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Dear Lord Patel

Select Committee on Science and Technology - Ageing: Science, Technology and Healthy Living Call for Evidence

We are delighted to enclose our response to the Science and Technology Select Committee Call for Evidence on Ageing: Science, Technology and Healthy Living. The National Physical Laboratory (NPL) welcomes this timely call and the opportunity to participate in such an important review.

Our response primarily focusses on where we, as the UKs National Measurement Institute see the main opportunities for delivering the UK Government's Industrial Strategy's 'Ageing Society' Grand Challenge and the associated mission to "Ensure that people can enjoy at least five extra healthy, independent years of life by 2035, while narrowing the gap between the experience of the richest and poorest".

Our Life Sciences and Health priorities are strongly aligned to the UK Measurement Strategy, NHS Long Term plan, the UK's Industrial Strategy and the UK Life Sciences Industrial Strategy. The Accelerated Access Review is a seminal document that sets out an important but ambitious framework to transform our health and care system for patients, the NHS and innovators and is crucial to future outcomes and impact in this space. As is the TOPOL review which sets out the necessary requirements for building a future-proof workforce who can deliver a whole life course approach to care in the context of new and emerging technologies and treatments.

We welcome the launch of NHSX and feel that their work in delivering the Secretary of State's 'Tech Vision' ('The future of healthcare: our vision for digital, data and technology in health and care') will be a key enabler to delivery of the 'extra 5 healthy and independent years' ambition set out in the Grand Challenge. We are keen to support them in this work as a collaborator to successful and sustainable delivery of the vision.

In our response we have set out where, through our world leading cutting edge measurement solutions, we can add value and impact to collaborative evidenced-based policy and future opportunities to support joint discoveries and innovation relating to healthy ageing across a range of strategic themes.

We hope you find this information useful and please feel free to use all or parts of this submission in future work. If I can be of any further assistance, please do not hesitate to contact me.

Yours Sincerely

Carolyn Ruston
Strategy and Business Development – Health and Life Sciences

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Select Committee on Science and Technology - Ageing: Science, Technology and Healthy Living Call for Evidence

National Physical Laboratory

Introduction and Context

1. Every citizen should have the opportunity to live a long and healthy life, however there are a range of factors spanning our whole life course that can impede this such as physiological, psychological factors as well as societal and environmental triggers all of which can be potentially harmful to our health and our ability to age well.

2. At NPL we are working to tackle some of the world's biggest health challenges, from reducing attrition rates in drug development to treating cancer and dementia, as well as creating new antibiotics all of which are crucial to enabling a healthier population. Good measurement improves productivity and quality; it underpins public confidence and is vital to innovation.

3. We are working with the NHS, industry and academia to support the increased drive for earlier diagnosis of disease, leading innovation and acceleration in the use of personalised medicine, developing techniques to improve data modelling and analytics and leading the conception of new drugs, treatments and therapies that have an impact across the whole life course.

Theme 1 - Data and Informatics

4. The Gartner report estimates by 2020, more than 20 billion connected devices will be in use across the world. However only a fraction of the data generated is ever used. The UK has world-leading public health data assets that can drive innovation in early diagnosis and precision treatments to deliver both better health and economic growth for the UK. The UK also has internationally envied population data initiatives such as UK Biobank and Genomics England with NHS electronic health records for 65 million patients.

5. Within some parts of the NHS and Social Care the digital infrastructure is either not in place or is immature. The NHS Five Year Forward View highlighted that the NHS lags behind in its use of innovative digital technologies and datasets to transform health care delivery and health outcomes. There are significant issues relating to interoperability, outdated technology and data security issues that can often result in patients receiving suboptimal care and citizens lacking the tools to manage their own health and well-being effectively.

6. Future healthcare will increasingly rely on the integration of large healthcare datasets with a key requirement being the development of data and interoperability standards. New technologies that harness the power of data, like artificial intelligence (AI), present huge opportunities to transform healthcare e.g. for earlier diagnosis and better management of chronic diseases and long term conditions. ***The right partnerships and collaborations will facilitate cutting edge analysis of UK health data to transform patient care and population health outcomes across the whole life course.***

7. **Data Quality:** It is crucial that going forward decision takers/commissioners can access high quality data that is traceable, has good provenance, can be presented in a standardised and consistent way and can be stratified and linked to patient outcomes and population health data.

