**House of Lords Select Committee on Science and Technology Inquiry into Ageing: Science, Technology and Healthy Living**

**Faculty of Pharmaceutical Medicine**

The Faculty of Pharmaceutical Medicine is a Faculty of the three Royal Colleges of Physicians of London, Glasgow and Edinburgh. Pharmaceutical medicine is a medical specialty concerned with the discovery, development, evaluation, licensing and monitoring of medicines and the medical aspects of their marketing. The FPM's members work in diverse environments; from front line clinical trials, to pharmaceutical marketing and medicines regulation. Our mission is to advance the science and practice of pharmaceutical medicine by working to develop and maintain competence, ethics and integrity and the highest professional standards in the specialty for the benefit of the public. The FPM seeks, through its activities, to bring about an improvement in the health of the public.

**Questions:**

**Scientific basis**

1.How complete is the scientific understanding of the biological processes of ageing and their epidemiologies (including the relative roles of genetics, epigenetics, lifestyle, environment, etc.)?

**FPM Response:** A large body of scientific evidence exists on the biological processes of aging and the increasing availability of tools has contributed to an increased understanding of the impact of genes and environment on these processes. Two factors, changes in leucocyte telomere length (LTL) and rate of DNA methylation rate have been linked to ‘healthy’ and ‘unhealthy aging (1-3). There is no current agreement on the interpretation of evidence derived from this work for the purpose of predicting healthy lifespan, although these measurements might be helpful as a means to assess the impact of interventions in short term (1-3 years) studies rather than requiring lifetime follow up studies. In addition, the Hutchinson-Gilford Progeria Syndrome, a genetic disease of humans has documented common pathways with normal aging and may constitute a population in whom novel medicines might be first investigated (4).

2.How firm is the scientific basis for public health advice about healthy lifestyles to increase health span, including physical health and mental health?

**FPM Response:** The decline in deaths from cardiovascular disease and lung cancer have documented the public health value of not smoking/smoking cessation. The impact of weight loss on reversing type 2 diabetes also supports the public health advice to maintain body weight within the recommended ‘healthy’ control and moderate exercise have all been shown to improve healthy lifespan, reduce the risk of lung and heart disease and improve physical wellbeing (5-7). Cardiovascular disease is a major component of poor health in later years. Healthcare Improvement Scotland have reviewed all the evidence concerning the effect of lifestyle (body weight, smoking, exercise, alcohol intake etc) on incidence of disease and the reported benefits of lifestyle changes in diminishing events (8). The review suggests that there is strong evidence for smoking cessation, weight restriction, exercise and medical intervention to manage recognised risk factors including diabetes, hypertension and hyperlipidaemia.

3.Which developments in biomedical science are anticipated in the coming years, in time to contribute to the Government’s aim of five more years of healthy and independent life by 2035?

**FPM Response:** In order to impact the government’s aim of 5 more years of healthy independent life by 2035, clinical trials with novel treatments would need to be underway now or due to start imminently. To date only metformin, a treatment already licensed for type II diabetes, has been studied specifically for its impact on gene methylation and other longevity associated pathways. Although successful in prolonging longevity in mice there is no current positive human data. Although a range of products with effects on telomere length and DNA methylation have been discovered, these have primarily been investigated as treatments for cancer, with mixed results and significant side effects limiting use for otherwise healthy persons. Treatment of a range of disorders including hypertension, hyperlipidaemia and diabetes can prevent complications including ischemic heart disease, renal disease and stroke prevention of all of which would contribute to healthy aging and guidelines for primary and secondary prevention of cardiovascular disease already exist. A fixed dose combination product (‘Polypill’) suitable for secondary prevention of cardiovascular disease may improve compliance with long term therapy. Such a product exists and has been shown to be clinically effective (9). In addition, a modelling study has suggested that a modest use of such a product would be cost effective in the UK (10). Simple diagnostic measures which can provide ‘early warning’ of potential unrecognised disorders leading to limited life spans include testing urine for the presence of protein (early identification of renal disease) and sugar (identifies latent diabetes), measuring blood pressure (identifies hypertension) and blood lipid levels (identifies hyperlipidaemia). Wearable technologies including exercise bands which also measure pulse rate (and could identify asymptomatic atrial fibrillation) and cardiovascular fitness (VO2) can also be used to identify risk of disease at an earlier stage. Familial syndromes conferring a genetic predisposition to certain cancers have been identified and screening tools developed, while genetic testing of first line relatives of subjects developing cancer at younger ages may additionally enable early identification of subjects at higher risk for targeted screening for emergent disease facilitating earlier intervention, which is known to be associated with improved survival. A variety of on-line tools to assess memory and intellectual performance could be used to identify individuals at higher risk for development of dementia in later life for targeted intervention to protect mental performance. Friendship groups and peer support systems including community clubs and creative arts groups have been shown to benefit mental health in community living older people (11,12) and dementia sufferers (13).

