

## Written evidence submitted by Dr Cristina Richie, Lecturer at TU Delft (MSI0019)

Dear Parliament:

I am submitting evidence for “My Science Inquiry” on the carbon emissions of artificial intelligence in health care.

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### Recent publications:

#### Books

*Principles of Green Bioethics: Sustainability in Health Care* (East Lansing: Michigan State University Press, 2019).

#### Selected Peer-Reviewed Journal Articles and Reports

“Carbon Emissions from Overuse of US Healthcare Delivery: Medical and Ethical Problem,” Co author: Cassandra L. Thiel. *Hastings Center Report* 52, no. 4 (2022): 10-16.

“Re-imagining Research Ethics to Include Environmental Sustainability: A Principled Approach, Including a Case Study of Data-Driven Health Research,” Co author: Gabrielle Samuel. *Journal of Medical Ethics*. (2022): doi:10.1136/jme-2022-108489.

“Environmentally Sustainable Development and Use of Artificial Intelligence in Health Care,” *Bioethics* 36, no. 5 (2022): 547-555.

“Environmental Sustainability and the Carbon Emissions of Pharmaceuticals,” *Journal of Medical Ethics* 48, no. 5 (2022): 334–337.

“Can United States Healthcare Become Environmentally Sustainable?: Towards Green Healthcare Reform,” *Journal of Law, Medicine, and Ethics* 48, no. 4 (2020): 643-652.

“Sustainability and Bioethics: Where We Have Been, Where Are, Where We Are Going,” *The New Bioethics* 26, no. 2 (2020): 82-90.

#### Why the Science and Technology Committee should examine this area

Artificial intelligence (AI) has advanced health care significantly, but they also contribute to negative effects on the environment through carbon emissions in the development, deployment, dissemination, and disposal of medical devices and medical services.<sup>i</sup> The computational infrastructure that enables AI systems has significant additional environmental implications. For instance, forty days of training Google’s AlphaGo Zero game generated the equivalent of 1,000 hours of air travel or a carbon footprint of 23 American homes.<sup>ii</sup> Google’s biggest AI model “The Switch Transformer” now has more than 1.6 trillion parameters.<sup>iii</sup> Each training run of a giant

transformer like this can generate 626,155 pounds of CO<sub>2</sub> emissions, the equivalent of 17 American life-years (at 36,156 CO<sub>2</sub> emissions / per year).

### **Why is this the right time for the Committee to examine the area**

Increasingly, health care delivery is reliant on technologies which require the use of artificial intelligence to provide supportive care, such as triage algorithms, electronic patient records, and robotics.<sup>iv</sup>

### **Why this area would benefit from parliamentary scrutiny**

The government oversees data regulation and also climate change policy such as the *Climate Change Act* and the *NHS Carbon Reduction Strategy*.

### **Why the Government needs to act in this area**

The health care industry is responsible for 4-5% of total world emissions,<sup>v</sup> which is similar to the global food sector.<sup>vi</sup> By 2017, the National Health Service's Health, and Social Care sectors had a carbon output of 27.1 million tons.<sup>vii</sup> Carbon dioxide emissions contribute to pollution, violent conflict over scarce resources, loss of biodiversity, and diminished quality of life for humans. Moreover, the "safe" amount of carbon dioxide—350 parts per million—has been exceeded. This adds to the disease burden of climate change health hazards.

### **How Government policy in this area could be developed or improved**

Environmental bioethics is at the core of my current contributions to ethics and I am happy to lend my expertise to this proposed topic, which I have written about.<sup>viii</sup> Policy can be developed to:

- Calculate AI carbon emissions
- Require disclosure of AI emissions and energy source use
- Financially support researchers to make AI more sustainable

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<sup>i</sup> Malmodin, Jens, and Dag Lundén. "The energy and carbon footprint of the global ICT and E&M sectors 2010–2015." *Sustainability* 10, no. 9 (2018): 3027.

<sup>ii</sup> Preetipadma, "New Mit Neural Network Architecture May Reduce Carbon Footprint By AI," *Analytics Instight*, April 29, 2020, at <https://www.analyticsinsight.net/new-mit-neural-network-architecture-may-reduce-carbon-footprint-ai/> (accessed 14 April 2021).

<sup>iii</sup> Kyle Wiggers, "Google trained a trillion-parameter AI language model," *The Machine* January 12, 2021, at <https://venturebeat.com/2021/01/12/google-trained-a-trillion-parameter-ai-language-model/>

<sup>iv</sup> Khaliq, Abdul, Ali Waqas, Qasim Ali Nisar, Shahbaz Haider, and Zunaina Asghar. "Application of AI and robotics in hospitality sector: A resource gain and resource loss perspective." *Technology in Society* 68 (2022): 101807.

<sup>v</sup> J. Karliner, et al., *Health Care's Climate Footprint: How the Health Sector Contributes to the Global Climate Crisis and Opportunities for Action* (Healthcare Without Harm/ARUP; September, 2019).

<sup>vi</sup> P.-P. Pichler, et al., "International Comparison of Health Care Carbon Footprints," *Environmental Research Letters* 14, no. 6 (2019): 064004.

<sup>vii</sup> Sustainable Development Unit for NHS England and Public Health England. *Reducing the use of Natural Resources in Health and Social Care: 2018 Report*. Cambridge: Victoria House, 2018,

<sup>viii</sup> Cristina Richie, "Environmentally Sustainable Development and Use of Artificial Intelligence in Health Care," *Bioethics* 36, no. 5 (2022): 547-555.