8. **Data Collation:** The development of standardised approaches that allow reproducible integration of large data sets from multiple sources that supports a whole person approach to prevention and care is crucial to supporting the healthy ageing mission. Data may come from a range of medical and non- medical sources for example: from diagnostics and treatment data, familial data (e.g. from gene counselling), wellbeing data as well as personal data (self-management) through apps and other personal health solutions.

9. **Outcome:** Data-driven technologies have the potential to transform the way the health and care system works. Not only will they **support faster and cheaper research** but they will enable the health and care system to **perform comprehensive data analysis with greater confidence in the outcomes** and allow full exploitation of the potential of artificial intelligence and machine learning tools in healthcare – vital for future improvements in healthcare especially in diagnosis, treatment and drug discovery.

10.

> NPL would welcome opportunities to work with the Select Committee and NHSX to bring together stakeholders and communities to understand the new capabilities in data science and develop a framework to deliver confidence in the intelligent and effective use of data based on measurement traceability and uncertainty analysis.
>
> Furthermore, we look forward to working collaboratively to deliver metrologically sound digital and data platforms and data standards. We will do this through the development and dissemination of standards for data interoperability, validation for numerical modelling and algorithms in complex biological environments, and thorough the development of methodologies and tools to manage and integrate large healthcare datasets that support the healthy ageing agenda.

Theme 2 - MedTech and Digital

11. Both the Accelerated Access Review[1] and the Life Sciences Industrial Strategy[2] call for the faster adoption of medical technologies and devices into the NHS to improve patient outcomes.

12. Increasingly complex treatments and greater patient demands are leading to novel medical devices being developed e.g. surgical robots, implantable and wearable devices, sensors, smart prosthetics and orthotics.

13. **Innovation:** The UK has over 3000 UK-based companies active in the development of medical devices and technologies, made up primarily of innovative SMEs. The UK health and life sciences system is well placed to pull these innovations through to market for use within the NHS, social care and public health.

[1] https://www.gov.uk/government/publications/accelerated-access-review-final-report
[2] https://www.gov.uk/government/publications/life-sciences-industrial-strategy

14. **Enablers:** One of the critical enablers for rapid and widespread adoption of new medical devices is ensuring their performance, safety and effectiveness can be measured and optimised properly. For example, correct calibration and validation of medical devices and technologies is vital to ensure consumer products yield measurements that meet health requirements and translate into better patient and population health outcomes.

15. **Outcome:** Digital technologies have the potential to transform patient care and the lives of citizens as well as driving significant and sustained efficiencies within the NHS and social care. For example, through taking over repetitive tasks, supporting greater personalised self-management of care and to enable analysis of outcomes and impact not possible previously.

16.

> NPL will continue to lead cutting-edge innovation, translation and acceleration of research within the healthy ageing space and beyond. We welcome approaches from the NHS, industry and academia to explore potential collaborative R&D opportunities.
>
> Through the UK National Measurement System (NMS) we will provide the necessary measurement infrastructure to ensure the acceleration and adoption of such technologies into hospitals, community setting and people's homes.

Theme 3 - Diagnostics

17. Earlier diagnosis of diseases and personalised treatment can improve the quality of life for patients, as well as increase the likelihood of complete recovery. Prediction and early diagnosis can lead to improved patient outcomes by preventing or delaying the onset of disease, managing disease progression and allowing for more effective treatments. For example:
    - The Cancer Strategy for England (2015-2020)[3] emphasises that 'diagnosing substantially more cancers earlier could be transformative in terms of improving survival, reducing mortality and improving quality of life'. This is particularly important, given that 1 in 2 people born after 1960 in the UK will be diagnosed with some form of cancer; culminating in some 330,000 new diagnoses each year.
    - For neurodegenerative diseases early diagnosis is essential as it is only during the later stages of the disease, that a clinical diagnosis is possible with 70-90 % certainty. However, this is often too late for treatment of diseases such as Alzheimer's disease, other than patient care.