4.How complete is the understanding of behavioural determinants and social determinants of health in old age, and of demographic differences?

**FPM response**: A body of work has reviewed the social determinants of health and these were well described in the Marmot Report (14). There is less understanding of personal behavioural determinants which may impact individuals taking up interventions or instituting life-style change to impact their future health. Factors influencing personal behavioural change include peer support systems and celebrity endorsement but the evidence that these systems support the sustained behavioural change required to facilitate healthy aging is currently limited.

A recent analysis of Global Burden of Disease from 1950 to 2017 indicates significant reductions in mortality rates across the world in the ages up to 20 years, particularly in the youngest age groups from 0 to 5 years where there has been a 30% fall (15). Advances from the health sciences have been a major contributor. For people above the age of 20, the improvements have been much less impressive. Misuse of medicines both prescribing errors (16) and poor patient adherence (17) has prevented medicines from delivering better health outcomes to these age groups, including longer life expectancy. Levels of efficacy demonstrated in randomise controlled trial undertaken for Marketing Authorisation are not replication in “real world” studies where the dosing prescriptions are not followed (18, 19, 20).

**Technologies**

* 1. 5. What technologies will be needed to facilitate treatments for ageing and ageing-related, and what is their current state of readiness?

**FPM Response:** A variety of delivery devices exist to enable self-administration of potential future therapies, including self-injectors, transdermal (e.g., patch) drug delivery technology, implants and a variety of technologies for oral delivery of medicines. However, currently there are no specific pharmacological interventions, other than existing treatments that prevent cardiovascular disorders, that are known to increase longevity. The introduction of wearable devices to enable self (and if required health care professional remote) monitoring of blood pressure, heart rate and rhythm as well as blood sugar levels are already available for home use. Remote monitoring approaches could be used to stimulate individuals with deteriorating health status to attend for medical advice and early intervention if required and to prompt individuals to take their medicines regularly or to recognise when doses are missed and send a reminder. On line GP consultations have been successfully introduced in some systems (15,16) and internet based therapy for depression has had some reported success (17,18). However these interventions are currently not available to persons without internet connectivity or the financial resources to purchase the equipment required. Additionally, while these lessen social isolation and loneliness, they are not a complete replacement for face to face interactions.

Misuse of medicines requires further education and training for prescribers and dispensers. We are asking for training on reading the Summary of the medicinal Product Characteristics (SmPC). At present it is underused (19) that proves a summary of all the work performed to gain market approval, dosing and duration plus all the evidence on safety and efficacy. Healthcare Professionals are not trained in its use and could be accomplished during training and on-line. Tue use of e-prescribing is welcomed by the elderly (20) and is well accepted nationally (21).

* 1. 6. What technologies will be needed to help people to live independently for longer, with better health and wellbeing? What is the current state of readiness of these technologies, and what should be done to help older people to engage with them?

**FPM Response:**

Although digital communications have been available and growing in use for several years, many individuals, particularly those in the lowest income brackets, the group with the worst health outcomes, may not have access to these as they will not be able to afford to purchase the systems required to interact with these technologies. These individuals will continue to require community based services close to home. Similarly, the centralization of healthcare services in larger institutions distant to communities in which most users live limits access to available clinics. Local community car and transport services provided by volunteers are increasingly used by elderly individuals, particularly those based in rural areas, to access services based primarily in urban centres. Community care provision is often provided by charitable organisations or local volunteers. Family dispersal has increased social isolation for some individuals. Smart home technology now exists to enable distant relatives to ‘view’ and speak with their relatives in their own home, but is not a complete substitute for personal interaction with other human beings. Encouraging the growth and maintenance of local community clubs and places in which individuals can come together for social interaction is an important contribution to healthy aging.

