalized medicine should be demonstrated by applications in promotion of wellbeing, disease detection, prevention and treatment, aiming to demonstrate cost effectiveness as well as health benefit and it should be accessible to diverse populations. A more unified and systematic approach to the research and applications of personalized medicine is needed, for:

➤ Chronic multifactorial diseases affecting large sections of the population.

➤ Rare diseases, which affect very few persons individually but represent a significant societal challenge collectively.

The research should aim to establish or support a 'pipeline' needed to implement personalized medicine:

➢ Understanding diseases and their co-morbidities better at the systems and mechanistic levels. Formulating hypotheses for biomarkers or targeted interventions aimed at disease prevention or therapy.

➢ Development of tools for utilizing/extracting/sharing new knowledge in the most informative and efficient manner (e.g. molecular profiling, biotechnology, diagnostic, ICT tools) in the most appropriate personalized setting (e.g. health care system, at home). Accelerating and facilitating regulatory approval paths for new medical products for personalized medicine.

➢ Piloting the personalized medicine concept in real life settings (e.g. genetic/phenotypic screening programmes, responding to the paradigm shift in clinical trials which move away from unselected patient populations towards more individualized approaches in molecularly defined subgroups), demonstrating the health benefit and cost-effectiveness.

➢ Sharing the huge amounts of data generated in new and existing studies while ensuring confidentiality and data security, and feeding this information towards new discoveries (see above). Empowerment of the individual to manage his or her data.

An EU-wide approach to the utilization, maintenance and joining up of existing and future bio- and data-banks should be supported:

➢ There are many cohorts in Europe where individuals have been monitored and sampled over long periods of time, providing a wealth of health-related information which could now be comprehensively characterized with 'omics' technologies. By linking these studies with long term outcome data, they could become a "gold mine" for discoveries and innovation as well as for the validation of novel tools and solutions for personalized medicine.

➢ New studies should also be encouraged which collect/sample relevant medical information in longitudinal settings (health care system, workplace; also birth cohorts, natural history and epidemiological studies). Such studies will in time gather crucial information for implementing and demonstrating the power of personalized medicine.

3. ICT for health

➢ Research is needed to establish the evidence for integration of ICT for health solutions in national health systems, building on current technological infrastructure through targeted applications and focused evaluation of these applications with long-term follow-up.

➢ This should also involve technological development and innovation to bridge the gap between raw technologies and business intelligence, amounting to a technologically enabled culture shift in health care and also in lifestyle promotion and wellbeing.

A dual focus is therefore needed:

1. Focus on person-centred health care delivery, also integrating health and social care and considering the environment and community setting of the individual.

2. A separate focus on wellbeing and prevention to identify trends towards ill health and so strive to keep people away from unnecessary care and to encourage them to be proactive.

4. Population health and health promotion

We need to know more about the individual, social and political determinants of health. Knowledge about the determinants and the causal mechanisms are crucial for creating effective population-based and targeted interventions.

Focus on non-communicable diseases:

➢ Mental health disorders: Individuals with mental disorders, depression, anxiety, antisocial behavior, should be targeted and prioritized because mental illnesses contribute more to the global burden of disease in Europe than any other illnesses.

➢ Obesity is clearly another target. It carries with it all sorts of consequences and there is a lot of interest in whether these consequences are differentially related to obesity in childhood and middle adult age.

➢ Smoking among girls remains an issue and is hazardous for development and offspring.

➢ Illicit drug use and alcohol binge drinking cause concern.

➢ Social isolation among the elderly is common.

5. Infectious diseases at large

Vaccines:

➤ Research and development for vaccines against infections no longer controllable by antibiotics due to AMR, e.g., *S. aureus*, gonorrhoea, and for very specific severe emerging diseases.

➤ Vaccines for malaria

➤ Research into new vaccine platforms and/or improvement of existing ones: for multi-antigen delivery; for more comprehensive protection against strain variation; for more rapid manufacture and scaling-up to respond to events or increased demand; for improved immunogenicity and/or safety; for immunetherapeutic interventions; for greater public acceptability.

Therapeutics including anti-infectives:

➤ Discovery and development of novel antibacterial agents to treat diseases such as tuberculosis and gonorrhoea, and to control infections with *Staph. aureus* and multi-drug-resistant Enterobacteriaceae.

➤ Antivirals against influenza, respiratory syncytial virus and herpesviruses (especially HSV and CMV).

Diagnostics and host–microbial interactions:

➢ Exploration of modalities for controlling sepsis through more comprehensive understanding of signalling pathways, both for diagnosis and for intervention.

➢ Development of affordable point of care (POC) and near-patient diagnostic tests for multiple agents and capable of enabling differential diagnoses.

➢ Research to reassess the position of biomarkers for diagnostics, assessment of stage of evolution of illness, to monitor treatments, to capture interactions between communicable diseases and NCDs and/or comorbidities as well as to guide choice of therapeutic interventions.