18. **Imaging**: The growth of advanced clinical imaging has had a hugely powerful effect as an earlier diagnostic tool in medicine. Imaging techniques (such as MRI, positron emission tomography (PET) and ultrasound) are a major weapon in the fight against disease but are **often limited to detecting structural changes and quantitative measures of tissue characteristics** and are often difficult to interpret.

[3] Achieving World-Class Cancer Outcomes: A Strategy for England 2015 – 2020 https://www.cancerresearchuk.org/sites/default/files/achieving_world-class_cancer_outcomes_-_a_strategy_for_england_2015-2020.pdf

19. **Outcome:** The supply and establishment of new imaging modalities will enable earlier diagnosis of disease states and aid in improved treatment planning and monitoring. It will support the NHS aspiration for patients/citizens to have access to state-of-the-art diagnosis and treatment facilities; one that requires a traceable, quantitative clinical imaging framework for better clinical trials, patient diagnoses, treatment planning and delivery. **NPL is working with charities such as Cancer Research UK, industry and academia to develop advanced imaging techniques to better understand tumour development and progression, whilst putting in place the necessary measurement infrastructure to ensure the uptake of new radiotherapies, such as proton beam therapy.**

20.

> Our goal is to increase the confidence and reproducibility in diagnosis and treatment efficacy both inside and outside of the clinical setting. NPL will work collaboratively to deliver the necessary metrology infrastructure that can support the adoption of new treatments and cutting edge clinical imaging diagnostics and robust testing. This will provide a very early indication of disease and also enable the patient to manage disease progression, allowing for better treatment and ultimately an increase life expectancy.
>
> NPL will continue to support and develop new measurements that enable real-time and non-invasive monitoring and diagnosis of the critical physical, chemical and biological health parameters in the clinic or home setting is an area as part of a self-management approach to healthy ageing.

Theme 3 – Personalised medicine and access to new drugs and therapies

21. Whilst rightly much of the focus on healthy ageing is placed on prevention, the need to support a research infrastructure that can accelerate access to new drugs and therapies both to target the process of ageing and prevent life limiting diseases and conditions is vital. Personalised medicine is crucial in addressing the concept of the ‘average patient’ now something viewed across the system as a much outdated notion.

22. **Drug Discovery and Development:** Future drug discovery needs to “fail faster” during preclinical research and it is vital to improve efficacy by better understanding and measuring drug uptake and efficacy in cells and tissues. Regenerative medicine and cell and gene therapies could provide much needed therapeutic solutions to many global diseases, such as cardiovascular and infectious diseases and metastatic cancers.

23. **Biosimilars:** The growth in the use of Biosimilars has the potential to save the NHS millions over the next few years and their uptake could free up much needed space for funding innovative medicine and treatments and deliver improvements to pathways of care.

24. **Microbiome:** Measurements to improve our understanding of the microbiome and how factors such as foods, nutrients and diet influence cellular processes and how

these in turn affect overall health outcomes is an area that requires further exploration.

25. **Outcome:** Ineffective treatments are costly to the NHS. The adoption of a personalised medicine approach (through the integration of genomics into the NHS – 100,000 Genomes Project) will allow the most appropriate intervention for the individual as well as reducing costs and preventing adverse reactions in those who will not respond to certain treatments. The goal ultimate is the greater personalisation of medicine, culminating in the right treatment for the right patient at the right time.

26.

As the UK's National Metrology Institute NPL is well placed to lead future work to improve traceable and quantitative measurement at the cellular and subcellular level. It will support the system to achieve greater understanding of the origin and progress of diseases and conditions such as dementia and support the development of possible prevention and/or treatment that will support citizens to live well longer. NPL will focus on the need for measurements that support rapid acceleration of the development and implementation of innovative new technologies (e.g. proton/ion beam therapy, MRI guided radiotherapy molecular radiotherapy, HIFU) to accelerate improved treatments of conditions such as cancer and dementia into clinical practice.

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