7. How can technology be used to improve mental health and reduce loneliness for older people?

**FPM response:** See responses to questions 5 and 6. Increasing computer literacy and access to home computing/smart phone technology will, over time, diminish the principle barriers to access of these technologies, which includes the ability to finance equipment purchase and fund access to the internet-of-things. None of these technologies are a substitute for the touch of another human hand and continued effort to encourage direct engagement within their community may be preferred by many. Continued support for community-based services and encouragement to form and maintain local friendship clubs and activities can alleviate loneliness and provide a support network. Provision of computer services in a private area in a local library or community hall could provide access to internet support services where required. Individuals can accept advice if it is delivered with care and empathy by individuals that they trust; traditionally this has been the local GP or community nurse. Conflicting information concerning the balance of evidence on benefits and risks may inhibit individuals from accepting specific interventions, particularly those intended to prevent a future event rather than to alleviate symptoms/signs of actual disease. Screening technologies which identify disorders for which there is no accepted treatment are unlikely to be broadly accepted. Thus diagnostic techniques and treatment programs must be aligned.

**Industrial strategy**

9. What opportunities are there for industry in the development of new technologies to help increase health span? In which areas of medical research and technology development does the UK excel?

**FPM response:** The healthcare industry has been able to respond to perceived need for new or improved treatment for established disease and will continue to do so provided that there is access to capital and likelihood of uptake of novel medicines once approved; increased understanding of disease pathways has resulted in novel drugs while understanding of repair mechanisms has resulted in novel cell based technologies to enhance organ and tissue repair. The technology industry has made significant change to human communications enabling rapid access to information which has empowered individuals to take care of their own health. The industry has been slower to invent other technologies for healthcare purposes in part due to relative rarity of conditions amenable to technological device support and in part due to perceived slow uptake of technology already available. Providing defined challenges for which technological solutions might be devised could encourage greater innovation in devising specific technology to meet these needs while preparedness to rapidly adopt approved technology would enhance industrial innovation in general. The UK excels in many areas of medicines development and in computer, transport and small device technologies as well as in vitro diagnostic tools and is thus well placed to drive this change.

10. What more is required for the UK to benefit from commercialisation of its discoveries and inventions relating to healthy ageing, as envisioned by the Government’s Industrial Strategy?

**FPM response:** Innovation is expensive and maintenance of access to capital, effective patent protection mechanisms and an educated scientific and engineering workforce is critical as well as rapid uptake of resulting innovations in practice.

**Healthier ageing**

11. How feasible is the Government’s aim to provide five more years of health and independence in old age by 2035? 12. To what extent are inequalities in healthy ageing, as well as differences in acceptance of technologies, a barrier to achieving the aims of the Government’s Ageing Society Grand Challenge? 13. What would be the implications of a paradigm shift to people leading healthier lives for longer, and spending less time suffering ill health?

* 1. **FPM response:** Without a significant shift in the lifestyle choices of adults currently in middle age the government’s aim may not be feasible, as much will depend on widespread adoption of healthier lifestyles by high risk groups within a short timeframe. To address this more effort will be needed to provide information, accessible services and support networks in areas with high proportions of high risk adults. Schools can do much to teach children about healthy lifestyles and influence parents via their children. Encouragement of healthy workplaces, if necessary via health and safety legislation, can carry these efforts forward to the workplace. If a significant proportion of individuals live longer, healthier lives, current retirement ages may be increased to facilitate increased employment opportunity and career enhancement for workers of older age. Access to training and education should not be age restricted and mentoring of younger by older workers may enhance mutual understanding and respect.