Clinical management for diverse resource settings:

➢ Development of new approaches to clinical trial design and of new regulatory pathways.

Improving standards to support innovation:

➢ Development of standards to support public acceptance of medicines and the manufacture and sale of safe and effective medicines, vaccines and health technologies.

6. Early development

➢ Discovery and delivery research of pathways and interventions can lead to optimal development, increase resilience and mitigate the impact of biological, psychosocial and environmental risk factors.

➢ A life course perspective is needed for addressing mental health and wellbeing from childhood to older ages. There is huge heterogeneity among children in their response to the same adversity, stress and trauma. Some children are more susceptible to both negative and positive influences. Consequently, we need research examining which protective processes and adaptive systems make a difference in children's lives and change the environment for the better. Variations in the expression of vulnerability for disorders across age and gender are striking. This has to be taken into consideration when designing prevention and implementing interventions.

7. Sustainable health and care systems

Policy research:

➢ Research on uptake of existing research evidence for policy-making and on policy bottlenecks, especially those concerned with quality and patient safety.

➢ Research on Human Resources for Health Policies (e.g. education, certification, recruitment, training, retention, migration).

➢ Research on how to move from a reactive health care system to implementing proactive and sustainable population health.

Research on data management and technological change:

➢ Research on methods to analyse and interpret exponentially growing data sets.

➢ Research on approaches to enable the integration of big data in day-to-day health care management and delivery.

Implementation research:

➢ Systematic analysis and comparison, in various socio-economic and cultural contexts, of the most important determinants of effectiveness of health systems and of successful scaling up of innovations.

➢ Research on patient engagement and empowerment (e.g. health-seeking behaviour; individual patient and citizen satisfaction; attitudes and behaviours in m-Health and e-Health; training and use of new technologies; integration of civil society's needs in decision-making processes; measures of patient and health care provider satisfaction using qualitative and mixed-methods; changing relationships between health systems and professionals with patients, families and communities.

➢ Exploration of best practices towards creation of a continuous learning people-centred integrated health system including new value-based payment schemes and new leadership approaches.

➢ Research on the integration of health and social services, and community-based delivery systems, their impact on care, sustainability and new job profiles for the future.

8. Environment and health

In the challenge area of environment and health, "environment" has been defined in both small and large terms, encompassing the individual human biome to the built and natural environments to local and global environmental change, including but not limited to climate change. The following are key research actions needed in environment and human health:

➢ Explore and measure the beneficial and negative impacts, as well as the underlying mechanisms and behaviours, arising from the interactions between the environment and human health and wellbeing, taking an inter/multidisciplinary/ institutional/sector approach with stakeholder engagement and attention to social equity.

➢ Expand the use of big data to include all types of data, with innovative data "mashups" of health and environmental data linkages (including longitudinal data from existing and new databases), for the purposes of: surveillance, screening, and identification of high risk populations and inequalities; the study of "mechanisms"; the modelling different approaches and scenarios; the creation of new methods; innovation; translation to policy makers and other stakeholders; etc.

➤ Promote innovation with technology to proactively change behaviour towards more sustainable lifestyles which promote both health and wellbeing and healthy ecosystems in a world of rapid environmental change; in this area, there is much to learn from developing countries.

➤ Provide concrete "motivational" examples at different levels (i.e. individual, familial, community, regional, national, international, and global) of successful behaviour change around prevention, adaptation, mitigation and resilience in the face of continual environmental change demonstrating impacts both on health and wellbeing and on ecosystems.

➤ Move towards sustainable health/public health/social care systems which would serve not only as important exemplars of best practice, but also as sources of innovation.

Areas with the strongest potential for innovation and participation of industry and SMEs

For this Challenge, "Health, Demographic Change and Wellbeing", which is Challenge 1 in Horizon 2020 Research and Innovation Programme, the possibilities for involvement of industry and SMEs are huge. All our eight themes have great innovative potential. Innovation is a broad concept comprising new products: drugs, diagnostics, tools, surgical procedures, software and hardware for imaging, medical technology and devices and a new, large area with ICT solutions and big data. ICT solutions will be relevant throughout the chain from prevention, screening, early diagnosis and treatment, through to rehabilitation and everyday life, including for the growing number of patients with long-term, chronic diseases.

Cross-cutting and interdisciplinary activities

Interdisciplinarity and collaborative research addressing the different societal challenges is important for Horizon 2020 to ensure that the research is used to its full potential. There are recommendations about inter- and cross-disciplinary research in all our eight research themes for Health, Demographic Change and Wellbeing, reaching out to the other Societal Challenges. The future organization of joint research activities should be developed in close collaboration with the Advisory Groups, and strong emphasis should be on quality, so that all partners in joint research projects are excellent. This can be implemented by a strong peer review system with focus on quality in all parts of the process. Focus on concrete proposals with practical forward looking solutions is crucial.