# References

1. Müezzinler A, Zaineddin AK, Brenner H. A systematic review of leukocyte telomere length and age in adults. Ageing Res Rev 2013;12:509–19.
2. Hannum G, Guinney J, Zhao L. et al. Genome-wide methylation profiles reveal quantitative views of human aging rates. Mol Cell 2013;49:359–67.
3. Horvath S. DNA methylation age of human tissues and cell types. Genome Biol 2013;14:R115.
4. Feldman AL, Griffith SJ, Ahern AL et al. Impact of weight maintenance and loss on diabetes risk and burden: a population-based study in 33,184 participants. BMC Public Health. 2017; 17:170
5. Ekpu VU, Brown AK. The Economic Impact of Smoking and of Reducing Smoking Prevalence: Review of Evidence. Tob Use Insights. 2015; 8: 1-35
6. Galloza J, Castillo B, Micheo W. Benefits of Exercise in the Older Population. Phys Med Rehabil Clin N Am. 2017; 28: 659-669.
7. Li Y, Zhou G, Bruno IG, Zhang N et al. Transient introduction of human telomerase mRNA improves hallmarks of progeria cells. Aging Cell. 2019; 18:e12979. doi: 10.1111/acel.12979.
8. Scottish Intercollegiate Guidelines Network: SIGN 149 • Risk estimation and the prevention of cardiovascular disease. July 2017
9. Castellano JM, Verdejo J, Ocampo S et al. Clinical Effectiveness of the Cardiovascular Polypill in a Real-Life Setting in Patients with Cardiovascular Risk: The SORS Study. Arch Med Res. 2019; 50: 31-40.
10. Becerra V, Gracia A, Desai K et al. Cost-effectiveness and public health benefit of secondary cardiovascular disease prevention from improved adherence using a polypill in the UK. BMJ Open. 2015; 5:e007111. doi: 10.1136/bmjopen-2014-007111.
11. Poulos RG, Marwood S, Harkin D et al. Arts on prescription for community-dwelling older people with a range of health and wellness needs. Health Soc Care Community. 2019; 27: 483-492.
12. Lindsay-Smith G, Eime R, O'Sullivan G et al. A mixed-methods case study exploring the impact of participation in community activity groups for older adults on physical activity, health and wellbeing. BMC Geriatr. 2019; 19: 243
13. Leggieri M, Thaut MH, Fornazzari L et al. Music Intervention Approaches for Alzheimer's Disease: A Review of the Literature. Front Neurosci. 2019; 13: 132
14. Strategic Review of Health Inequalities in England post-2010. Published by The Marmot Review February 2010
15. GBD 2017 Mortality Collaborators.Global, regional, and national age-sex-specific mortality and life expectancy, 1950–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018; 392: 1684–735.
16. The Report of the Short Life Working Group on reducing medication-related harm. Acute Care and Workforce/ Acute Care and Quality / CQC, Investigations and Quality Policy / 17160. <https://www.gov.uk/government/publications/medication-errors-short-life-working-group-report>
17. Fatoye F, Smith P, Gebrye T, Yeowell G. Real-world persistence and adherence with oral bisphosphonates for osteoporosis: a systematic review. *BMJ Open* 2019;9:e027049. doi:10.1136/ bmjopen-2018-027049.
18. Khan S, Rupniewska E, Neighbors M, Singer D, Chiarappa J, Obando C. Real‐world evidence on adherence, persistence, switching and dose escalation with biologics in adult inflammatory bowel disease in the United States: A systematic review. J of Clin Pharmacy and Thera. 2019; 44: 102-25
19. Vromans L, Doyle G, Petak-Opel S, Rodiger A, Rottgemann M, Schlussel E, Stetter Eva. Shaping medicinal production: a before and after study exploring physician’s perspectives on the summary of product characteristics, BMJ Open 2013;3: e003033.doi:10.1136/bmjopen-2013-003033
20. Schleiden L, Odukoya O, Chui M. Older Adults’ Perceptions of E-Prescribing: Impact on Patient Care. Perspect Health Inf Manag. 2015 Jan 1;12:1d. eCollection 2015.
21. Parv L, Kruus P, Mõtte K, Ross P. An evaluation of e-prescribing at a national level

Inform Health Soc Care. 2016;41(1):78-95. doi: 10.3109/17538157.2014.948170. Epub 2014 Aug 12.

1. Deshpande S, Quek RG , Forbes CA, de Kock S , Kleijnen J, Gandra SR, Simpson RJ Jr . A systematic review to assess adherence and persistence with statins. Curr Med Res Opin. 2017; 33 :769-778.
2. Pham P, Brown J. Real-world adherence for direct oral anticoagulants in a newly diagnosed atrial fibrillation cohort: does the dosing interval matter? Pham and Brown BMC Cardiovascular Disorders 2019; 19: 64-79. <https://doi.org/10.1186/s12872-019-1033-3>
3. Liddy C., Afkham A., Drosinis P et al. Impact of and Satisfaction with a New e Consult Service: A Mixed Methods Study of Primary Care Providers. J. Am. Board Fam. Med. 2015; 28: 394–403.
4. Edwards H., Marques E., Hollingworth W et al. Use of a Primary Care Online Consultation System, by Whom, When and Why: Evaluation of a Pilot Observational Study in 36 General Practices in South West England. BMJ Open. 2017; 7 doi: 10.1136/bmjopen-2017-016901
5. Hallgren M, Kraepelien M, Öjehagen A et al. Physical exercise and internet-based cognitive-behavioural therapy in the treatment of depression: randomised controlled trial. Br J Psychiatry. 2015 Sep;207(3):227-34. doi: 10.1192/bjp.bp.114.160101. Epub 2015 Jun 18.
6. Andrews, G, Cuijpers, P, Craske, MG et al. Computer therapy for the anxiety and depressive disorders is effective, acceptable and practical health care: a meta-analysis. PLoS One. 2010; 5: e13196